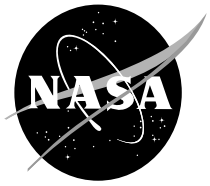
NASA/TM–2007–209984/Ver.1/Vol.9



GEOSAT Follow-On (GFO) Altimeter Document Series, Volume 9

GFO and JASON Altimeter Engineering Assessment Report

Update:

GFO—Acceptance to December 18, 2006
JASON—Acceptance to December 24, 2006

Version 1: June 2007

A.M. Conger, D.W. Hancock, III, G.S. Hayne, and R.L. Brooks

August 2007

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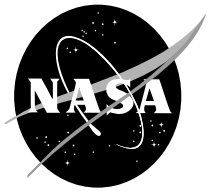

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Foreword

The Navy's Geosat Follow-On (GFO) Mission, launched on February 10, 1998, is an altimetric satellite with heritage that includes Seasat, Geosat, TOPEX/POSEIDON (T/P), and ERS-1. Data derived from these missions has and will lead to improvements in the knowledge of ocean circulation, ice sheet topography, and climate change. In order to capture the maximum amount of information from the altimetric data, accurate altimeter calibrations are required for the GFO civilian data set that NOAA produces. NASA/Goddard Space Flight Center/Wallops Flight Facility (GSFC/WFF) has provided these calibrations for the Seasat, Geosat and T/P missions, and is doing the same for GFO.

Wallops serves GFO in the following areas:

- NASA Representative for Radar Altimeter Performance
- Calibration Collaboration
- Member of GFO Cal-Val Team
- Data distribution to members of Cal-Val Team
- Validate sensor-related corrections
- Provide corrections for sensor changes

For the latest updates on the performance of the GFO Radar Altimeter, and for accessing many of our reports, readers are encouraged to contact our WFF/GFO Home Page at http://gfo.wff.nasa.gov/

This WFF GEOSAT Follow-On (GFO) Altimeter Engineering Assessment Report has been prepared by SGT, Inc./GGSG under Contract NNG06HX14C with the NASA Goddard Space Flight Center, Greenbelt, Maryland. This work was performed under the direction of David W. Hancock, III, WFF GFO Altimeter Verification Manager, Cryospheric Sciences Branch, Hydrospheric and Biospheric Sciences Laboratory, NASA Goddard Space Flight Center, Wallops Flight Facility, Wallops Island, Virginia.
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Acknowledgments

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  WFF GFO Altimeter Verification Manager
- Annette Conger (SGT, Inc./GGSG)
- Ron Brooks (Raytheon ITSS)
- George Hayne (SGT, Inc./GGSG)
- Carol Purdy (SGT, Inc./GGSG)

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Section 1

Introduction

1.1 Identification of Document

The purpose of this document is to present and document GFO performance analyses and results. This is the seventh Assessment Report since the initial report. This report extends the performance assessment since acceptance to 18 December 2006.

The initial *GFO Altimeter Engineering Assessment Report,* March 2001 (NASA/TM-2001-209984/Ver.1/Vol.1) covered the GFO performance from Launch to Acceptance (10 February 1998 to 29 November 2000). The second of the series covered the performance from Acceptance to the end of Cycle 20 (29 November 2000 to 21 November 2001). The third of the series covered the performance from Acceptance to the end of Cycle 42 (29 November 2000 to 30 November 2002). The fourth of the series covered the performance from Acceptance to the end of Cycle 64 (29 November 2000 to 17 December 2003). The fifth of the series covered performance from Acceptance to the end of Cycle 86 (29 November 2000 to 17 December 2004). The sixth of the series covered performance from Acceptance to the end of Cycle 109 (29 November 2000 to 26 December 2005).

Since launch, we have performed a variety of GFO performance studies; Appendix A provides an accumulative index of those studies.

In this year's GFO report, we have begun the inclusion of analyses of the JASON altimeter. In past years, JASON and TOPEX were compared during our assessment of the TOPEX altimeter; however, with the end of the TOPEX mission, we have developed methods to report on JASON as it relates to GFO. We see no change trend between the three altimeters and conclude all three are stable based on our cross comparison analyses.

1.2 Definition of a GFO Cycle

Like its predecessor, GEOSAT, the GFO groundtrack has a repeat ($\pm$1 km) period of 17.05 days. For our analyses, the repeat periods are referred to as cycles, and are used as data dividers to assess sensor internal consistency, taking into account seasonal differences.

For simplification in tracking the performance of the satellite, the Navy is using exactly 17-day boundaries in the definition of a cycle. The first 17-day cycle after acceptance by the Navy is numbered 000, Cycle 000, and is used as a reference for the succeeding cycles. The 17-day cycle which started on December 16, 2000 (Julian day 2000352) is the beginning of the first evaluation cycle, Cycle 001, which ended on January 2, 2001 (Julian day 2001002). Each subsequent cycle is consecutively numbered.

1.3 GFO Data Flow to/from Wallops

1.3.1 To Wallops

The daily near-real time GFO data flow from the Naval Oceanographic Office (NAVO), Altimetry Data Fusion Center (ADFC), Stennis Space Center, Bay St. Louis, MS, to Wallops Flight Facility (WFF) consists of:

- Science data without waveforms (ra_data)
- Science data with waveforms (ra_cal_data)
- Engineering data (eng_data)
- Water Vapor Radiometer data (wvr_data)
- Sensor data (sdr)

Additional data are forwarded by the Navy to Wallops as soon as they are available, consisting of:

- Navy Geophysical Data (ngdr)
- Operational Orbital Determination data (oodd)

1.3.2 From Wallops to Cal/Val Team Members

Wallops forwards the following GFO data types to the other members of the Cal/Val Team:

- Sensor data (sdr)
- Science data with waveforms (ra_cal_data)
- Operational Orbital Determination data (oodd)

Section 2

On-Orbit Instrument Performance (GFO Cycles 00 - 129 and JASON Cycles 01-182)

From the time of acceptance on November 29, 2000, to the end of this reporting period, the GFO altimeter has acquired a total of 129 cycles of data. Cycles 59 through 61 were not processed due to a CPU reset that placed the spacecraft into a safe-hold; the time period of the safe-hold was from 9 September 2003 (2003-249) to 20 October 2003 (2003-293). Cycles 70 and 71 were not processed due to payloads being powered off as a preventative measure related to the altimeter and for additional satellite maintenance; the time period of the payload power off was from 22 February 2004 (2004-053) to 09 April 2004 (2004-100). Cycles 121 (2006-200) through 129 (2006-352) were not processed due to low voltage conditions on the satellite during eclipse. The payload was shutdown during this time for spacecraft testing. The payload was off from 3 August 2006 (2006-215) to 5 October 2006 (2006-278). Since its Acceptance, the GFO altimeter has acquired a total of 2027 days of data.

The following subsections will illustrate that the altimeter tracking data have been internally consistent. The subsections discuss:

- internal calibrations
- cycle summaries
- key events

2.1 GFO Internal Calibrations

The GFO's internal calibration mode has two submodes, designated CAL-1 and CAL-2. CAL-1 is designed to detect changes in the internal path delays, to measure range drift. CAL-1 also monitors changes in the receiver automatic change control (AGC); the altimeter's estimates of the ocean surface radar backscattering cross-section are obtained from the AGC values. The purpose of the second mode, CAL-2, is to characterize the response of the receiver and digital filter bank.

During CAL-1, a portion of the transmitter output is fed back to the receiver through a digitally controlled calibration attenuator and a delay line, whereupon the altimeter acquires and tracks the signal. Then, during CAL-2, the altimeter processes received thermal noise with no transmitted signal present, to characterize the waveform sampler response.

The GFO Project initially performed two internal calibrations per day. This was changed to one calibration per day on 2005-03-14 in order that more waveforms could be collected water to land monitoring.

Prior to Wallops' receiving the calibration data, the GFO ground data processing system routinely performs the following: (1) adds a large constant bias to the CAL-1 range, such that the magnitude of the resultant range sum is comparable to a nominal

nadir altimeter range to the surface of the earth, and then (2) applies an oscillator drift correction to the total range.

To reconstruct a meaningful CAL-1 range, Wallops performs the following: (1) using the GFO-Project-provided VTCW (Vehicle Time Code Word), removes the oscillator drift correction, and then (2) removes a large constant bias.

2.1.1 GFO Range

The CAL-1 range calibrations are shown in the middle of Figure 2-1 "CAL-1 Range/ Temperatures for the First 130 GFO Cycles", denoted by the x's and are referenced to the left vertical scale in millimeters. The data plotted nearer the bottom of the figure, denoted by the diamonds, are the Composite Temperature corresponding to the times of the calibrations; the temperatures are referenced to the right vertical scale in degrees centigrade. Data shown in the figure below can be found in Appendix G. A small, and linearly decreasing, temperature dependence is noted in the CAL-1 range. At the time of Acceptance near the end of year 2000, the CAL-1 range dependence on Receiver Temperature, as observed in Figure 2-1, was approximately +0.8 mm per degree. By the end of 2003, the dependence had disappeared. The total span of the CAL-1 range change has remained within the centimeter range specification for GFO.

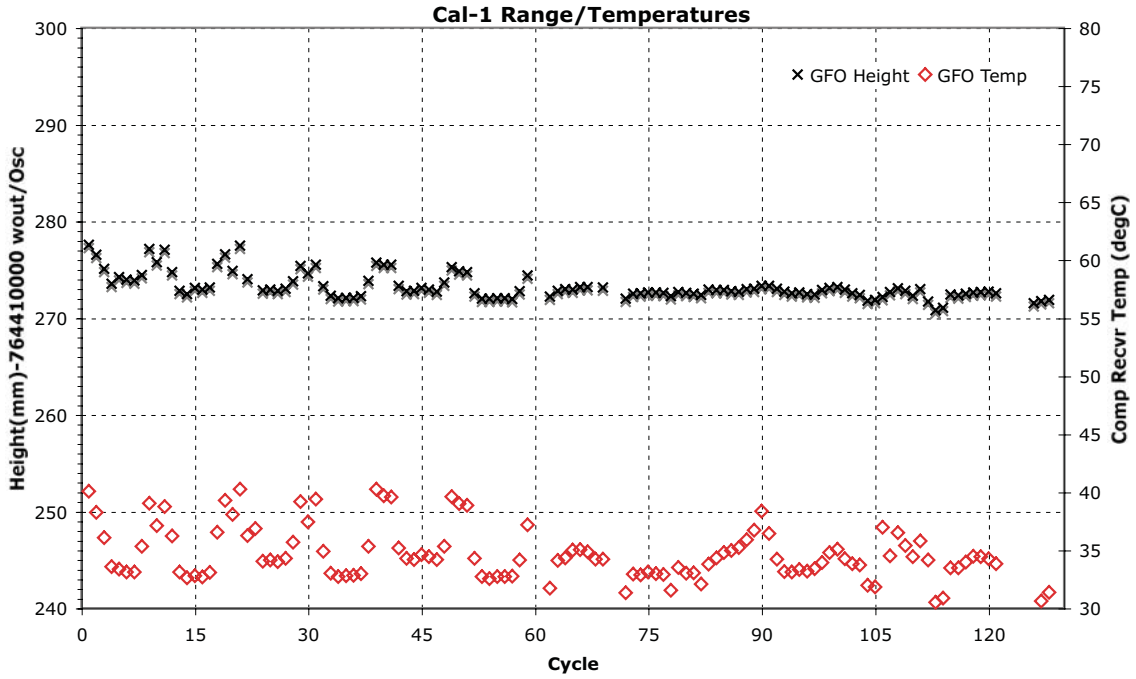

Figure 2-1 CAL-1 Range/Temperatures for the First 130 GFO Cycles

2.1.2 GFO AGC

The CAL-1 and CAL-2 AGCs have been routinely temperature-corrected using an algorithm derived by Wallops. The same AGC temperature correction algorithm is used for both CAL-1 and CAL-2, although the correction algorithm is based solely on the CAL-1 data.

To date, after temperature correction, the CAL-1 AGCs remain in a fairly narrow band of 42.6$\pm$0.1 dB, as shown in Figure 2-2 "CAL-1 AGC for the First 130 GFO Cycles". No significant AGC drift is noted, and no further temperature dependency is indicated.

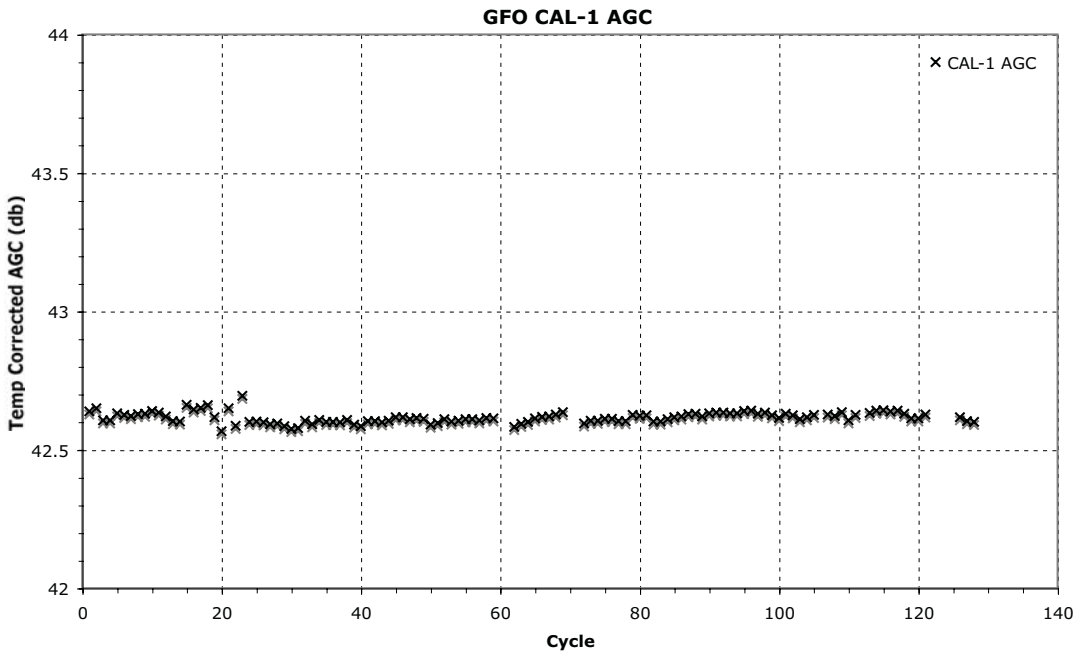

Figure 2-2 CAL-1 AGC for the First 130 GFO Cycles

After applying the temperature correction, a CAL-2 AGC residual temperature dependence is evident in Figure 2-3 "CAL-2 AGC for the First 130 GFO Cycles". The CAL-2 residuals are observed to be correlated with and correctable with temperature as can be seen by the temperature plot depicted by the diamonds at the bottom of Figure 2-1. For the temperature correction algorithm, WFF elected to apply the temperature correction for CAL-1 and not CAL-2 as being more applicable for normal operational AGC processing.

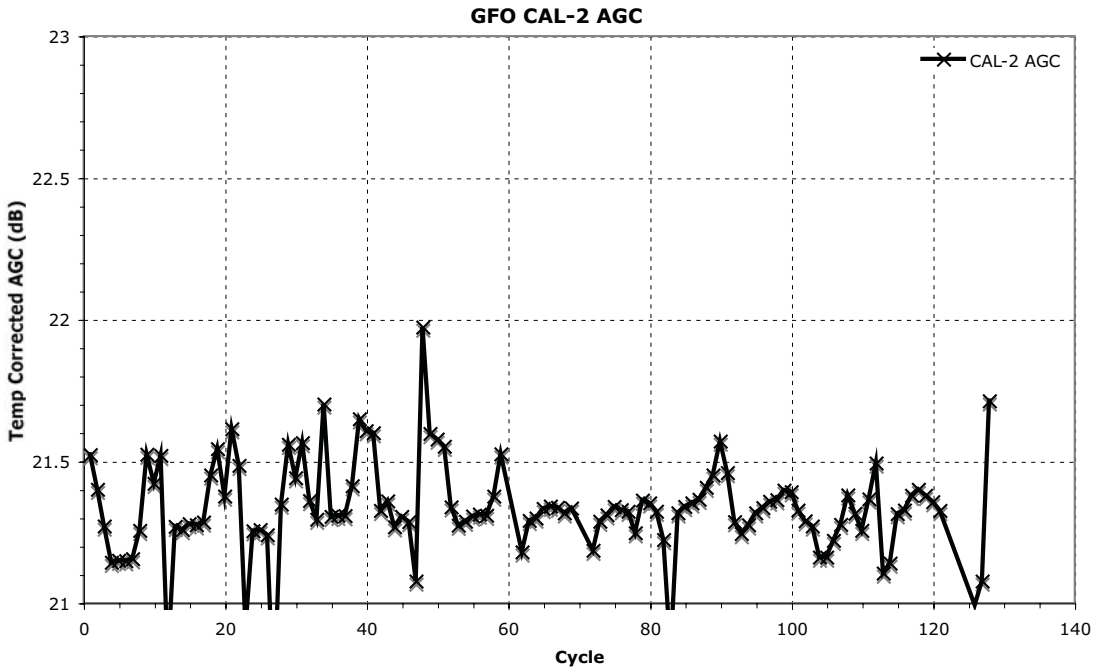

Figure 2-3 CAL-2 AGC for the First 130 GFO Cycles

2.2 GFO Cycle (17-day) Summaries

Another indication of the GFO altimeter's internal consistency is the agreement of cycle-to-cycle means for: global significant waveheights, sigma-naughts, and windspeed. For this analysis, the measurements for complete cycles (17 days) were meaned, standard deviations were computed, and measurement histograms were produced.

Prior to the computations, the data sets were edited to eliminate suspect measurements. Our edit criteria are as follows:

- Quality Word #1
  - Bit 2: Record is zero-filled
  - Bit 3: Altimeter not in Fine Track
  - Bit 5: Receiver Temperature error

  - Bit 7: No smoothed VATT
  - Bit 10: SWH bounds error
  - Bit 18: Off-Nadir error
  - Bit 19: SWH standard error
  - Bits 22-31: More than 5 frames missing
- Quality Word #2
  - Bit 11: Land contamination
- Default fill values indicative of bad data

Note: Bit 0 is defined as LSB

We suggest the use of above criteria by data users for editing the GFO data.

The process by which the cycle summaries were produced involved the following criteria:

- 60 second averaging interval
- 0.2 < SWH < 12.0
- -66.0 < Latitude <66.0
- 6.0 < Sigma0 < 16.0
- 44 < Numpoints in intervals < 62

All the cycle summaries produced at Wallops so far indicate excellent cycle-to-cycle consistency. Summaries for the first 130 cycles (cycles numbered 0-129) are shown in Table 2-1 "GFO Cycle Summaries". Cycle summaries are generated from the NGDR data provided to NAVO from NAVSOC.

During the payload off times and periods with no WVR data that occurred during this reporting period, the NGDR data was not provided. Therefore, no cycle processing could be performed for cycles 121-129.

Column Definitions for Table 2-1 Cycle Summaries	
Cycle	Equivalent to Exactly 17 Days
Days in Cycles	Beginning Year and Julian Day through the Ending Year and Julian Day of the Cycle
SSHUSTD (m)	Cycle Average Uncorrected Sea Surface Height Standard Deviation
SWH (m)	Cycle Average Significant Wave Height
Sigma0 (dB)	Cycle Average Sigma0
AGC (dB)	Cycle Average Automatic Gain Control
Attitude (deg)	Cycle Average Attitude
RecvrTemp (C)	Cycle Average Receiver Temperature
WindSpeed (.1m/s)	Cycle Average Windspeed
# Points Used	Total Number of Points Processed in the Cycle Period used in the Cycle Average

Table 2-1 GFO Cycle Summaries

Cycle	Days in Cycle, yyddd	SSHUSTD, m	SWH, m	Sigma0, dB	AGC, dB	Attitude, deg	RecvrTemp, C	WindSpeed, 0.1m/s	# Points Used
0	00335 - 00351	0.0426	2.4634	11.3467	43.2169	0.2392	38.1004	82.2133	661930.0
1	00352 - 01002	0.0435	2.5893	11.5076	43.3676	0.2502	39.7169	76.9435	670179.0
2	01003 - 01019	0.0421	2.4539	11.5464	43.4072	0.2422	38.1625	76.1032	705661.0
3	01020 - 01036	0.0424	2.5145	11.3383	43.2053	0.2105	35.9461	82.4006	705066.0
4	01037 - 01053	0.0428	2.5048	11.2909	43.1539	0.2340	33.6365	83.9581	575112.0
5	01054 - 01070	0.0440	2.5950	11.3143	43.1754	0.2362	33.5342	83.6164	792452.0
6	01071 - 01087	0.0443	2.6296	11.3496	43.2111	0.2335	33.3062	82.7288	778777.0
7	01088 - 01104	0.0448	2.6688	11.2597	43.1205	0.2255	33.2810	85.4292	727955.0
8	01105 - 01121	0.0442	2.6110	11.3374	43.1974	0.2270	35.3536	82.6415	781960.0
9	01122 - 01138	0.0445	2.5979	11.5202	43.3821	0.2361	38.7920	77.0297	682787.0
10	01139 - 01155	0.0429	2.4273	11.5259	43.3883	0.2254	37.1360	77.1754	769511.0
11	01156 - 01172	0.0431	2.4743	11.5309	43.3925	0.2301	38.9564	77.0553	761652.0
12	01173 - 01189	0.0442	2.6248	11.3143	43.1751	0.2200	36.1441	83.6154	767214.0
13	01190 - 01206	0.0437	2.5423	11.3137	43.1745	0.2083	33.2537	81.3067	750630.0
14	01207 - 01223	0.0441	2.6452	11.1944	43.0576	0.2097	32.7243	87.3751	747226.0
15	01224 - 01240	0.0428	2.5422	11.2748	43.1381	0.2180	32.9023	84.7361	757575.0
16	01241 - 01257	0.0440	2.5988	11.2864	43.1472	0.2232	32.8176	84.7772	752352.0
17	01258 - 01274	0.0441	2.5846	11.3227	43.1835	0.2298	33.1715	83.4550	708963.0

Table 2-1 GFO Cycle Summaries (Continued)

Cycle	Days in Cycle, yyddd	SSHUSTD, m	SWH, m	Sigma0, dB	AGC, dB	Attitude, deg	RecvrTemp, C	WindSpeed, 0.1m/s	# Points Used
18	01275 - 01291	0.0442	2.6115	11.4142	43.2758	0.2441	36.5931	80.1253	733146.0
19	01292 - 01308	0.0422	2.3769	11.5406	43.4015	0.2506	39.0869	76.0492	740202.0
20	01309 - 01325	0.0431	2.4908	11.3894	43.2502	0.2456	38.0352	80.7366	763436.0
21	01326 - 01342	0.0423	2.4054	11.5086	43.3702	0.2565	40.3354	76.7640	760609.0
22	01343 - 01359	0.0421	2.4211	11.3740	43.2340	0.2390	36.0733	81.4164	776570.0
23	01360 - 02011	0.0430	2.4595	11.3632	43.2214	0.2372	34.6067	81.6712	777658.0
24	02012 - 02028	0.0419	2.4555	11.2929	43.1544	0.2374	33.8748	83.8318	788337.0
25	02029 - 02045	0.0434	2.5995	11.2344	43.0959	0.2403	33.9140	85.6793	793967.0
26	02046 - 02062	0.0418	2.4363	11.3118	43.1726	0.1960	33.7699	83.3240	776874.0
27	02063 - 02079	0.0420	2.4820	11.2993	43.1601	0.0959	34.0986	83.7140	759495.0
28	02080 - 02096	0.0431	2.5973	11.3047	43.1647	0.1062	35.5185	83.6089	763915.0
29	02097 - 02113	0.0429	2.5122	11.4835	43.3435	0.1303	39.3145	78.3730	777198.0
30	02114 - 02130	0.0433	2.5705	11.3721	43.2352	0.1275	37.5810	81.2207	771475.0
31	02131 - 02147	0.0431	2.5229	11.5137	43.3769	0.1378	39.4172	77.3539	769096.0
32	02148 - 02164	0.0426	2.4842	11.3335	43.1951	0.1176	34.9234	82.7158	751307.0
33	02165 - 02181	0.0432	2.5975	11.1661	43.0261	0.0936	33.2024	88.1230	695887.0
34	02182 - 02198	0.0426	2.4700	11.2788	43.1397	0.0891	32.8489	84.6981	759199.0
35	02199 - 02215	0.0436	2.6013	11.2309	43.0918	0.0856	32.9862	86.5075	753679.0
36	02216 - 02232	0.0437	2.5655	11.2559	43.1159	0.0816	32.9686	85.8057	756166.0
37	02233 - 02249	0.0432	2.4940	11.3231	43.1839	0.0824	33.1290	83.5694	750831.0
38	02250 - 02266	0.0433	2.4764	11.4104	43.2782	0.0984	35.2167	80.6096	722417.0
39	02267 - 02283	0.0417	2.3496	11.5440	43.4040	0.1257	39.8588	75.9570	790561.0
40	02284 - 02300	0.0429	2.4216	11.5900	43.4525	0.1260	39.4430	74.9548	741718.0
41	02301 - 02317	0.0452	2.4552	11.4899	43.3531	0.1291	39.5481	77.9058	758725.0
42	02318 - 02334	0.0366	2.4707	11.3157	43.1773	0.1060	34.9509	83.2591	726926.0
43	02335 - 02351	0.0454	2.5430	11.3260	43.1868	0.0985	33.9964	83.1453	777845.0
44	02352 - 03003	0.0366	2.4304	11.3788	43.2456	0.0919	33.9796	81.3639	756223.0
45	03004 - 03020	0.0370	2.5188	11.3788	43.2722	0.0954	34.3442	81.5900	759120.0
46	03021 - 03037	0.0437	2.4140	11.3696	43.2318	0.0969	34.1612	81.2326	796658.0
47	03038 - 03054	0.0445	2.5299	11.3311	43.1919	0.0954	33.9011	82.8948	803538.0
48	03055 - 03071	0.0448	2.4707	11.4510	43.3133	0.1025	35.1232	79.4225	797328.0
49	03072 - 03088	0.0449	2.5453	11.5661	43.4293	0.1270	39.8270	76.2134	789422.0
50	03089 - 03105	0.0455	2.5855	11.4690	43.3298	0.1281	39.2894	78.8082	781713.0
51	03106 - 03122	0.0449	2.5349	11.4994	43.3594	0.1312	38.9355	77.9592	721614.0
52	03123 - 03139	0.0456	2.5981	11.2533	43.1156	0.1118	34.3041	85.6061	788121.0

Table 2-1 GFO Cycle Summaries (Continued)

Cycle	Days in Cycle, yyddd	SSHUSTD, m	SWH, m	Sigma0, dB	AGC, dB	Attitude, deg	RecvrTemp, C	WindSpeed, 0.1m/s	# Points Used
53	03140 - 03156	0.0455	2.5929	11.3193	43.1808	0.1047	32.9220	83.7258	775966.0
54	03157 - 03173	0.0447	2.4875	11.3113	43.1713	0.0990	32.7629	84.0875	771445.0
55	03174 - 03190	0.0444	2.3957	11.3784	43.2419	0.0921	32.9165	82.0420	746389.0
56	03191 - 03207	0.0452	2.6326	11.1701	43.0333	0.0867	32.8827	88.5271	767126.0
57	03208 - 03224	0.0454	2.5396	11.3199	43.1814	0.0816	32.9097	84.0493	762023.0
58	03225 - 03241	0.0439	2.3609	11.4089	43.2740	0.0870	34.1636	81.0249	751092.0
59	03242 - 03258								
60	03259 - 03275								
61	03276 - 03292								
62	03293 - 03309	0.0445	2.3825	11.3561	43.2171	0.0753	31.5633	82.6144	714232.0
63	03310 - 03326	0.0452	2.4420	11.3125	43.1733	0.0952	33.8310	83.4008	766574.0
64	03327 - 03343	0.0444	2.4505	11.3686	43.2403	0.0958	34.0098	81.8461	598223.0
65	03344 - 03360	0.0442	2.4414	11.3529	43.2171	0.0971	34.7116	81.7847	727762
66	03361 - 04012	0.0431	2.3448	11.3925	43.254	0.0982	34.6763	80.6005	797884
67	04013 - 04029	0.0438	2.399	11.4714	43.3338	0.1055	34.5151	78.636	787084
68	04030 - 04046	0.0438	2.4265	11.3416	43.2058	0.0958	33.9595	82.3677	783256
69	04047 - 04063	0.0449	2.5274	11.3894	43.2494	0.0927	34.0635	81.0399	320568
70	04064 - 04080								
71	04081 - 04097								
72	04098 - 04114	0.0459	2.6563	11.2089	43.0708	0.0893	31.5338	87.3962	651944
73	04115 - 04131	0.0453	2.6239	11.2271	43.0887	0.1005	33.022	86.1777	793578
74	04132 - 04148	0.0443	2.4494	11.388	43.248	0.0977	33.1254	81.6354	778311
75	04149 - 04165	0.0458	2.5434	11.2702	43.131	0.0994	33.3311	84.9079	779784
76	04166 - 04182	0.0451	2.5768	11.223	43.0863	0.0944	33.1352	86.8351	773090
77	04183 - 04199	0.0451	2.4671	11.3719	43.2337	0.0927	33.1096	82.6065	757315
78	04200 - 04216	0.0448	2.4281	11.3099	43.1739	0.074	31.6784	84.2954	753333
79	04217 - 04233	0.045	2.4844	11.3565	43.2181	0.0815	33.3948	82.6463	761187
80	04234 - 04250	0.0444	2.4076	11.4278	43.2886	0.0755	32.7667	80.4139	757306
81	04251 - 04267	0.0461	2.5871	11.2939	43.1547	0.0809	33.059	84.6105	739086
82	04268 - 04284	0.0447	2.3928	11.3346	43.1953	0.075	32.0057	83.0817	761552
83	04285 - 04301	0.045	2.424	11.3353	43.1969	0.0919	33.6228	82.909	755527
84	04302 - 04318	0.0449	2.437	11.3582	43.22	0.0962	34.0789	82.0715	762176
85	04319 - 04335	0.0437	2.3269	11.4547	43.3155	0.1025	34.4577	79.1597	763112
86	04336 - 04352	0.0444	2.4564	11.3589	43.2197	0.105	34.6028	81.8532	778088
87	04353 - 05003	0.0435	2.3944	11.4336	43.2967	0.1044	34.8401	79.7772	794525.0

Table 2-1 GFO Cycle Summaries (Continued)

Cycle	Days in Cycle, yyddd	SSHUSTD, m	SWH, m	Sigma0, dB	AGC, dB	Attitude, deg	RecvrTemp, C	WindSpeed, 0.1m/s	# Points Used
88	05004 - 05020	0.0434	2.4182	11.3789	43.2446	0.1023	35.4445	80.9943	745006.0
89	05021 - 05037	0.0439	2.3955	11.4394	43.3395	0.1098	36.5548	79.0209	800996.0
90	05038 - 05054	0.0438	2.4323	11.5270	43.4406	0.1168	38.5072	76.5776	800211.0
91	05055 - 05071	0.0446	2.5360	11.4290	43.2898	0.1059	36.4254	79.9209	798349.0
92	05027 - 05088	0.0444	2.4492	11.4378	43.3020	0.0989	33.9925	80.0597	784569.0
93	05089 - 05105	0.0450	2.6753	11.1450	43.0082	0.0958	33.0399	88.7786	798740.0
94	05106 - 05122	0.0449	2.5371	11.3881	43.2488	0.0959	33.2064	81.8642	782553.0
95	05123 - 05139	0.0443	2.4739	11.3906	43.2514	0.1012	33.4951	81.4249	787969.0
96	05140 - 05156	0.0452	2.5341	11.3624	43.2240	0.1068	33.4000	82.4498	780476.0
97	05157 - 05173	0.0447	2.4439	11.3925	43.2548	0.1125	33.7084	81.2082	776894.0
98	05174 - 05190	0.0451	2.4515	11.3684	43.2284	0.1149	34.2058	82.2904	766282.0
99	05191 - 05207	0.0461	2.5732	11.3474	43.2091	0.1062	35.0449	83.0317	759861.0
100	05208 - 05224	0.0444	2.3756	11.4706	43.3331	0.1023	35.3591	79.4001	758354.0
101	05225 - 05241	0.0453	2.4730	11.4032	43.2642	0.0974	34.6719	80.9772	709951.0
102	05242 - 05258	0.0462	2.5612	11.2951	43.1562	0.0876	33.8876	84.1186	655934.0
103	05259 - 05275	0.0448	2.4949	11.3497	43.2121	0.0890	33.7256	82.6856	753236.0
104	05276 - 05292	0.0455	2.5146	11.2664	43.1328	0.0784	31.9898	84.9222	735601.0
105	05293 - 05309	0.0451	2.5256	11.2459	43.1328	0.0787	31.7480	85.4549	758290.0
106	05310 - 05326	0.0451	2.4094	11.3724	43.2348	0.0856	32.0910	81.7747	759513.0
107	05327 - 05343	0.0443	2.3681	11.4074	43.2741	0.0993	34.2384	80.2246	754972.0
108	05344 - 05360	0.0436	2.3197	11.5451	43.4085	0.1082	36.2805	76.2705	745056.0
109	**05361 - 06012**	**0.0447**	**2.3892**	**11.4591**	**43.3207**	**0.0997**	**35.3343**	**79.0905**	**791008.0**
110	**06013 - 06029**	**0.0442**	**2.4991**	**11.2779**	**43.1411**	**0.0976**	**34.3512**	**84.1140**	**648853.0**
111	**06030 - 06046**	**0.0443**	**2.4749**	**11.3883**	**43.2483**	**0.1076**	**35.5479**	**80.7752**	**777175.0**
112	**06047 - 06063**	**0.0431**	**2.4127**	**11.3363**	**43.1980**	**0.0787**	**31.9016**	**83.0314**	**796451.0**
113	**06064 - 06080**	**0.0443**	**2.5154**	**11.2183**	**43.0806**	**0.0670**	**30.2860**	**86.4960**	**805763.0**
114	**06081 - 06097**	**0.0458**	**2.6231**	**11.2402**	**43.1010**	**0.0724**	**30.7167**	**86.0258**	**800850.0**
115	**06098 - 06114**	**0.0439**	**2.4934**	**11.3492**	**43.2100**	**0.0967**	**33.5405**	**82.6970**	**792310.0**
116	**06115 - 06131**	**0.0454**	**2.5518**	**11.3771**	**43.2394**	**0.0978**	**33.6332**	**81.9919**	**786920.0**
117	**06132 - 06148**	**0.0455**	**2.4960**	**11.4187**	**43.2804**	**0.1070**	**34.2497**	**80.8597**	**783726.0**
118	**06149 - 06165**	**0.0460**	**2.6011**	**11.3870**	**43.2501**	**0.1140**	**34.8401**	**81.9158**	**785136.0**
119	**06166 - 06182**	**0.0451**	**2.5637**	**11.3025**	**43.1625**	**0.1119**	**34.8128**	**83.9928**	**771283.0**
120	**06183 - 06199**	**0.0456**	**2.5784**	**11.3117**	**43.1743**	**0.1047**	**34.6627**	**83.8550**	**771259.0**

Note: The Cycle Summaries since last year's report are indicated by bold type.

2.2.1 GFO Sigma0 and its Comparison with JASON-1

The GFO Sigma0 (backscatter coefficient) cycle-averages are shown by the black squares in Figure 2-4. GFO Sigma0 has remained in a band between 11.16 and 11.59 dB.

In section 2.2.7 of the *GFO Altimeter Engineering Assessment Report,* May 2004 (NASA/TM-2004-209984/Ver.1/Vol.6), we documented that the GFO Sigma0 has a small, uncorrected, dependence on receiver temperature, wherein the Sigma0's are higher with increasing temperature. George Hayne of Wallops analyzed this Sigma0 temperature dependence in Appendix B of the *GFO Altimeter Engineering Assessment Report*, September 2005 (NASA/TM-2005-209984/Vol. 7) and found it to be 0.033$\pm$0.003 dB per degree Centigrade.

For this report we have added the JASON-1 10-day cycle averages. Since the time periods of average (10 days for JASON-1 and 17 days for GFO) and latitude coverage are different, we can not compute a meaningful difference but the trends agree extremely well. The 2 dB bias depicted in Figure 2-4 is from JASON having its own absolute calibration and not being calibrated into the GFO measurement system.

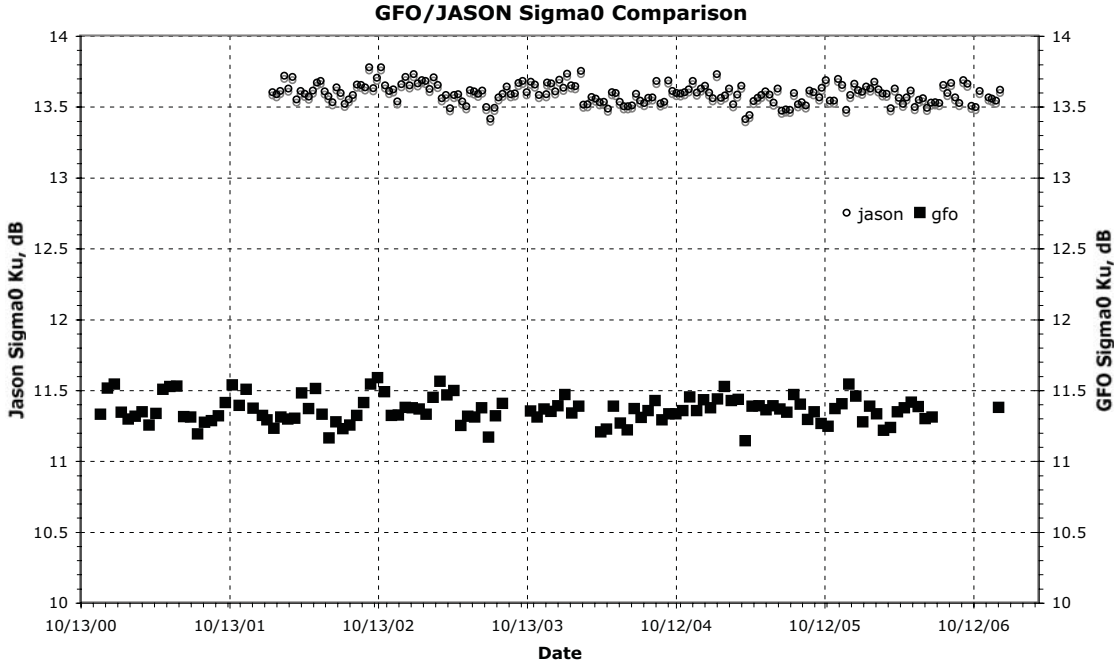

Figure 2-4 GFO/JASON Sigma0 Comparison

2.2.2 Delta of JASON C minus Ku Sigma0

We evaluated the JASON Ku and C-band sigma 0 relationship and find both frequencies are producing internally stable measurements. The JASON C-band and Ku-band Sigma0 differences (C-band minus Ku-band) are shown in Figure 2-5.

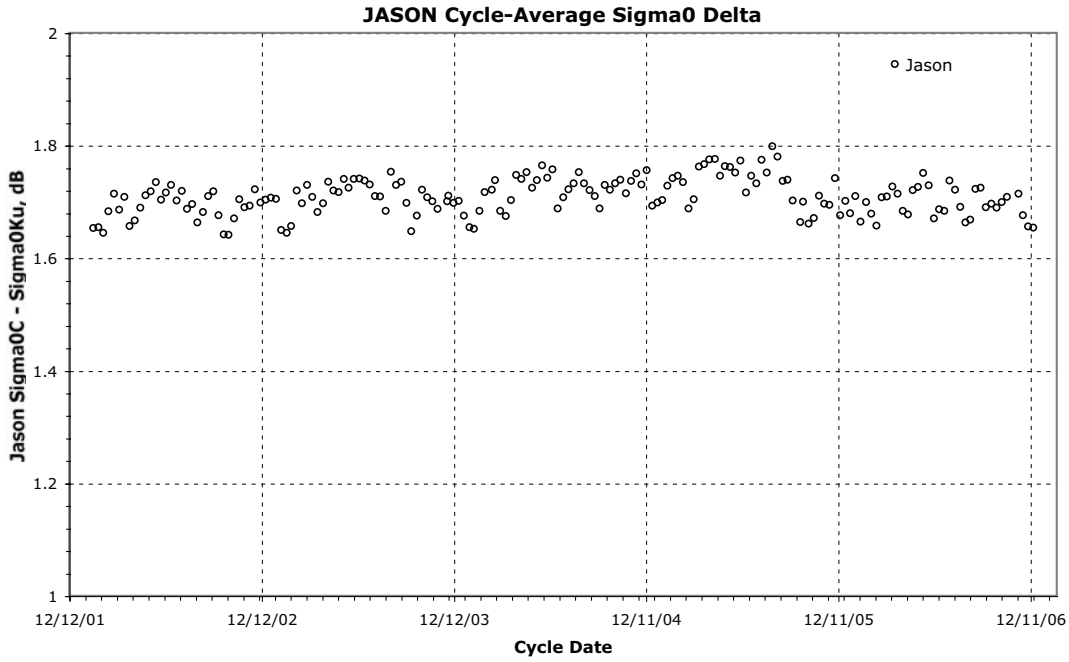

Figure 2-5 JASON Cycle-Average Sigma0 Delta

2.2.3 GFO Significant Wave Height and its Comparison with JASON-1

The GFO significant wave height (SWH) cycle-averages, shown by the black squares in Figure 2-6, have remained very stable with cycle average between 2.3 and 2.7 meters. The GFO SWH cycle average compared to JASON cycle averages in Figure 2-6 show consistent agreement with JASON SWH approximately 0.3 m higher.

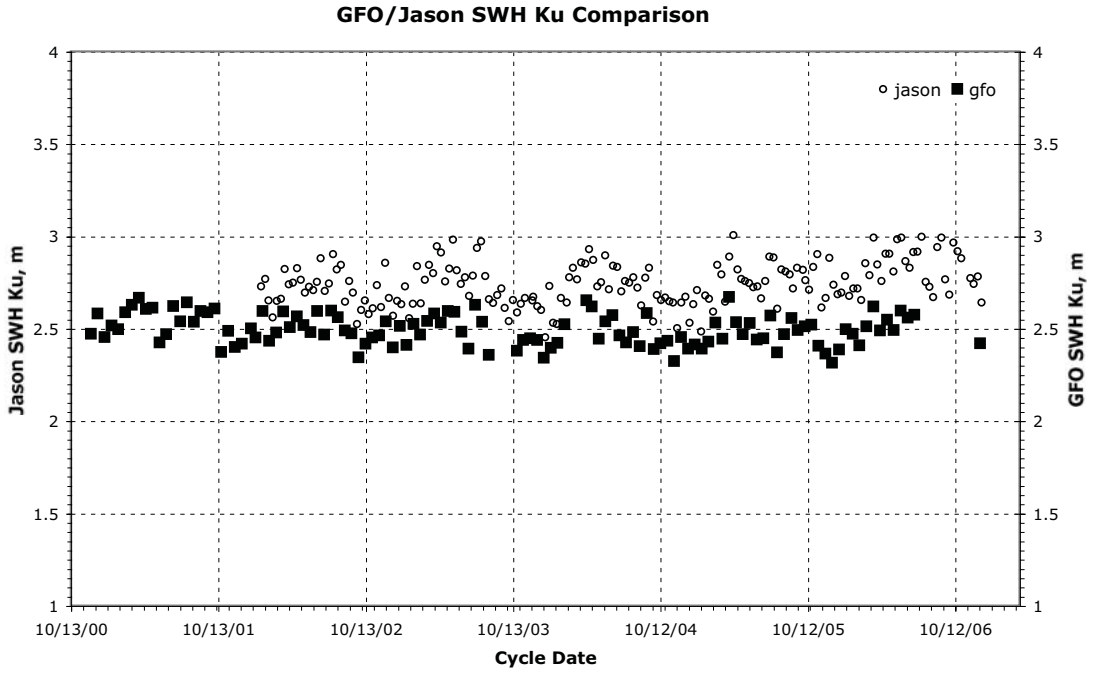

Figure 2-6 GFO/JASON SWH Ku Comparison

2.2.4 Delta of JASON SWH C minus KU

For the JASON Ku and C-band SWH comparison, we computed the differences in the cycle means. There appears to be a small negative change in the difference for this past year. This shift (<2 cm) is considered to be insufficient for any need to investigate further or calibrate out.

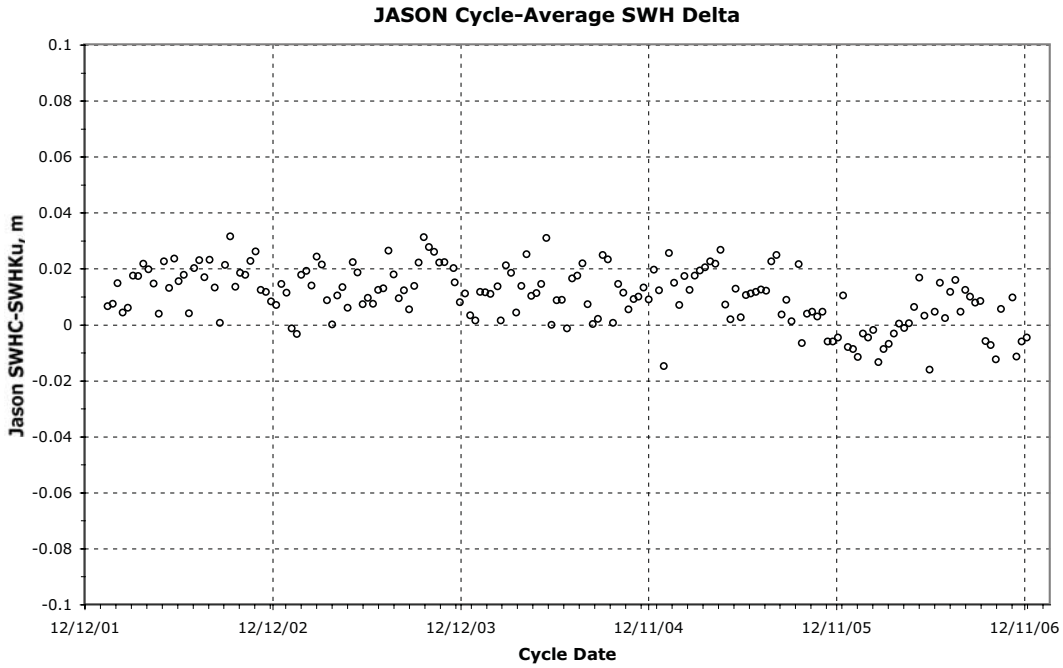

Figure 2-7 JASON Cycle-Average SWH Delta

2.2.5 GFO Attitude

The GFO attitude (Off-Nadir) cycle-averages are shown in Figure 2-8. Through Cycle 25, the attitude remained between 0.20 and 0.25 degrees. On Day 2002057, a spacecraft attitude adjustment lowered the cycle-average attitude by approximately 0.15 degrees. Since Cycle 27, the cycle average attitude has remained between 0.067 and 0.14 degrees.

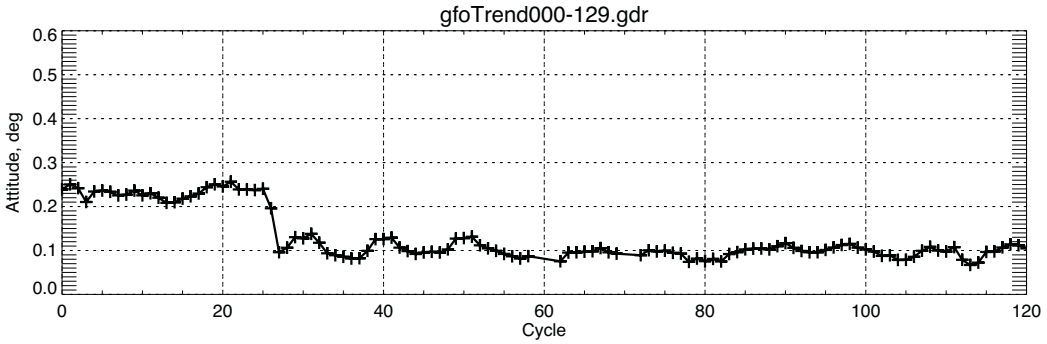

Figure 2-8 GFO Cycle-Averages Attitude in Degrees

2.2.6 GFO Receiver Temperature

The GFO receiver temperature cycle-averages are shown in Figure 2-9. Receiver temperature has remained between 30.2 and 40.4 Degrees Celsius.

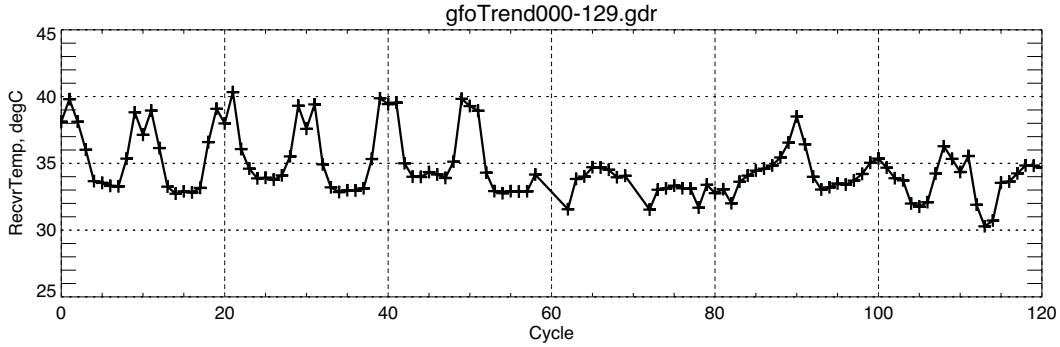

Figure 2-9 GFO Cycle-Averages Receiver Temperature in Degrees Celsius

2.2.7 GFO Windspeed

The GFO windspeed cycle-averages are shown in Figure 2-10. Windspeed has remained between 7.50 and 8.9 meters/second.

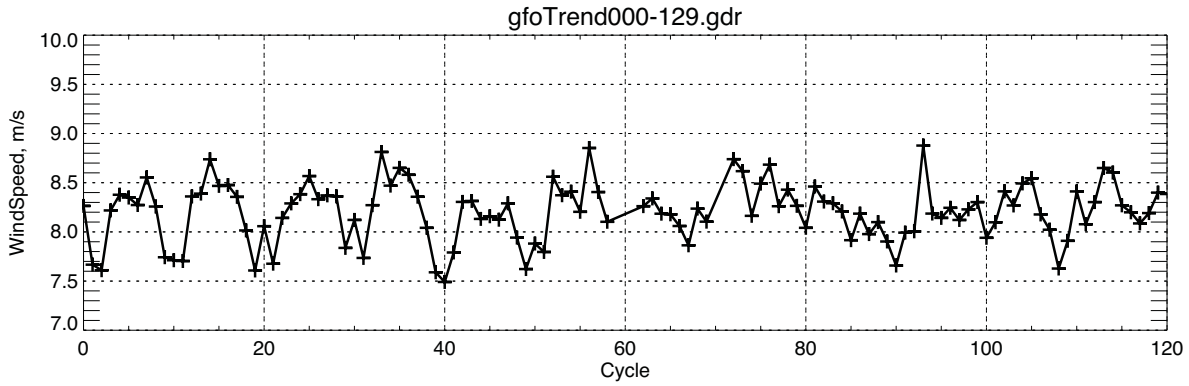

Figure 2-10 GFO Cycle-Averages Windspeed in Meters Per Second

2.2.8 GFO Windspeed, Sigma0 and Receiver Temperature Dependence and its Comparison with JASON-1

Comparisons of the cycle averages of Sigma0 and waveheight (SWH) between GFO, JASON Ku and JASON C-band show consistent relationships. This implies all the systems are stable and respond similarly to the surface features of wind and waves. It is believed the orbital differences between GFO and JASON account for the large range of SWH. The larger noise on GFO is probably from induced small temperature dependence discussed below.

An informal memo, "GFO Sigma0 Trends with Temperature: Analysis Efforts", by George Hayne of Wallops, can be found in Appendix B of the *GFO Altimeter Engineering Assessment Report,* September 2005 (NASA/TM-2005-209984/Vol. 7) which discusses the GFO Sigma0 correlation with receiver temperature.

Another informal memo, by George Hayne, "GFO Wind Speed Correction for Sigma0 Temperature Dependence", can be found in Appendix E of the same document describing how to correct the GFO windspeed for the receiver temperature effect in Sigma0. This memo also describes two methods to derive corrected windspeed. The first is to correct Sigma0, then use the modified Chelton-Wentz equation to recompute windspeed. The other method is to compute a delta windspeed correction that can be added to the GFO estimate windspeed. For the corrected data plots (Figure 2-12 thru Figure 2-15), we corrected the GFO Sigma0, then recomputed the windspeeds.

As we have noted in the past, the GFO Sigma0 has an uncorrected small instrument temperature dependence of about ±0.1 dB. This is similar in magnitude to the CAL-2 dependence on temperature mentioned in Section 2.1.2. This temperature dependence is seen in Figure 2-11 depicting global Sigma0 vs. receiver temperature with a band of Sigma0 at 11.20 to 11.60, a span of 0.40 dB. Since this variation is smaller than the GFO specification, the correction had not been earlier implemented.

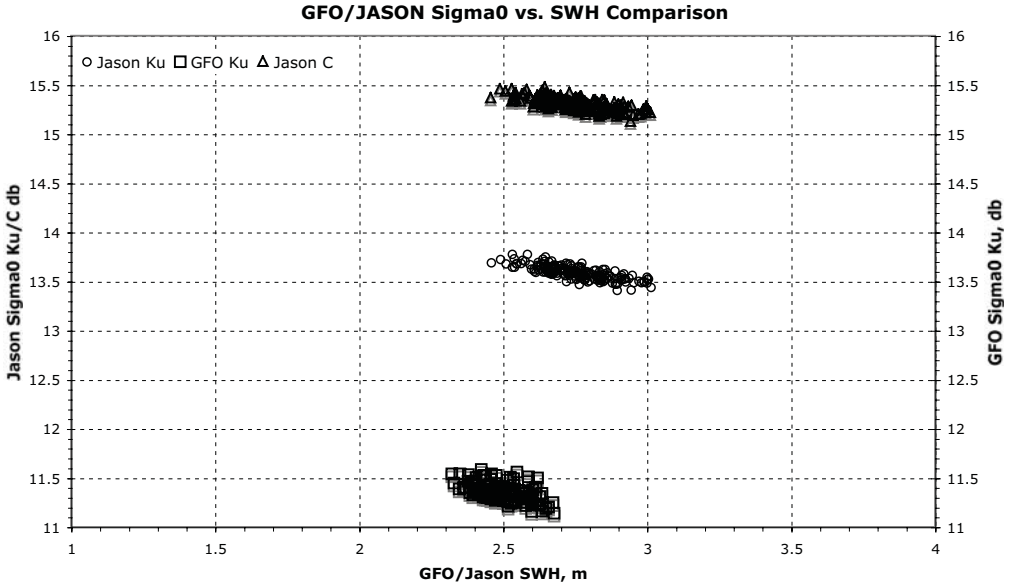

Figure 2-11 GFO/JASON Cycle-Averages Sigma0 vs. Temperature

The propagation of the GFO Sigma0 temperature-dependence to windspeed can be seen in the global average windspeed relationship plotted in Figure 2-12 showing a total cycle-average range of about ±0.7 meters/second. This is well within the GFO windspeed specification of 2.0 meters/second.

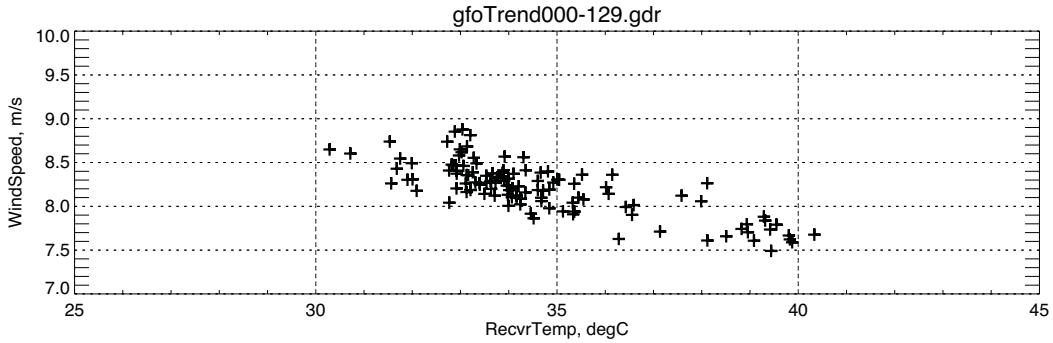

Figure 2-12 GFO Cycle-Averages Windspeed vs. Temperature

Figure 2-13 shows the resulting cycle-average Sigma0 after being temperature corrected. Figure 2-14 shows the temperature corrected Sigma0 vs. the receiver temperature. This correction reduces the band of Sigma0 to a span of 0.25dB. Figure 2-15 shows the resulting cycle-average windspeed from using the new temperature corrected Sigma0, in the Modified Chelton-Wentz equation given in Appendix E of the document mentioned earlier in this section. Figure 2-16 shows the recomputed windspeed vs. the receiver temperature with a reduced cycle-average variation of $\pm$0.6 meters/second.

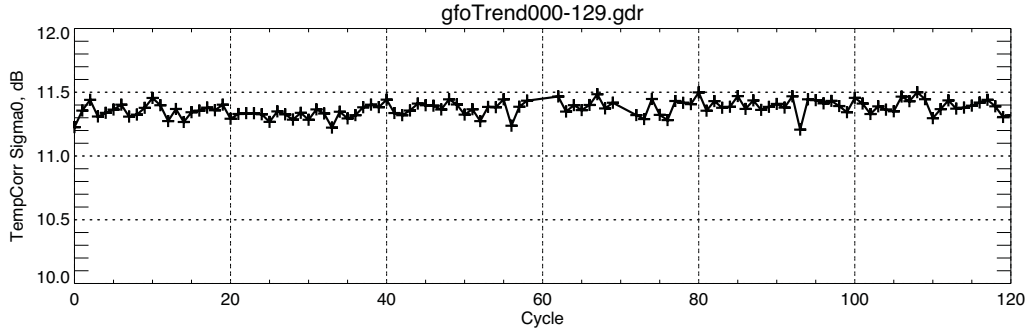

Figure 2-13 GFO Cycle-Averages Temperature Corrected Sigma0 in dB

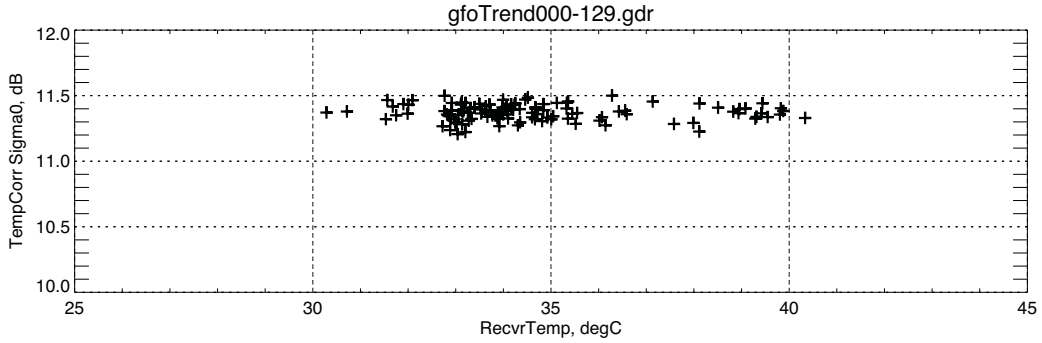

Figure 2-14 GFO Cycle-Averages Temperature Corrected Sigma0 vs. Temperature

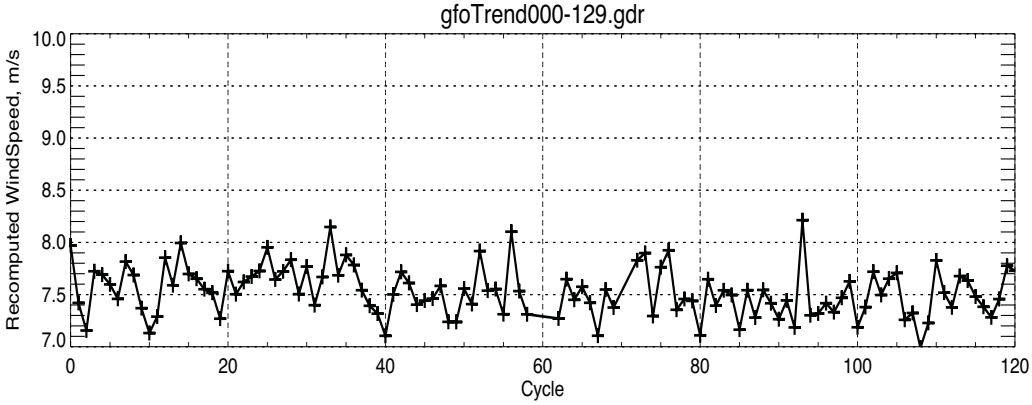

Figure 2-15 GFO Cycle-Averages Recomputed Windspeed in Meters Per Second

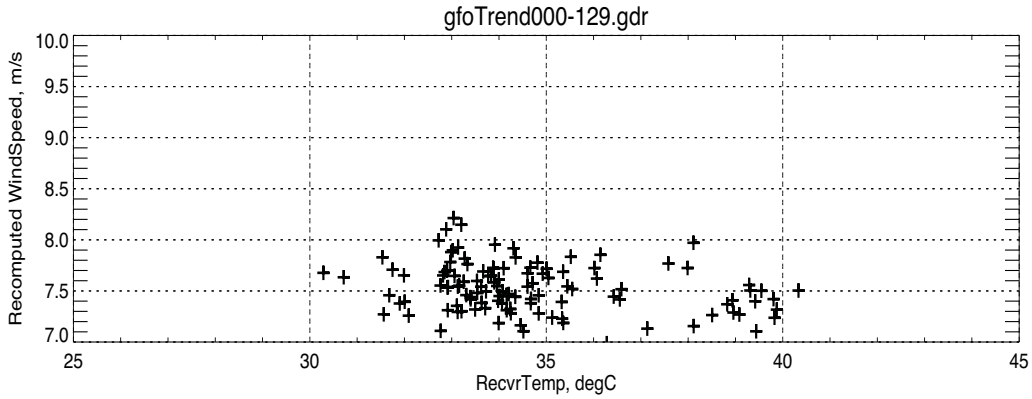

Figure 2-16 GFO Cycle-Averages Recomputed Windspeed vs. Temperature

2.2.9 GFO Cycle Summary Conclusions

We have previously found with TOPEX that, if the geophysical data are strictly edited, a global cycle-average of parameters provides a means of assessing cycle-to-cycle stability, and that variations can indicate changes in the altimeter instrument. Table 2-1 "GFO Cycle Summaries" on page 2-6 and the subsequent plots demonstrate similar stable performance for GFO.

The GFO Sigma0, Figure 2-4, exhibits a small temperature effect as shown in Figure 2-11. We have not applied a temperature correction to this data, but the uncorrected Sigma0 still remains within $\pm$0.25 dB, well within the 1 dB specification. It was previously recommended in the *GFO Altimeter Engineering Assessment Report, From Launch to Acceptance, 10 February 1998 to 29 November 2000*, March 2001 (NASA/TM-2001-209984/Ver.1/Vol.1) that a correction be implemented.

The waveform estimated attitude (Off-Nadir), Figure 2-8, has remained stable except for the spacecraft attitude adjustment on 2002 Day 057 that shifted its mean to a smaller angle. This indicates that the data are consistent, spacecraft operations have maintained attitude control, and that the waveform samples have not changed their calibrations.

The average windspeed, Figure 2-10, is directly related to the Sigma0 and shows approximately a 1.4 meter per second variation. For calibration purposes, it is recommended the temperature correction be applied (see Appendix E, “GFO Wind Speed Correction for Sigma0 Temperature Dependence” in the *GFO Altimeter Engineering Assessment Report*, September 2005 (NASA/TM-2005-209984/Vol. 7)); however, the raw average is better than the specification of 2 meters per second.

2.3 GFO Key Events Log

The key events log is a list of sensor-related events. The key events for the GFO altimeter that have occurred since the previous Engineering Assessment Report are summarized in Table 2-2. These sensor-related key events are extracted from:

http://gfo.bmpcoe.org/Gfo/Event_Log/gfo_event_log.htm

Additionally, key events from a Wallops perspective have been included. Reduced support usually indicates that either the WVR is turned off or that there is no full waveform collection occurring. In 3.2, we define 'reduced support' as periods where collection of full waveforms for several days has stopped. Key events that have occurred prior to December 26, 2005, are summarized in Appendix B.

Table 2-2 GFO Key Events (since previous report)

Event	Date & Time of Event	Comments
FWF Suspended	26 Dec 2005 2005360t22:02:49Z	Due to ground system limitations, the standard 7-hour RA calibration will instead be run as a ten-minute calibration
FWF Restored	27 Dec 2005 2005361t23:20:00Z	Full waveform (FWF) data collection resumed
Yaw Maneuver	05 Jan 2006 2006005T23:30:00Z	Point-state yaw modification from +2.5degrees to 5 degrees.
Yaw Maneuver	07 Jan 2006 2006007T01:06:34Z	Due to increasing sun duration per orbit, changing GFO's yaw by itself is no longer effective in controlling GFO's thermal environment while maintaining minimum battery power. Hence, NAVSOC changed yaw back to 2.5 degrees at 0107z on 07 Jan 2006.
DDL Off FWF Suspended	07 Jan 2006 2006007T01:14:34Z	The Direct Down Link turned off for thermal management. The ten minute CAL performed but no Full Waveform data collection.
FWF Restored	12 Jan 20056 2006012t23:20:00Z	Full waveform (FWF) data collection resumed
Shut Down	14 Jan 2006 2006014T04:00:00Z	GFO experienced an apparent Under-Voltage 3 (UV3) fault response on Day 014 between approximately 0400z and 0700z. As a result, the spacecraft stopped producing payload data, and transitioned into an automated tumble. Because all DSU data is erased during a UV3 (as a result of the loss of the ACB, which powers the DSU), it may not be possible to determine the exact time of the fault response.

Table 2-2 GFO Key Events (Continued)
(since previous report)

Event	Date & Time of Event	Comments
Payloads Restored	15 Jan 2006 2006015T04:00:00Z	GFO has been returned to Point state, real-time telemetry has been restored, the DSU has resumed recording health data, and the spacecraft continues transmitting in mode 2. It is anticipated that payload service will be restored within the next two days. The specific cause of this fault is currently under investigation.
Reduced Support	16 Jan 2006 2006016T19:24:47Z	Ocean wave height data collection for GFO resumed at 016/1924z. The Water Vapor Radiometer (WVR) is still powered off, therefore the data may be degraded.
Trim Maneuver	19 Jan 2006 2006019T03:03:00Z	The burn magnitude was15.610 mm/s with a 0 degree yaw. GFO out of point: 02:57:45z - 03:03:15z.
Yaw Maneuver	19 Jan 2006 2006019T19:35:00Z	Point-state yaw modification from -5 degrees to 0 degrees.
Yaw Maneuver	23 Jan 2006 2006023T20:45:00Z	Point-state yaw modification from 0 degrees to 2.5 degrees.
Reduced Support FWF Suspended	25 Jan 2006 2006025T21:22:00Z	The Water Vapor Radiometer (WVR) was powered on and it was re-initialized (reset and re-calibrated) at exactly, 20:51:18 z on 26 Jan 2006. Ten minute CAL performed but no Full Waveform data collection.
Yaw Maneuver	09 Feb 2006 2006040T22:00:00Z	Point-state yaw modification from 2.5 degrees to 0 degrees.
FWF Restored	09 Feb 2006 2006040T02:20:00Z	Full waveform (FWF) data collection resumed.
Commanded	15 Feb 2006 2006046T00:59:00Z	The VT level was changed from 7.0 to 7.5 on Wednesday.
FWF Suspended	21 Feb 2006 2006052T02:20:00Z	Ten minute CAL performed but no Full waveform (FWF) data collection.
Yaw Maneuver	25 Feb 2006 2006056T00:01:00Z	Point-state yaw modification from 0 degrees to -2.5 degrees.

Table 2-2 GFO Key Events (Continued)
(since previous report)

Event	Date & Time of Event	Comments
ABCAL	02 Mar 2006 2006061T20:54:00Z	Performed ABCAL Maneuver: 061T20:54:00Z - 061T21:10:00Z.
Yaw Maneuver	09 Mar 2006 2006069T17:35:00Z	Point-state yaw modification from -2.5 degrees to -5.0 degrees.
FWF Restored	07 Apr 2006 2006097T05:50:13Z	Full waveform (FWF) data collection resumed.
Trim Maneuver	13 Apr 2006 2006103T01:35:00Z	The burn magnitude was 12.002 mm/s with a 0 degree yaw. Raise SMA slightly. 021:29:45z - 01:35:15z.
Yaw Maneuver	31 May 2006 2006151T18:30:00Z	Point-state yaw modification from -5 degrees to -2.5 degrees.
Trim Maneuver	13 Jul 2006 2006194T01:43:00Z	The burn magnitude was 3.000 mm/s with a 0 degree yaw.
Shut Down	02 Aug 2006 2006214T08:34:00Z	Three payload outages occurred due to low voltage conditions on the satellite during eclipse. This event shut the payload off. The RA and WVR will remain off temporarily during testing.
Yaw Maneuver	03 Aug 2006 2006215T22:15:00Z	GFO's yaw orientation was modified from -5 degrees to -7.5 degrees.
Yaw Maneuver	08 Aug 2006 2006220T17:50:00Z	GFO's yaw orientation was modified from -7.5 degrees to -10.0 degrees.
Trim Maneuver	17 Aug 2006 2006229T00:24:00Z	The burn magnitude was 9.000 mm/s with a 180 degree yaw. GFO out of point: 00:19:30z- 00:30:00z.
Payloads Restored	23 Aug 2006 2006235T16:50:00Z	GFO satellite systems came back online as of approximately 16:50z on 23 Aug 06. The WVR was turned on at 16:30z on 23 Aug 06. The payload started producing high quality data as of 16:06:23z on 24 Aug 06. The ADFC has begun processing the data on 24 Aug 06 and data delivery has resumed.
Shut Down	25 Aug 2006 2006237T00:40:00Z	GFO is still experiencing voltage problems and the critical sensors are currently off

Table 2-2 GFO Key Events (Continued)
(since previous report)

Event	Date & Time of Event	Comments
Trim Maneuver	27 Sep 2006 2006270T01:00:00Z	The burn magnitude was 12.127 mm/s with a 0 degree yaw. GFO out of point: 00:54:38z- 01:06:00z.
Payload Operations Resumed Reduced Support	05 Oct 2006 2006278T13:00:00Z	As of approximately 1300 UTC on Day 278 the GFO RA was placed in Track One and has resumed collecting data.However the WVR will remain off until further notice
Trim Maneuver	12 Nov 2006 2006316T22:37:00Z	The burn magnitude was 15.4 mm/s with a 0 degree yaw. GFO out of point: 22:31:45z-22:43:00z.
Yaw Maneuver	14 Nov 2006 2006318T22:00:00Z	GFO's yaw orientation was modified from -10.0 degrees to -5.0 degrees.
Inclination Maneuver	16 Nov 2006 2006320T02:49:00Z	The burn magnitude was 150.0 mm/s with a 90 degree yaw. The RA was turned off at 01:48:57Z and back on at 02:52:05Z. The software patch was uploaded and the RA put in Track-1 mode between 06:00:00Z and 06:15:00Z.
Inclination Maneuver	22 Nov 2006 2006326T03:03:00Z	The burn magnitude was 1185.0 mm/s with a 90 degree yaw. The RA was turned off at 02:02:34Z and back on at 06:29:00Z. The software patch was uploaded and the RA put in Track-1 mode by 06:29:00Z. Data loss between 02:02:34 and 06:29:00Z.
Inclination Maneuver	25 Nov 2006 2006329T00:51:00Z	The burn magnitude was 65.0 mm/s with a 180 degree yaw. The RA was put in standby mode at 00:45:36Z and back on at 01:16:45Z. This was to correct the semi-major axis from the previous maneuver
Yaw Maneuver	28 Nov 2006 2006332T19:13:22Z	GFO's yaw orientation was modified from 0 degrees to +2.5 degrees.
Trim Maneuver	28 Nov 2006 2006332T22:48:00Z	The burn magnitude was 23.3 mm/s with a 0 degree yaw. The RA was put in standby mode at 22:42:26Z and back on at 23:13:21Z.

Table 2-2 GFO Key Events (Continued)
(since previous report)

Event	Date & Time of Event	Comments
Trim Maneuver	29 Nov 2006 2006333T00:28:00Z	The burn magnitude was 22.8 mm/s with a 0 degree yaw. The RA was put in standby mode at 00:23:05Z and back on at 00:54:01Z.
Yaw Maneuver	05 Dec 2006 2006339T18:55:00Z	GFO's yaw orientation was modified from +2.50 degrees to 0.0 degrees.
Support Resumed	06 December 2006 - 2005340T18:26:45Z	GFO WVR1 was turned on at approximately 18:26:45Z.
Reduced Support	7 December 2006 - 2005341T01:50:00Z	GFO WVR1 was turned off at approximately 01:50Z to reduce spacecraft temperatures.
Yaw Maneuver	08 Dec 2006 2006342T??Z	GFO's yaw orientation was modified from 0.0 degrees to +2.50 degrees.
Support Resumed	11 Dec 2006 2006345T19:20:00Z	The Water Vapor Radiometer (WVR) was powered on at 19:20z on 11 Dec 2006 and it was re-initialized (reset and recalibrated) at 18:45z on 12 Dec 2006.
Reduced Support	23 December 2006 - 2005357T21:55:00Z	GFO WVR1 was turned off at approximately 21:55Z due to increasing propulsion deck temperatures.
Yaw Maneuver	23 Dec 2006 2006357T21:55:00Z	GFO's yaw orientation was modified from +2.5. degrees to 0.0 degrees.

2.4 GFO Ground Processing Incident Log

The ground processing incident log is a list of ground processing problems. These problems are processing incidents that have been noted by NASA Wallops Flight Facility teams and are mostly resulting from either: (a) the processing of ground data at the Payload Operations Center located at NAVOCEANO, or (b) DSU dump failures because of antenna lost telemetry and antenna failure at different tracking stations.

Table 2-3, GFO Ground Processing Incident Log, is the table that indicates the problems that have occurred since the previous Engineering Assessment Report. Problems that have occurred prior to December 13, 2005, are summarized in Appendix C. The majority of these problems are listed as “Segment data for.....appears to be bad”. The determination on these data is that there are more than 40 messages of “Delta Science Time Gap” per segment, indicating problems with the data. Refer to Section 2.4, “GFO Ground Processing Incident Log”, of the *GFO Altimeter Engineering*

Assessment Report, The First 20 Cycles Since Acceptance, April 2003 (NASA/TM-2003-209984, Ver. 1/Vol. 4) for an example of a log for a segment of data.

The data processing errors that are listed as "Segment data for.....appears to be bad" are caused, on the most part, by noisy data in the Payload data file received from the DSU download at NAVSOC. The ENG, RA, RA-CAL, and WVR data are not filtered for noise, by the direction from the CALVAL team. The CALVAL team wanted to receive the data in the same manner as it is received at the Payload Operations Center (POC).

Table 2-3 GFO Ground Processing Incident Log (since previous report)

Data Type	Data Date	Comments
Support Resumed	13 December 2005 - 2005347	Full Waveform data collection resumed
RA	25 December 2005 - 2005359	Segment data for ra 05359_01_16_24 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 359t06:04 to 359t08:22.
RA	26 December 2005 - 2005360	Segment data for ra 05360_12_00_16 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 360t12:00 to 360t22:35.
Reduced Support	26 December 2005 - 2005360	Due to ground system limitations, the standard 7-hour RA calibration will instead be run as a ten-minute calibration starting on DOY 360 (22:02:49z).
Support Resumed	27 December 2005 - 2005361	Full Waveform data collection resumed
RA	28 December 2005 - 2005362	Received invalid ra segment 11020_01_54_10. Set of CALVAL files corrupted at the beginning of file.
NGDR	31 December 2005 - 2005365	Leap second problem caused a reduction in data. Files affected were: ngdr_gfoo_2005365_00000_84036 and ngdr_gfoo_2006001_09635_86080.

Table 2-3 GFO Ground Processing Incident Log (Continued)
(since previous report)

Data Type	Data Date	Comments
Reduced Support	07 January 2006 - 2006007 thru 11 January 2006 - 2006011	DDL off for thermal management. The ten minute CAL performed but no Full Waveform data collection
RA	10 January 2006 - 2006010	Received invalid ra segment 04070_07_00_21. Set of CALVAL files corrupted at the beginning of file.
Support Resumed	12 January 2006 - 2006012	Full Waveform data collection resumed
Payload Shutdown	14 January 2006 - 2006014	Under-Voltage 3 fault response, space-craft stopped producing payload data.
SDR	15 January 2006 - 2006015	Data segment for sdr03296_02_55_34_0 appears to be bad.
Payload Restored Reduced Support	16 January 2006 - 2006016	GFO ocean wave height data collection resumed. WVR remains powered off.
SDR	16 January 2006 - 2006016	Data segment for sdr03296_02_55_36_0 appears to be bad.
RA	22 January 2006 - 2006022	Received invalid ra segment 06014_12_13_58. Set of CALVAL files corrupted at the beginning of file.
Reduced Support	25 January 2006 - 2006025	The Water Vapor Radiometer (WVR) was powered on and it was re-initial-ized (reset and re-calibrated) at exactly, 20:51:18 z on 26 Jan 2006. Ten minute CALs will be performed but no Full Waveform data collection.
RA	26 January 2006 - 2006026	Segment data for ra 06026_04_42_24 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 026t04:42 to 026t09:51.
Support Resumed	9 February 2006 - 2006040	Full Waveform data collection resumed

Table 2-3 GFO Ground Processing Incident Log (Continued)
(since previous report)

Data Type	Data Date	Comments
RA	16 February 2006 - 2006047	Segment data for ra 06047_23_39_21 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 047t23:39 to 048t01:39.
RA	16 February 2006 - 2006047	There is a ~21 minute gap in the GFO Payload data for Julian Day 47 between 2319z to 2340z. NAVSOC reported the DSU has overwritten and they can not recover the data.
Reduced Support	21 February 2006 - 2006052	Due to low voltage considerations, ten minute CALs will be performed but no Full Waveform data collection
Data Loss	23 February 2006 - 2006054	NAVSOC has experienced problems downloading the data (gaps, overlaps, and irregularities). Data lost from 16:29:24 - 18:12:57
RA	24 February 2006 - 2006055	Segment data for ra 06055_17_35_20 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 055t17:35 to 056t00:19.
RA	09 March 2006 - 2006068	Segment data for ra 06068_16_27_13 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 068t16:27 to 068t17:33.
RA	14 March 2006 - 2006073	Received invalid ra segment 03359_11_52_47. Set of CALVAL files corrupted at the beginning of file.
RA	15 March 2006 - 2006074	Segment data for ra 06074_14_30_49 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 074t14:30 to 074t17:49.

Table 2-3 GFO Ground Processing Incident Log (Continued)
(since previous report)

Data Type	Data Date	Comments
RA	17 March 2006 - 2006076	Segment data for ra 06076_17_18_41 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 076t17:18 to 076t18:24.
Data Loss	20 March 2006 - 2006079	Due to ground system problems, some DSU data was lost on rev DC 42363 (at approximately 0115z on March 21). A majority of this lost data was subsequently recovered on rev DA 42370 (at approximately 1310z on March 21). The following indicates the unrecoverable portion of the data: March 20, 2006 19:34:06z - 19:42:45z (total loss of 8 min, 39 sec).
RA	20 March 2006 - 2006079	Segment data for ra 06079_18_31_54 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 079t18:31 to 080t00:42.
RA	24 March 2006 - 2006083	Segment data for ra 06083_19_49_25 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 083t19:49 to 084t00:48.
RA	25 March 2006 - 2006084	Segment data for ra 06084_19_16_48 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 084t19:16 to 085t00:19.
RA	26 March 2006 - 2006085	Segment data for ra 06085_00_19_38 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 085t00:19 to 085t01:51.
Support Resumed	07 April 2006 - 2006097	GFO Full waveform data collection has been restored as of 05:50:13 zulu.

Table 2-3 GFO Ground Processing Incident Log (Continued)
(since previous report)

Data Type	Data Date	Comments
RA	09 April 2006 - 2006099	Segment data for ra 06099_03_17_23 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 099t03:17 to 099t06:38.
RA	12 April 2006 - 2006102	Segment data for ra 06102_02_02_09 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 102t02:02 to 102t03:04.
RA	08 May 2006 - 2006128	Segment data for ra 06128_16_41_57 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 128t16:41 to 128t18:14.
RA	10 May 2006 - 2006130	Segment data for ra 06130_20_35_27 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 130t20:35 to 130t22:10.
Reduced Support	11 May 2006 - 2006131	Due to temporary ground support constraints, GFO RA data collection on Thursday, May 11 (DOY 131) will comprise a 10-minute Cal sequence rather than the usual 7-hour Cal.
RA	11 May 2006 - 2006131	Segment data for ra 06131_08_44_08 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 131t08:44 to 131t16:47.
Support Resumed	12 May 2006 - 2006132	GFO Full waveform has been restored as of 07:45:09 zulu.
RA	30 May 2006 - 2006150	Segment data for ra 06150_12_18_18 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 150t12:18 to 150t17:06.

Table 2-3 GFO Ground Processing Incident Log (Continued)
(since previous report)

Data Type	Data Date	Comments
RA	02 June 2006 - 2006153	Segment data for ra 06153_14_06_18 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 153t17:13 to 153t20:23.
RA	11 June 2006 - 2006162	Received invalid ra segment 05209_17_02_35. Set of CALVAL files corrupted at the beginning of file.
RA	11 June 2006 - 2006162	Segment data for ra 06162_14_28_27 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 162t14:28 to 162t17:34.
RA	17 June 2006 - 2006168	Segment data for ra 06168_19_49_43 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 168t19:49 to 168t20:39.
RA	03 July 2006 - 2006184	Segment data for ra 06184_16_22_58 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 184t16:22 to 184t19:32.
RA	09 July 2006 - 2006190	Segment data for ra 06190_16_36_13 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 190t16:36 to 190t19:46.
NGDR	28 July 2006 - 2006209	Beginning Fri., 28 July 06, the ADFC began delivering GFO NGDRs with an updated Ionospheric correction. The updated Iono data is from the Air Force derived PRISM (Parameterized Real-time Ionospheric Specification Model). Since NASA/JPL discontinued the GIM Iono generation, the NGDRs have utilized IRI95

Table 2-3 GFO Ground Processing Incident Log (Continued) (since previous report)

Data Type	Data Date	Comments
Data Loss	1 August 2006 - 2006213	Data Loss from 2006213t23:15 to 2006214t00:06.
Data Loss	2 August 2006 - 2006214	CPU reset in the Attitude Control subsystem and satellite put in safe mode. This event shut the payload off at 08:34Z.
Payload Restored Reduced Support	05 October 2006 - 2006278	The RA was commanded to Track 1 at 13:00Z on 05 Oct 2006. The WVR will remain off until further notice with no Full Waveform data collection.
RA	08 October 2006 - 2006281	Segment data for ra 06281_22_52_54 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 281t22:52 to 282t04:03.
SDR	12 October 2006 - 2006285	The ADFC has implemented the -82.4 millisecond timing bias into the SDR processing. All SDRs generated after 20:00 GMT, 12 Oct 06, will contain that correction. Reprocessing prior days, 278 - 285, The ADFC transitioned the latest POC software, SDR with WVR flagging, to operational mode on 2006291.
RA	13 October 2006 - 20062862	Received invalid ra segment 12258_10_34_51. Set of CALVAL files corrupted at the beginning of file.
Data Loss	22 October 2006 - 2006295	NAVSOC has experienced problems downloading the data Data lost from 05:36:24 - 17:04:41.
RA	26 October 2006 - 2006299	Segment data for ra 06299_00_06_38 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 299t00:06 to 214t10:55.

Table 2-3 GFO Ground Processing Incident Log (Continued)
(since previous report)

Data Type	Data Date	Comments
SCC Timing Jump	28 October 2006 - 2006301 thru 31 October 2006 - 2006304	Det A produced erroneous timing data. The original RA files had timing errors with a backward time jump. Files were reprocessed using new synthetic SCC.Dat files generated by NAVSOC and the new files were resent.
RA	12 November 2006 - 2006316	Segment data for ra 06316_01_18_33 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 346t18:10 to 136t08:25.
Data Loss	22 November 2006 - 2006326	To support an inclination maneuver the RA was turned off at 20:28:03Z and back on at 06:02:07Z. The software patch was uploaded and the RA put in Track-1 mode by 06:02:07Z. Data loss between 02:02:34 and 06:02:07Z.
RA	23 November 2006 - 2006327	Received invalid ra segment 11338_18_01_54. Set of CALVAL files corrupted at the beginning of file.
Data Loss	25 November 2006 - 2006329	To support an inclination maneuver the RA was put in standby mode at 00:45:36 and back on at 14:01:35Z. Data loss between 02:02:34 and 06:02:07Z.
RA	25 November 2006 - 2006329	Segment data for ra 06329_14_40_02 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 329t16:00 to 329t20:52. Segment data for ra 06329_20_52_48 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 329t20:52 to 330t02:19.

Table 2-3 GFO Ground Processing Incident Log (Continued)
(since previous report)

Data Type	Data Date	Comments
SDR	25 November 2006 - 2006329	Data segment for sdr06329_14_40_032_14540 appears to be bad. The Receiver Temperature had errors. Segment time is 14:40 to 20:52.
SDR	26 November 2006 - 2006330	Data segment for sdr06330_00_00_00_7419 appears to be bad. The Receiver Temperature had errors. Segment time is 00:00 to 02:19.
RA	28 November 2006 - 2006332	Segment data for ra 06332_19_18_48 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 332t19:18 to 333t00:57.
Data Loss	28 November 2006 - 2006332	To support a trim maneuver the RA was put in standby mode at 22:42:26Z and back on at 23:13:21Z.
Data Loss	29 November 2006 - 2006333	To support a trim maneuver the RA was put in standby mode at 00:23:05Z and back on at 00:54:01Z.
RA	3 December 2006 - 2006337	Segment data for ra 06337_22_33_17 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 337t22:33 to 338t08:28.
Data Loss	3 December 2006 - 2006337	NAVSOC experienced very high winds which prohibited them from downloading numerous scheduled orbits; 46048, 46051, 46052, and 46055. Data lost from 08:54 - 12:20.
Support Resumed	6 December 2006 - 2006340	GFO WVR1 was turned on at approximately 18:26:45Z.
Reduced Support	7 December 2006 - 2006341	GFO WVR1 was turned off at approximately 01:50Z to reduce spacecraft temperatures.

Table 2-3 GFO Ground Processing Incident Log (Continued)
(since previous report)

Data Type	Data Date	Comments
Support Resumed	11 December 2005 - 2006345	GFO WVR1 was turned on at approximately 19:20Z and it was re-initialized (reset and re-calibrated) at 18:45z on 12 Dec 2006.
RA	12 December 2006 - 2006346	Segment data for ra 06346_13_44_23 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 346t13:44 to 346t18:44.
SDR	12 December 2006 - 2006346	Data segment for sdr06346_08_01_70_17749 appears to be bad. The Receiver Temperature had errors. Segment time is 08:01 to 09:26.
Reduced Support	23 December 2006 - 2005357	GFO WVR1 was turned off at approximately 21:55Z due to increasing propulsion deck temperatures.

Section 3

Assessment of Instrument Performance

The following sub-sections report several assessments performed by the WFF GFO team. All analysis indicates the altimeter instrument is performing within pre-launch specifications and exhibits no significant change in performance since launch.

Section 3.1 addresses the range noise performance. Section 3.2 summarizes the groundtrack coverage of full-waveform GFO data for a typical 17-day cycle; these data are acquired for ice studies over southern Greenland and land-locked water. Then, Section 3.3 provides both an update on CAL-2 waveforms and an analysis of GFO's attitude (off-nadir) angles.

3.1 GFO and JASON-1 Range Measurement Noise

The GEOSAT Follow-on (GFO) and JASON altimeter white noise levels have been evaluated using the technique based on high-pass filtering of 1-Hz sea surface height time series. Refer to "Assessment of the Cycle-Per-Cycle Noise Level of the GEOSAT Follow-On, TOPEX, and POSEIDON Altimeters," *Journal of Atmospheric and Oceanic Technology,* December 2002, (http://gfo.wff.nasa.gov; select Documents; select Publications). High-pass filtering removes the geoid and oceanography signals while revealing the random noise. This filtering technique is simpler to use than the repeat-track method, gives essentially the same results, and makes it easier to analyze much larger amounts of data to investigate subtle variations in noise levels. The noise level measurements provided here all show a stable noise process from cycle-to-cycle with a linear dependence of the noise level upon significant waveheight (SWH). The interpolated noise estimate for 2 meter SWH for both GFO and JASON are shown in Figure 3-1. The GFO altimeter noise level is estimated to be about 2.57 cm for an SWH of 2m. The GFO average altimeter noise level has been consistent over the 120 cycles.

The WFF database does not include the JASON reprocessed data. The noise level for JASON at 2m SWH in Figure 3-1 shows a large step change at the end of March 2003 that we believe is related to changes in the ground processing waveform fitting and not a change in the JASON altimeter hardware. There also appears to be a small second step change in October 2005 related to new processing. The two bands in the JASON data in Figure 3-2 are also the result of the same inconsistent ground processed datasets.

Figure 3-2 shows the height noise performance of a GFO and JASON with respect to SWH. The GFO performance agrees with the expected modelled performance.

The data used for Figure 3-1 (see Appendix E for values) had slightly different data editing criteria than the data that were used in Section 2. The cycle "SWH Mean" is the SWH for the data used in each cycle, and the "Noise Level Mean" is the mean of the noise estimated by the high-pass filter method. The "Noise Level at 2m SWH" is the noise estimate from fitting the individual noise estimate as a function, then solving the fitted equation for a "2m SWH".

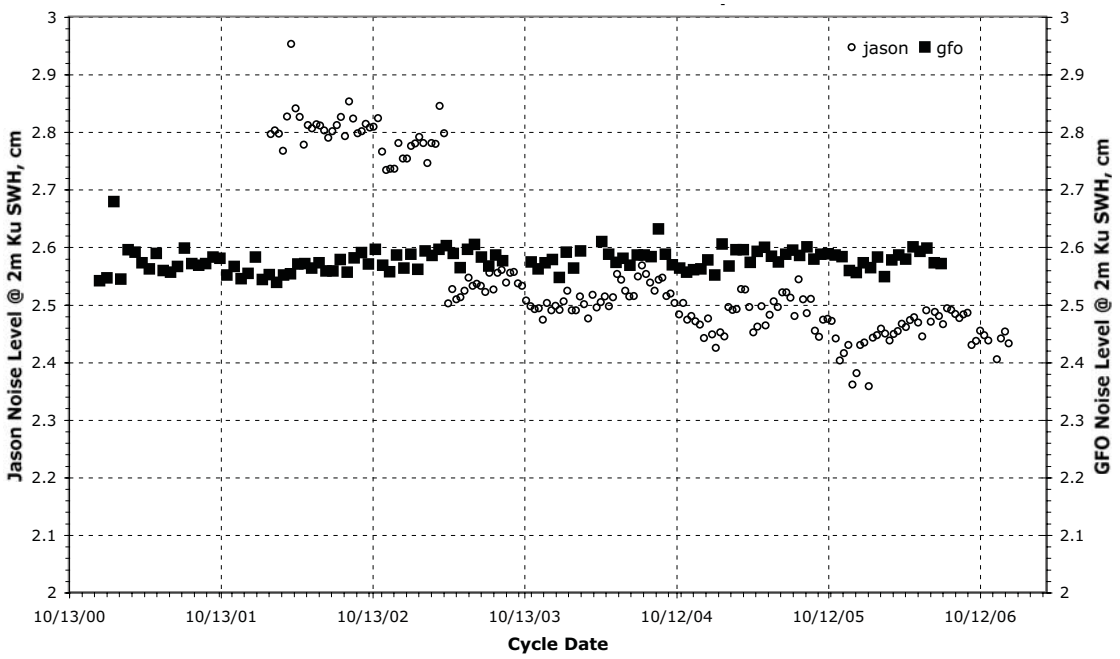

Figure 3-1 GFO/JASON Noise Level @ 2m Comparison

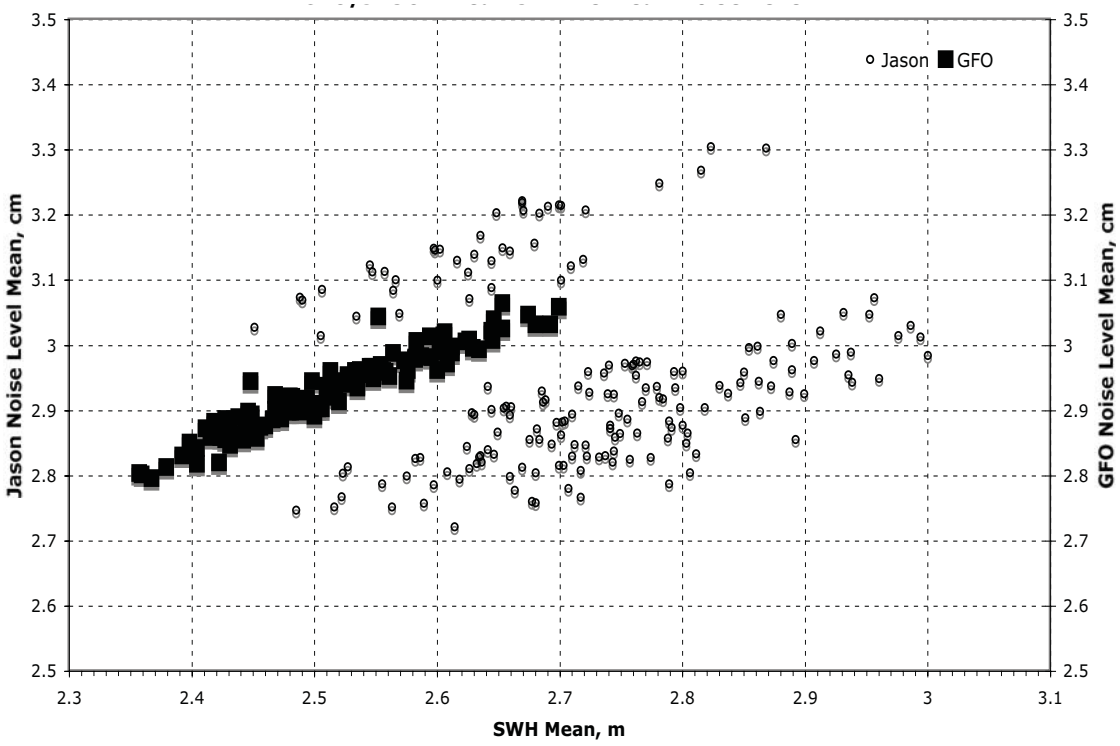

Figure 3-2 GFO/JASON Mean SWH vs. Mean Noise Level

3.2 Groundtrack Coverage for GFO Full-Waveform Data

In 2001, on day 171 (June 20), GFO started collecting full waveform data over Greenland. Collection of these waveforms was agreed upon to help study altimeter acquisition times and for the study of changes in the Greenland icesheet.

The process of collecting full waveform data is described in *GFO Altimeter Engineering Assessment Report*, NASA-TM-2005-209984/Version 1/Volume 7, 2005.

The collection of full waveform data since 2001-171 has been on-going for 1791 days.

Several operation events have stopped the GFO collection of full waveforms for several days; we call these periods 'reduced support' or FWF suspended. There have been a total of 544 days of reduced support since 2002-330 as indicated in Table 3-1; 215 of the reduced support days occurred in 2006. Refer to Table 2-3 and Appendix C, GFO Ground Processing Incident Log, for more details.

3.3 Additional Observations

3.3.1 GFO Calibration Mode 2 Waveforms

It was noted in the *GFO Altimeter Engineering Assessment Report, From Launch to Acceptance*, March 2001 (NASA/TM-2001-209984/Ver.1/Vol.1) that Calibration Mode 2 data should consist of flat waveforms, but the pre-launch data exhibited a "smile" pattern, with both ends of the waveform being higher than the middle. This "smile" introduces errors during normal processing. A software patch (Smile Patch) was developed to correct this by flattening the waveform. During the period from launch to acceptance there were several resets that necessitated the "smile patch" be reloaded.

During the period from acceptance to the end of this reporting period, there have also been occurrences of resets that turn the payloads off which results in the loss of the software patch (smile patch). When the payloads were turned back on, the software patch has always been loaded and data collection resumed without any additional data having the "smile" effect. Wallops continues to monitor this patch when the altimeter is powered on.

Table 3-1 Reduced Support for Full Waveforms

Beginning Date Reduced Support	Duration Days	Reason for Turn OFF
2002-330	6	ground systems at LP
2002-339	79	typhoon destroyed antenna Det C
2003-109	6	antenna at LP down
2003-200	11	antenna at LP not functional
2003-227	5	ground system at Det C

Table 3-1 Reduced Support for Full Waveforms (Continued)

Beginning Date Reduced Support	Duration Days	Reason for Turn OFF
2003-249	51	CPU reset, satellite in safemode
2003-336	4	CPU reset, satellite in sun acquire mode
2003-354	1	CPU reset, satellite in sun acquire mode
2004-053	48	Payloads Off
2004-134	1	problems at Det A & LP
2004-202	2	ground station hardware problems at Det A
2004-231	34	control temperature of the wheels due to high wheel voltage
2004-265	9	high wheel temperatures and ground system hardware problems at Det A
2004-288	9	ground system problems at Det C & LP
2004-297	5	ground system issues at Det C & LP
2004-310	4	extended power outage at NAVSOC
2004-357	9	ground system issues at DetC & LP
2005-018	3	CPU Reset, temperature sensor on wheel drive
2005-116	1	DetA & DetC down
2005-127	1	ground station limitations
2005-231	1	ground station problems
2005-263	1	ground station issues at DetA
2005-286	1	DDL off
2005-288	36	intermittent ground station limitation
2005-360	1	ground system limitations
2006-007	5	DDL off for thermal management
2006-014	2	Payloads Off
2006-016	24	Payload on, WVR off
2006-052	27	low voltage considerations
2006-079	18	ground system problems
2006-131	1	ground system constraints
2006-215	63	CPU reset, satellite in safehold, payloads off

Table 3-1 Reduced Support for Full Waveforms (Continued)

Beginning Date Reduced Support	Duration Days	Reason for Turn OFF
2006-278	75	WVR off for power considerations
	Total = 544 Days	

3.3.2 GFO Attitude

It was noted in the *GFO Altimeter Engineering Assessment Report, The First 20 Cycles Since Acceptance*, March 2002 (NASA/TM-2002-209984/Version 1/Volume 3) that there were more attitudes above 0.3 degrees than expected.

It was recommended by WFF that an attitude adjustment be performed. On 2002057, mid-Cycle 26, a spacecraft attitude change was performed by the GFO Project to improve the attitude control. In Figure 3-3, the averaged daily attitude is shown from time of acceptance to 18 December, 2006.

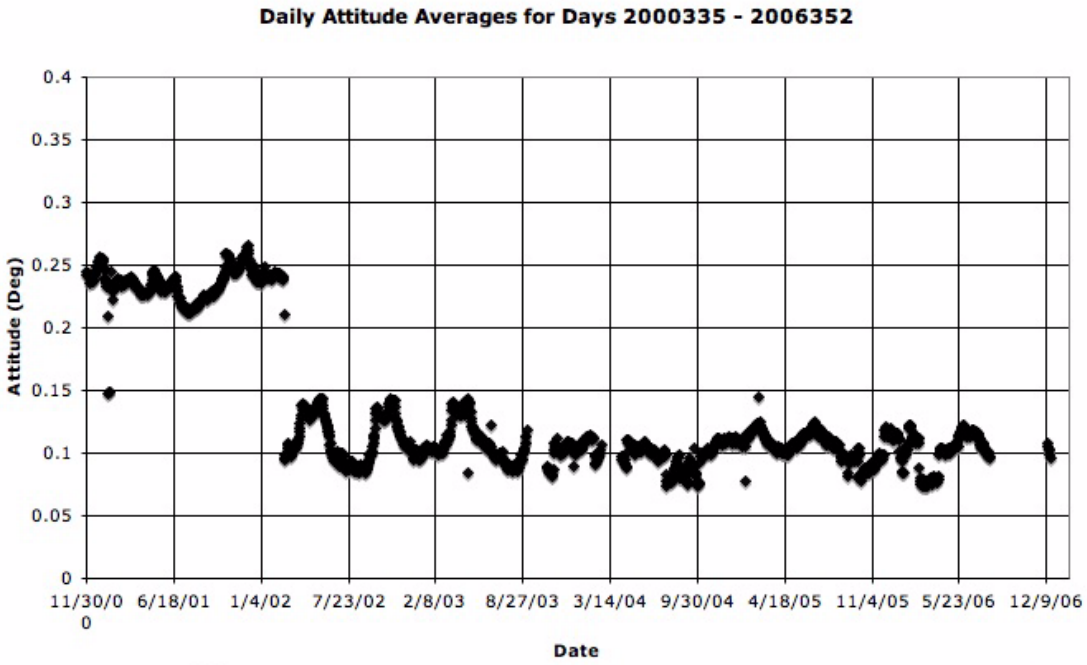

Figure 3-3 GFO Daily-Averages Attitude in Degrees

In the *GFO Altimeter Engineering Assessment Report, Update: The First 43 Cycles Since Acceptance*, April 2003 (NASA/TM-2003-209984/Ver.1, Vol.4), Section 3.3.2 (Attitude), the large number of high attitudes (off-nadir angles) were described for various cycles. This was to illustrate a need for an attitude adjustment, by showing the high number of attitudes that were above 0.3 degrees. In the *GFO Altimeter Engineering Assessment Report, Update: The First 65 Cycles Since Acceptance*, May 2004 (NASA/TM-

2004-209884/Ver.1/Vol.6), Section 3.3.2 (Attitude), illustrated that the large number of attitudes above 0.3 degrees had been reduced, while the number of attitudes above 0.2 degrees had increased. The three sets of figures; Figure 3-4 and Figure 3-5 (Cycle 111, February 2006), Figure 3-6 and Figure 3-7 (Cycle 117, May 2006), Figure 3-8 and Figure 3-9 (Cycle 129, December 2006), represent three of the four seasons. The satellite was in safehold due to a CPU reset and caused shutdown of the payload during the fall season so there is no data available during this time. In each pair of figures, the first plot shows the number of attitudes above 0.2 degrees, and the second plot shows the number of attitudes above 0.3 degrees. These reflect that the attitude control is maintaining better than 0.2 degrees most of the time. The performance is consistent with last year.

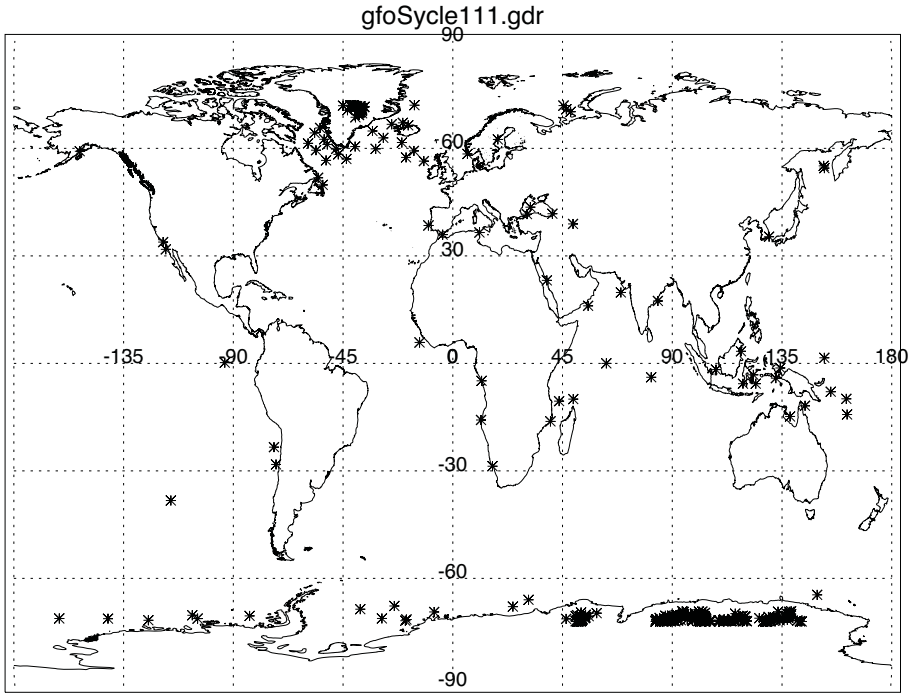

Figure 3-4 GFO Attitude > 0.2 Degree, Cycle 111

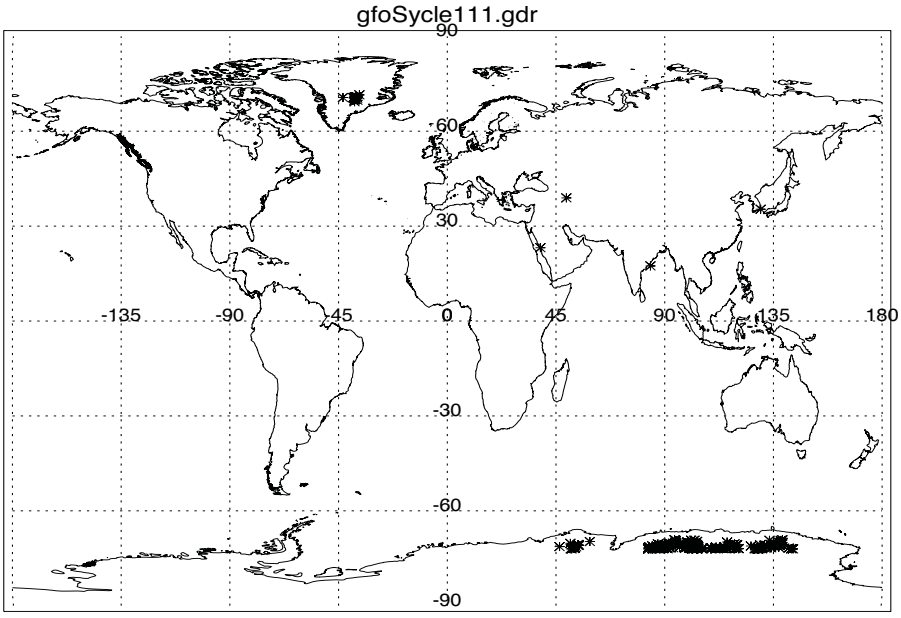

Figure 3-5 GFO Attitude > 0.3 Degree, Cycle 111

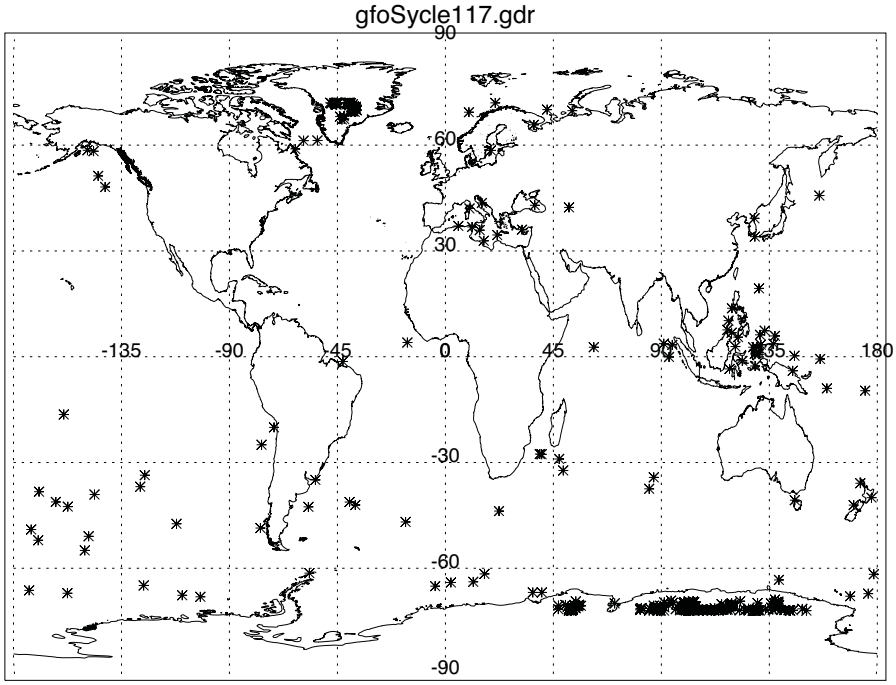

Figure 3-6 GFO Attitude > 0.2 Degree, Cycle 117

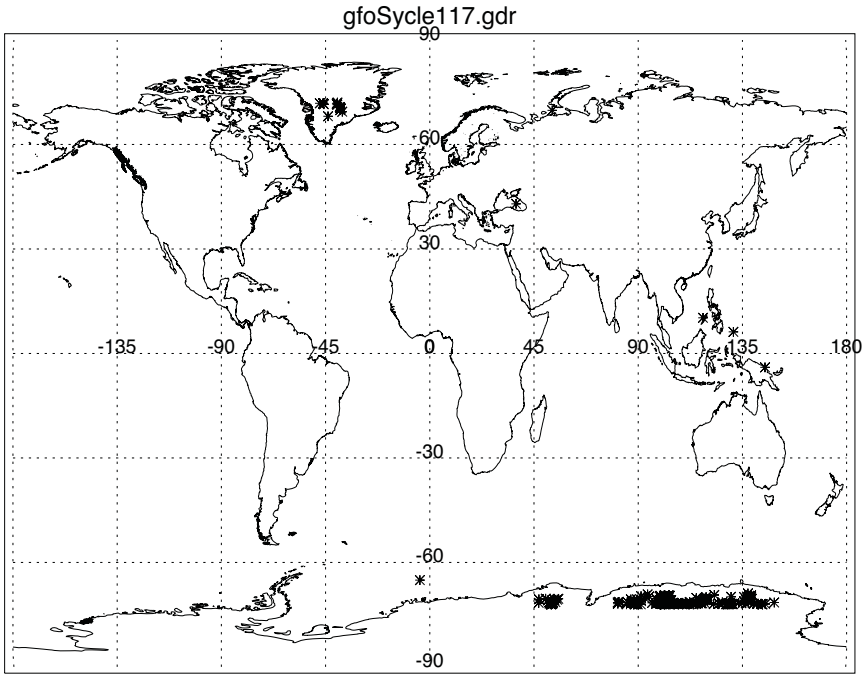

Figure 3-7 GFO Attitude > 0.3 Degree, Cycle 117

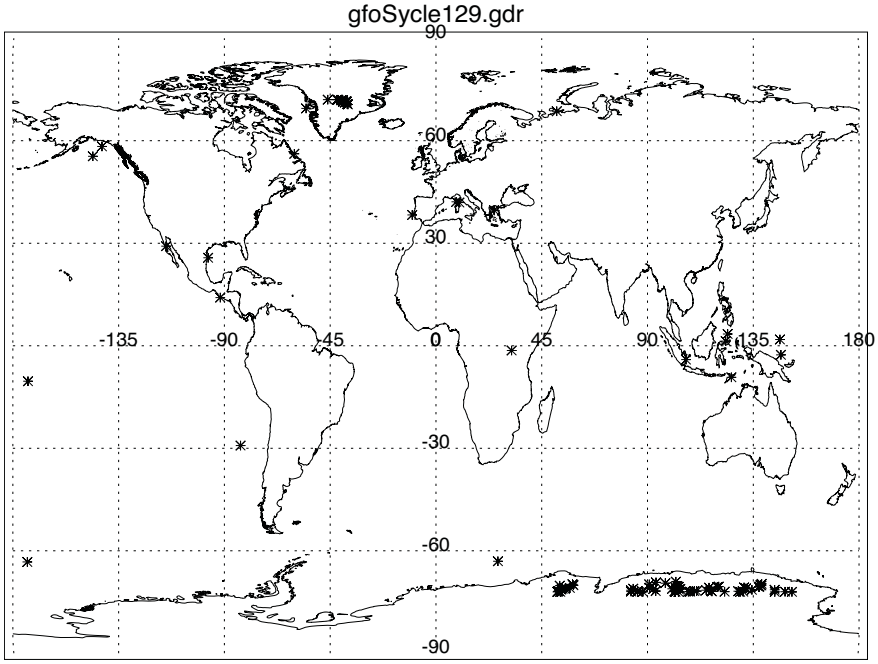

Figure 3-8 GFO Attitude > 0.2 Degree, Cycle 129

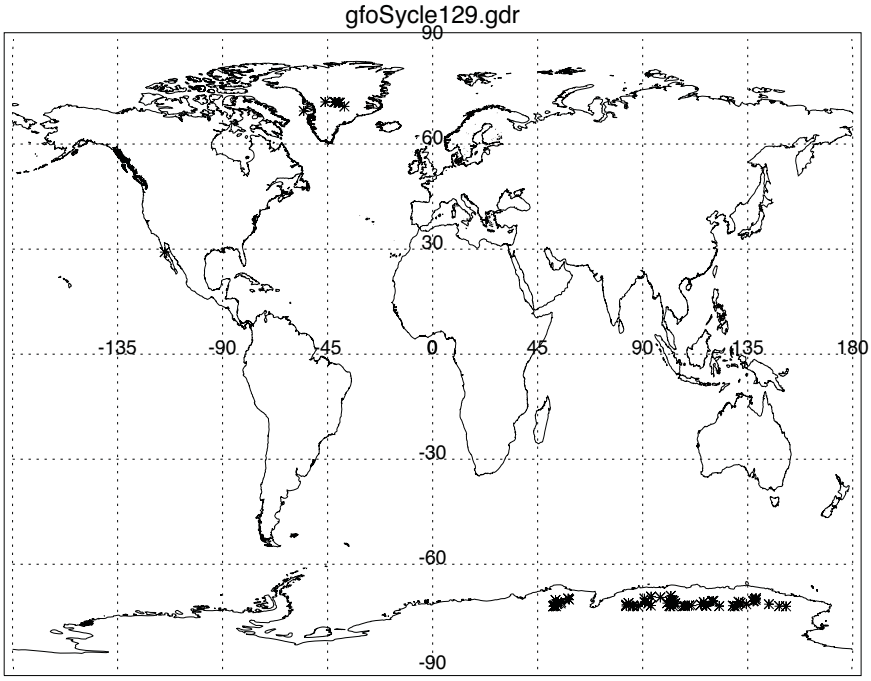

Figure 3-9 GFO Attitude > 0.3 Degree, Cycle 129

Section 4

Other Studies

4.1 GFO Altimeter Windspeed Monitoring

As part of the validation of GFO data, we monitor the surface windspeed retrieved from the radar cross-section measurements for possible trends. This analysis helps to check the proper functioning of the GFO instrument related to the altimeter return power estimation. For that purpose we use the National Centers for Environmental Prediction (NCEP) winds. The data and method of calculation was noted in the *GFO Altimeter Assessment Report, The First 20 Cycles Since Acceptance*, March 2002 (NASA TM-2002-209984/Ver. 1/Vol. 3).

Table F-1 (Appendix F) provides the cycle-per-cycle statistical indicators. The comparison shows small biases between GFO and NCEP windspeeds. The averaged bias for a cycle range is between -0.5 m/s and +0.7 m/s, a 1.2 m/s spread.

Column Definitions for Table 4-1 Statistical Indicators	
year	Year at the Beginning of the Cycle
cycle	Equivalent to Exactly 17 Days
limit 1	Averaged Value of NCEP - STD NCEP
limit 2	Averaged Value of NCEP + STD NCEP
$<\sigma_0>$	Averaged Value of Sigma0
<SWH>	Averaged Value of SWH
<Ugfo>	Averaged Value of GFO Windspeed
<Uncep>	Averaged Value of NCEP Windspeed
<Ugfo> - <Uncep>	Averaged GFO Windspeed - Averaged NCEP Windspeed

Figure 4-1 shows the variations of the averaged value of Sigma0, SWH, GFO windspeed and NCEP windspeed.

Section 2.2.8, 'GFO Windspeed, Sigma0 and Receiver Temperature Dependence', discusses how to correct the GFO windspeed for the receiver temperature effect on Sigma0.

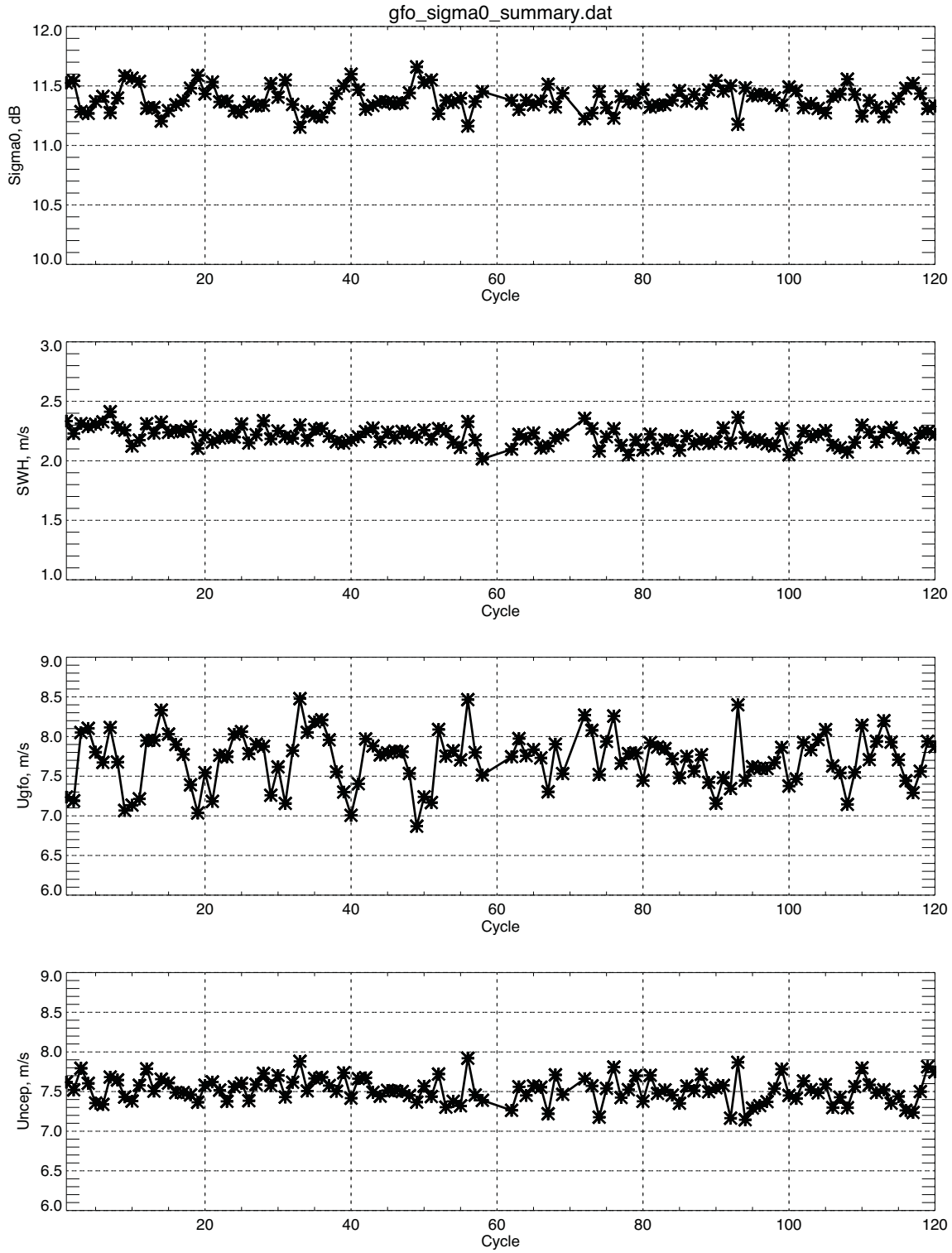

Figure 4-1 GFO Plot of Selected Statistical Indicators from Table F-1

In Figure 4-2, we show the temperature corrected Sigma0 (in the top plot), the recomputed GFO windspeed using the Modified Chelton-Wentz algorithm (in the middle plot), and the delta between the recomputed GFO windspeed and the NCEP windspeed (in the bottom plot). The total span of the difference of the recomputed windspeed and NCEP windspeed is less than 0.7 m/s. This illustrates the improved performance of the recomputed windspeed from the temperature corrected Sigma0 and the stable performance of the GFO altimeter.

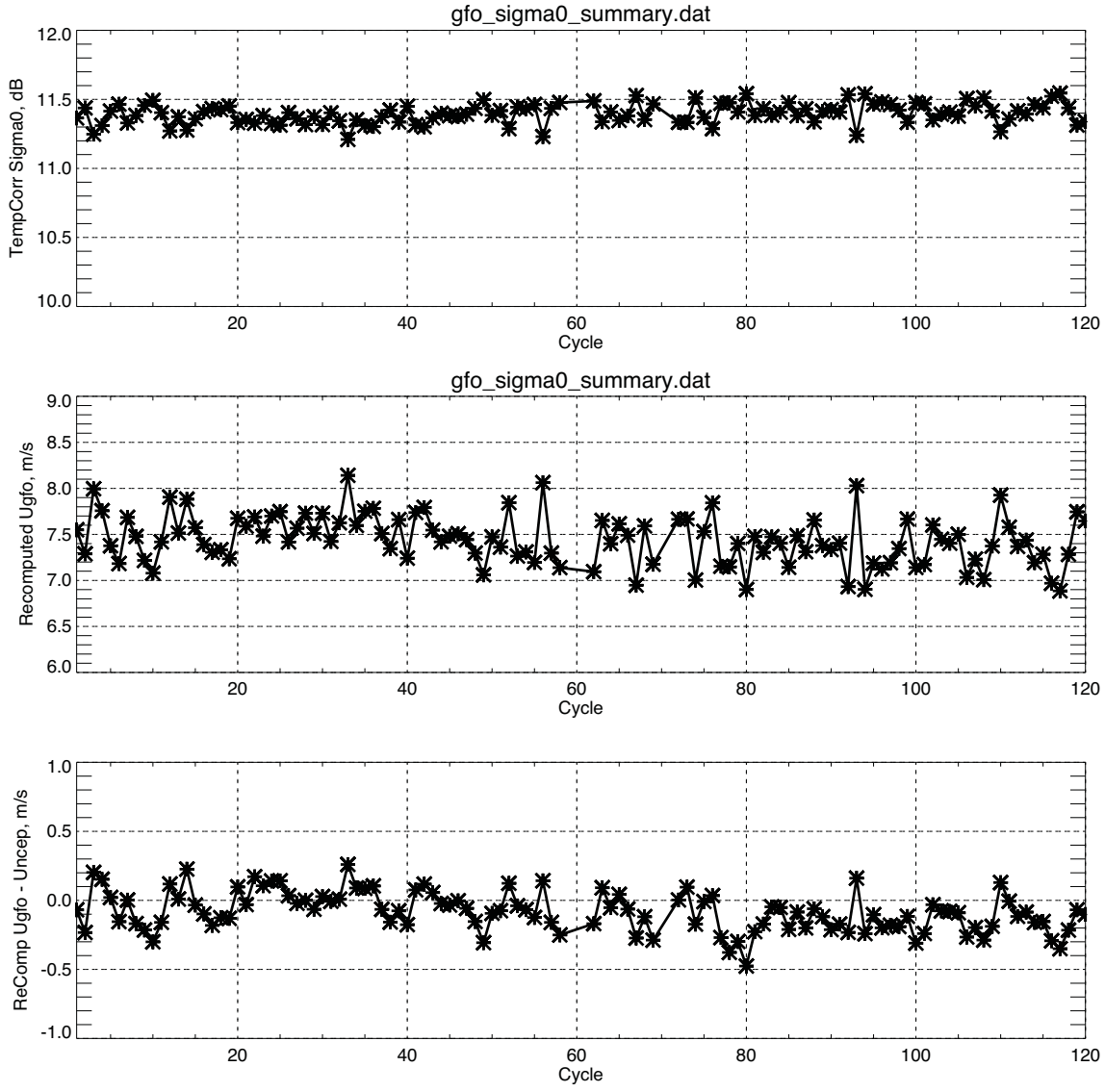

Figure 4-2 GFO Plot of Temperature Corrected Sigma0 and Recomputed Windspeed

In Figure 4-3, we show the comparison between the GFO recomputed windspeed and the JASON windspeed. The shift in JASON windspeed occurring about October

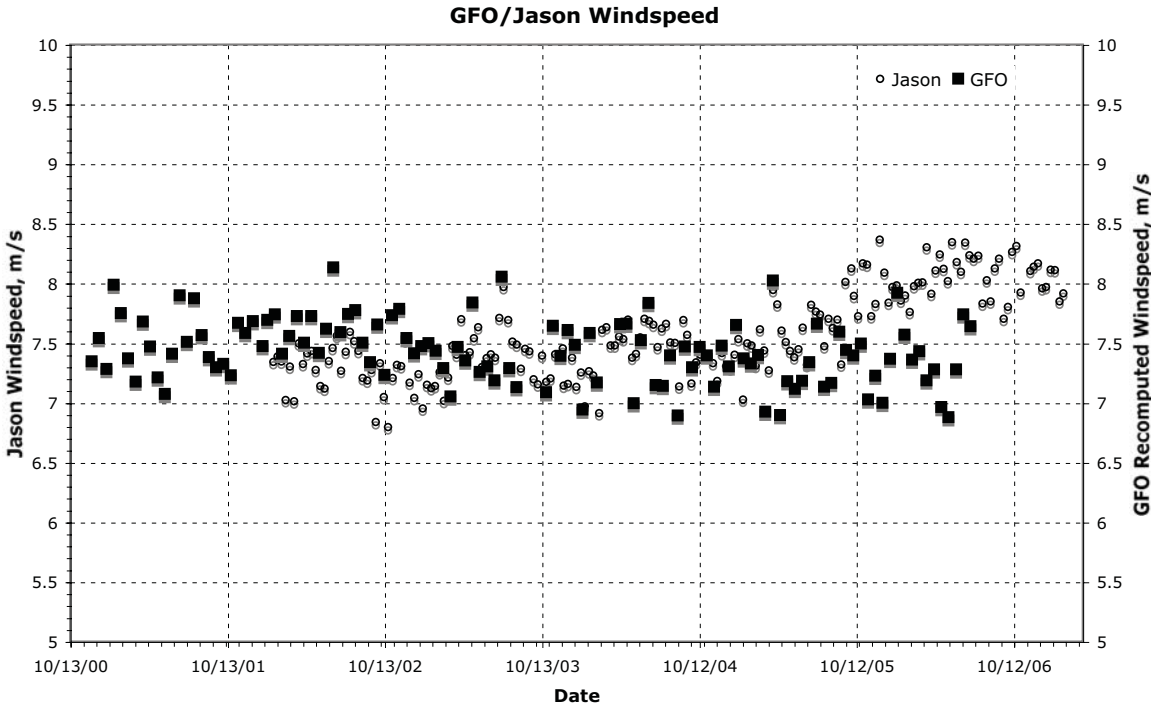

Figure 4-3 Comparison of GFO Recomputed Windspeed and JASON Windspeed

2005 is due to the release of JASON B processing algorithm implementing the Vandemark/Gourrion wind algorithm. The WFF database is not repopulated with the JASON reprocessed B data products.

4.2 GFO Altimeter Boresight Calibration Maneuvers

Early in GFO's on-orbit operation, an altimeter boresight calibration (also called attitude bias calibration) maneuver, referred to as an ABCAL, was executed to verify that the satellite attitude control system was adequately maintaining nadir pointing of the altimeter antenna's boresight axis. The GFO ABCAL sequence was described in more detail in the *GFO Altimeter Engineering Assessment Report Update: The First 43 Cycles Since Acceptance*, April 2003 (NASA/TM-2003-209984/Ver.1/Vol.4), Section 4.3 and Appendix B.

On 02 March 2006, a GFO ABCAL maneuver was performed and the following is a brief summary of the ABCAL's results.

While processing the ABCAL, it was determined there was no useful content in the output file. After reviewing the WFF CAL log listing from daily RA processing, there was an indication of noise during the downlink time of the ABCAL. The document, "Notes on editing bad GFO Cal Mode data while processing an ABCAL" dated 19 May 2006 (Appendix D of this report) describes how this data was edited to generate useful content for processing the ABCAL.

The maneuver's start time was 20:54:00Z on March 2, 2006 (2006 day 061) which was 194,604,840 seconds in the J2000 time system in which most of our altimeter analysis at WFF is done; the attached graphs are in time relative to this start-of-ABCAL time.

GFO performed well from the start to the completion of the ABCAL's four attitude excursions.During the 1000 seconds from ABCAL start, the GFO SWH varied relatively in the range from about 1.5 to 3.5 meters as shown in Figure 4-4 "GFO SWH Estimates and Gate Index Values in 2006/03/02 ABCAL". In the same 1000 seconds from ABCAL start, the GFO Sigma0 estimates were generally less than 14 dB except for small regions of data around 400 seconds and around 640 seconds from ABCAL start, as shown in Figure 4-5 "GFO NGDR Sigma0 Estimates". In general we start to be suspicious of possible Sigma0 bloom behavior whenever radar altimeter Sigma0 estimates exceed 14 dB, but the March 2006 GFO ABCAL seems to be free of significant Sigma0 bloom problems.

The usual WFF waveform fits to 2-second averages of GFO waveforms in the ABCAL were performed. These waveform fit attitude estimates were compared to the spacecraft attitude control system data, and a new boresight vector solution was obtained in the same way as described in earlier GFO ABCALs. The new boresight vector estimated x, y, z components are -0.16975876, -0.00083342, and 0.98548530 and Figure 4-6 "Waveform Fit and Calculated Attitudes in 2006/03/02 ABCAL from WFF Boresight Vector Solution" is the summary figure showing the fitted and calculated attitudes for the 02 March 2006 GFO ABCAL.

From the near symmetry of the attitude excursions in Figure 4-6, we can conclude that the GFO attitude control system has very small attitude bias and that no further attitude zero adjustment is needed at this time.

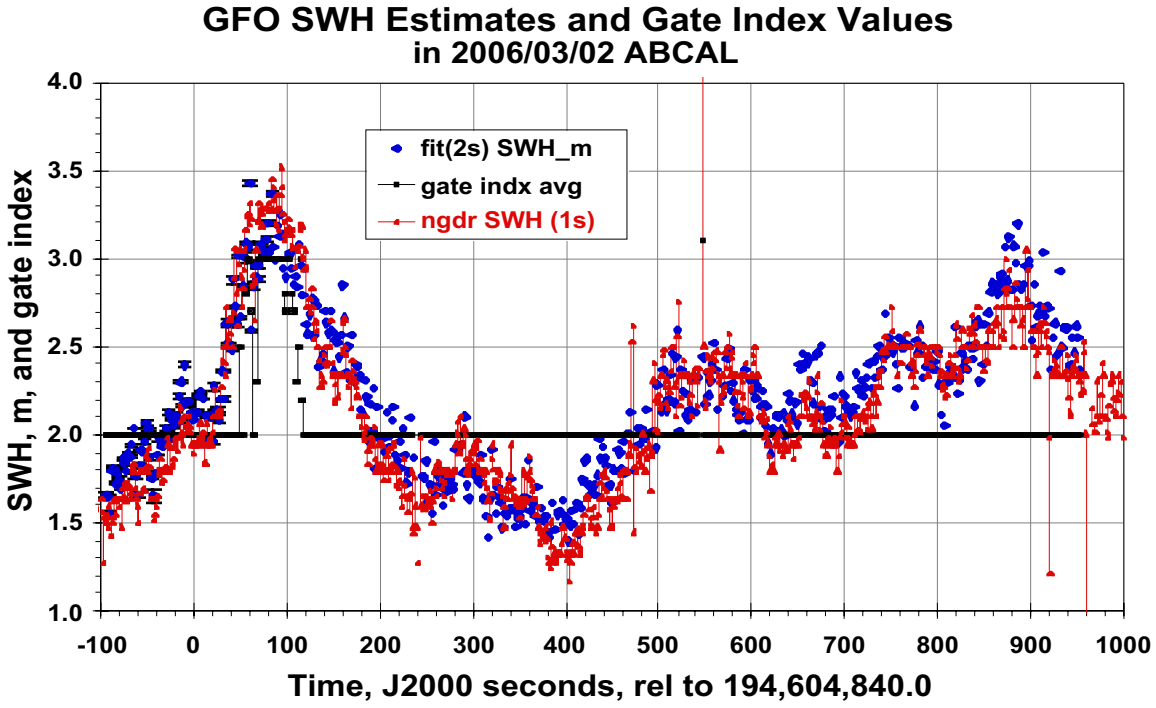

Figure 4-4 GFO SWH Estimates and Gate Index Values in 2006/03/02 ABCAL

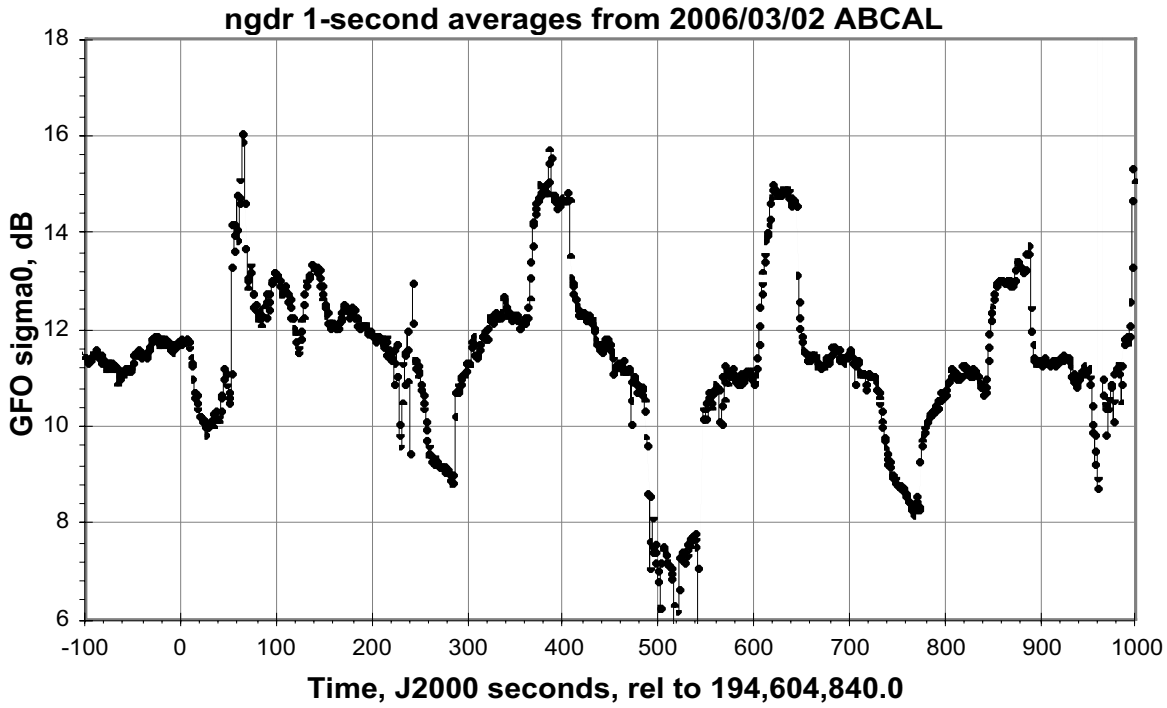

Figure 4-5 GFO NGDR Sigma0 Estimates

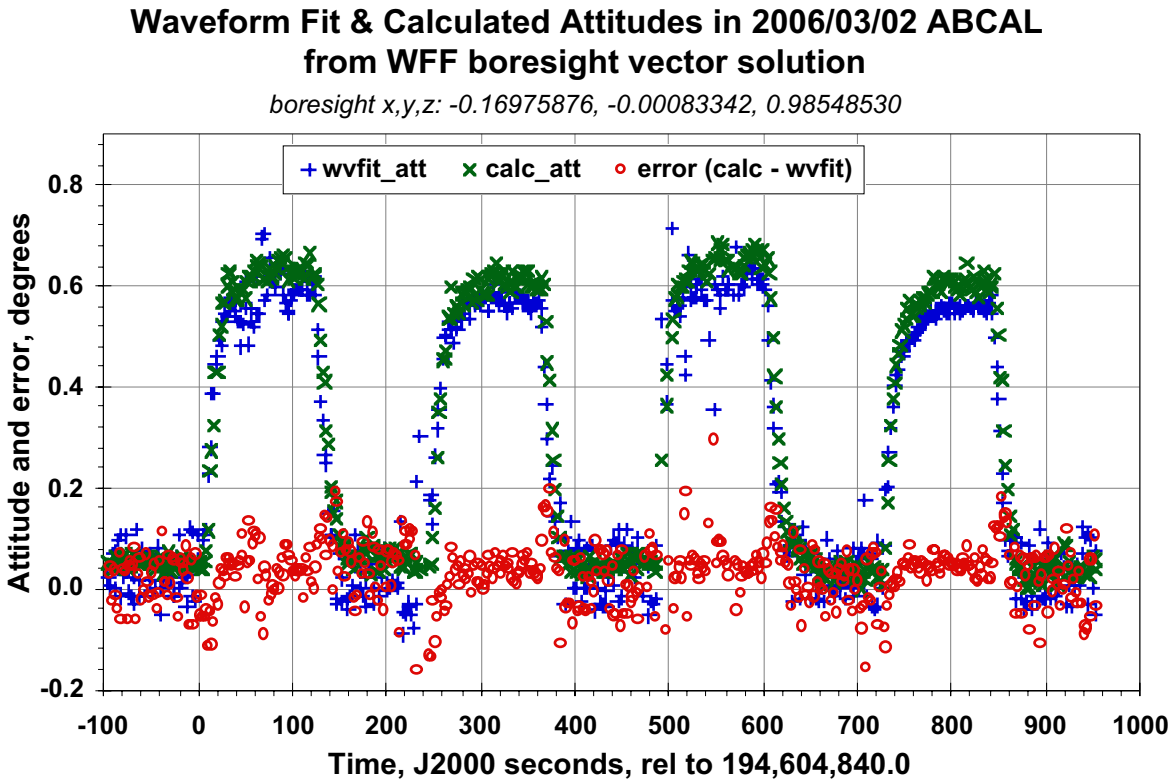

Figure 4-6 Waveform Fit and Calculated Attitudes in 2006/03/02 ABCAL from WFF Boresight Vector Solution

Section 5

WFF's Recommendation to GFO Project

5.1 GFO Wind Speed Correction for Sigma0 Temperature Dependence

The WFF team recommends that the GFO ground processing system implements a correction to Sigma0 for the residual effect of receiver temperature; this correction will improve the accuracy of the wind speed estimates. The correction details are provided in Appendices B and E of the *GFO Altimeter Engineering Assessment Report*, May 2005 (NASA/TM-2005-209984/Ver.1/Vol. 7). Corrected Sigma0 in terms of the receiver temperature is provided by:

$$Corrected\_Sigma0 = Sigma0 + (T_{ref} - T_{receiver})* 0.033$$

where Temperatures (T) are in degrees C, and Sigma0 is in dB and the recommended value for T_{ref} is 34 degrees C.

Users may correct existing data by either of the equations defined in Appendix E of the 2005 report. If users have Sigma0 and receiver temperature, then they can correct Sigma0 and use the Modified Chelton-Wentz equation to recompute the windspeed. If users have only the receiver temperature (an estimated cycle average could be used) and GFO wind speed, then the [D(windspeed)/D(Sigma0)] approach can be used to compute the additive corrections to the GFO wind speed.

Section 6

Engineering Assessment Synopsis

6.1 GFO and JASON-1 Performance Overview

Our analyses of the GFO altimeter demonstrate that it is performing well. Its internal calibrations and its cycle-to-cycle global averages have been very consistent. Comparisons with models and JASON indicate that measurement biases are well within GFO's pre-flight specifications of: SWH $\pm$0.5m, Sigma0 $\pm$1 dB, and Windspeed $\pm$2 m/s.

For calibration purposes, it is recommended the temperature correction for Sigma0 be applied (see Appendix E, "GFO Wind Speed Correction for Sigma0 Temperature Dependence" in the *GFO Altimeter Engineering Assessment Report*, September 2005 (NASA/TM-2005-209984/Vol. 7)); however, the raw average is better than the specification of 2 meters per second.

During the last part of 2006, the spacecraft was experiencing marginal loss of power. This resulted in the altimeter and WVR being turned off for periods, the suspension of full waveform, and GFO altimetry operations with the WVR off. With the WVR off, there is a change to the altimeter time tag bias as reported by John Lillibridge (NOAA). When the WVR is OFF, 82.4 milliseconds need to be ADDED to the GFO time tag. Unfortunately, the data products from the NAVY are inconsistent with this being applied or not applied. Lillibridge has development processing algorithms that detect the application and non-application of the time bias on the NAVY products and corrects time tags when needed for the data products provided by NOAA. All NOAA distributed GFO data products contain corrected time tags. With the long 2006 outage of WVR, the NAVY is planning to implement a model to provide wet troposphere range corrections.

This year during the intermittent operation of the GFO altimeter and radiometer which was caused by low spacecraft power, we were reminded of several odd data characteristics. One is the inconsistency switching from track to standby showed up in the RA data telemetry. An explanation of this problem was provided by Ball Aerospace as "on initial power-up of the RA, this telemetry point indicates "standby". Once the RA is commanded to Track, this telemetry point indicates "active" until the RA is powered off. It does NOT go back to standby when the RA is commanded to standby." So the issue with the RA STBY telemetry point is a hardware/software issue Ball discovered after RA delivery and decided not to correct. Another issue that was investigated was an increase in AGC and Height Bounds Faults. It was concluded that the errors were coming from receiving bad data (noise) from the ground stations and from the cycling of power and "smile" patch loading in the new GFO mode of operation.

This year we have included our analyses of the JASON altimeter and performed cross comparisons with the GFO altimeter. JASON performance appears nominal and the comparisons of the two altimeters indicate stable performance of both altimeters.

We will continue our GFO altimeter performance assessment as data become available, and plan supplemental performance reports to be issued as warranted.

Section 7

References

7.1 Supporting Documentation

A.M. Conger, D.W. Hancock III, G.S. Hayne, and R.L. Brooks, 2006, *GFO Altimeter Engineering Assessment Report*. NASA/TM-2005-209984/Ver.1/Vol.8.
http://gfo.wff.nasa.gov

D.W. Lockwood, D.W. Hancock III, G.S. Hayne, and R.L. Brooks, 2005, *GFO Altimeter Engineering Assessment Report*. NASA/TM-2005-209984/Ver.1/Vol.7.
http://gfo.wff.nasa.gov

D.W. Lockwood, D.W. Hancock III, G.S. Hayne, and R.L. Brooks, 2004, *GFO Altimeter Engineering Assessment Report*. NASA/TM-2004-209984/Ver.1/Vol.6.
http://gfo.wff.nasa.gov

D.W. Lockwood and A.M. Conger, 2003, *GFO Radar Altimeter Processing at Wallops Flight Facility*. NASA/TM-2003-209984/Ver.1/Vol. 5.
http://gfo.wff.nasa.gov

R.L. Brooks and D.W. Lockwood, 2003, T*emperature Correction for GFO Windspeed*, NASA/WFF report. Appendix B of NASA TM-2004-209984/Ver.1, Vol.6.
http://gfo.wff.nasa.gov

D.W. Lockwood, D.W. Hancock III, G.S. Hayne, and R.L. Brooks, 2003, *GFO Altimeter Engineering Assessment Report*. NASA/TM-2003-209984/Ver.1/Vol.4.
http://gfo.wff.nasa.gov

D.W. Lockwood, D.W. Hancock III, G.S. Hayne, and R.L. Brooks, 2002, *GFO Altimeter Engineering Assessment Report*. NASA/TM-2002-209984/Ver.1/Vol.3.
http://gfo.wff.nasa.gov

N. Tran, D.W. Hancock III, G.S. Hayne, D.W. Lockwood, D. Vandemark, M.L. Driscoll, and R.V. Sailor, 2001, Assessment of the Cycle-Per-Cycle Noise Level of the GEOSAT Follow-On, TOPEX, and POSEIDON Altimeters, *Journal of Atmospheric and Oceanic Technology*, December 2002.
http://gfo.wff.nasa.gov

D.W. Hancock III, G.S. Hayne, and D.W. Lockwood, 2001, GFO Radar Altimeter Performance. NASA/WFF GFO presentation at GFO meeting in Silver Spring, MD, on June 12, 2001.
http://gfo.wff.nasa.gov

D.W. Hancock III, G.S. Hayne, R.L. Brooks, and D.W. Lockwood, 2001, *GFO Altimeter Engineering Assessment Report*. NASA/TM-2001-209984/Ver.1/Vol.1.
http://gfo.wff.nasa.gov

G.S. Hayne and D.W. Hancock III, 2000, GFO Radar Altimeter Performance. NASA/WFF GFO presentation at GFO meeting in Washington, D.C., on July 20, 2000.
http://gfo.wff.nasa.gov

Naval Oceanographic Office, 2000, *Navy-IGDR Users Handbook*.
http://gfo.bmpcoe.org/Gfo/Data_val/Cal_formats/gdr_format.htm

N. Tran, D.W. Hancock III, G.S. Hayne, D.W. Lockwood and D. Vandemark, 2000, GFO Altimeter Sigma0 and SWH Calibration Correction. NASA/WFF report.
http://gfo.wff.nasa.gov

D.W. Hancock III, et al, 1998, On the Evaluation of the GEOSAT Follow-on (GFO) Altimeter. NASA/WFF presentation at the AGU meeting in San Francisco, CA, on December 10, 1998.
http://gfo.wff.nasa.gov

G.S. Hayne and D.W. Hancock III, 1998, GFO Preliminary Results for Waveform Fitting to On-Orbit Waveform Sample Data. NASA/WFF report.
http://gfo.wff.nasa.gov

Naval Oceanographic Office, 1998, SDR Format, Contents and Algorithms.
http://gfo.bmpcoe.org/Gfo/Data_val/Cal_formats/sdr_format.htm

G.S. Hayne, 1996, Geosat Follow-On Altimeter Height Loop and AGC Loop Step Responses from Ground Testing. NASA/WFF report.
http://gfo.wff.nasa.gov

D.W. Hancock III, 1995, GFO Altimeter Height Noise Comparison with TOPEX, NASA/WFF report.
http://gfo.wff.nasa.gov

J.E. Lee, Documentation for the GFO File Transfer System. NASA/WFF report.
http://gfo.wff.nasa.gov

Appendix A

GFO Cumulative Index of Studies

GFO Altimeter Sigma0 and SWH Calibration Correction - *GFO Altimeter Engineering Assessment Report, From Launch to Acceptance*, NASA/TM-2001-209984/Ver.1/Vol.1, March 2001.

GFO "Smile Patch" and Its Consequences - *GFO Altimeter Engineering Assessment Report, From Launch to Acceptance*, NASA/TM-2001-209984/Ver.1/Vol.1, March 2001.

GFO Sigma0 and SWH Calibration Correction - *GFO Altimeter Engineering Assessment Report, From Launch to Acceptance*, NASA/TM-2001-209984/Ver.1/Vol.1, March 2001.

GFO Sigma0 Comparison of GFO and TOPEX - *GFO Altimeter Engineering Assessment Report, From Launch to Acceptance*, NASA/TM-2001-209984/Ver.1/Vol.1, March 2001.

GFO SWH Comparison of GFO and TOPEX - *GFO Altimeter Engineering Assessment Report, From Launch to Acceptance*, NASA/TM-2001-209984/Ver.1/Vol.1, March 2001.

GFO Range and SWH Consequences of Thermal Change - *GFO Altimeter Engineering Assessment Report, From Launch to Acceptance*, NASA/TM-2001-209984/Ver.1/Vol.1, March 2001.

Sigma0 Blooms and Examples in GFO Data - *GFO Altimeter Engineering Assessment Report, From Launch to Acceptance*, NASA/TM-2001-209984/Ver.1/Vol.1, March 2001.

Temperature Correction for AGC - *GFO Altimeter Engineering Assessment Report, From Launch to Acceptance*, NASA/TM-2001-209984/Ver.1/Vol.1, March 2001.

WFF Recommended Sigma0 and SWH Corrections - *GFO Altimeter Engineering Assessment Report, From Launch to Acceptance*, NASA/TM-2001-209984/Ver.1/Vol.1, March 2001.

GFO On-Orbit Altimeter Noise Assessment, NASA/TM-2001-209984/Vol. 2, March 2001.

Great Lakes Study, *GFO Altimeter Engineering Assessment Report, The First 20 Cycles Since Acceptance*, NASA/TM-2002-209984/Ver.1/Vol.3, March 2002.

GFO Correction to Range for the Effects of Oscillator Drift, *GFO Altimeter Engineering Assessment Report, The First 20 Cycles Since Acceptance*, NASA/TM-2002-209984/Ver.1/Vol.3, March 2002.

AGC Trends for the First 17 GFO Cycles, *GFO Altimeter Engineering Assessment Report, The First 20 Cycles Since Acceptance*, NASA/TM-2002-209984/Ver.1/Vol.3, March 2002.

GFO Altimeter Windspeed Monitoring, *GFO Altimeter Engineering Assessment Report, The First 20 Cycles Since Acceptance*, NASA/TM-2002-209984/Ver.1/Vol.3, March 2002.

Temperature Correction for GFO Windspeed, NASA/WFF report, May 2003.

GFO Altimeter Windspeed Monitoring, *GFO Altimeter Engineering Assessment Report, The First 43 Cycles since Acceptance*, NASA/TM-2003-209984/Ver.1/Vol.4, April 2003.

Ice-Sheet Measurement Precision from Groundtrack Crossovers, *GFO Altimeter Engineering Assessment Report, The First 43 Cycles since Acceptance*, NASA/TM-2003-209984/Ver.1/Vol.4, April 2003.

Altimeter Boresight Calibration Maneuvers, *GFO Altimeter Engineering Assessment Report, The First 43 Cycles since Acceptance*, NASA/TM-2003-209984/Ver.1/Vol.4, April 2003.

Comments on the GFO Attitude Calibration Maneuver (ABCAL) of 20 December 2001, and its Data Analysis, *GFO Altimeter Engineering Assessment Report, The First 43 Cycles since Acceptance*, NASA/TM-2003-209984/Ver.1/Vol.4, April 2003.

Discussion of GFO Flags and Low SWH in Cycle 35, *GFO Altimeter Engineering Assessment Report, The First 43 Cycles since Acceptance*, NASA/TM-2003-209984/Ver.1/Vol.4, April 2003.

Altimeter Boresight Calibration Maneuvers, *GFO Altimeter Engineering Assessment Report, The First 65 Cycles since Acceptance*, NASA/TM-2004-209984/Ver.1/Vol.6, May 2004.

GFO Altimeter Windspeed Monitoring, *GFO Altimeter Engineering Assessment Report, The First 65 Cycles since Acceptance*, NASA/TM-2004-209984/Ver.1/Vol.6, May 2004.

GFO Temperature Correction for GFO Windspeed, *GFO Altimeter Engineering Assessment Report, The First 65 Cycles since Acceptance*, NASA/TM-2004-209984/Ver.1/Vol.6, May 2004.

GFO Altimeter Windspeed Monitoring, *GFO Altimeter Engineering Assessment Report, The First 87 Cycles since Acceptance*, NASA/TM-2005-209984/Ver.1/Vol.7, September 2005.

Altimeter Boresight Calibration Maneuvers, *GFO Altimeter Engineering Assessment Report, The First 87 Cycles since Acceptance*, NASA/TM-2005-209984/Ver.1/Vol.7, September 2005.

GFO Wind Speed Correction for Sigma0 Temperature Dependence, *GFO Altimeter Engineering Assessment Report, The First 87 Cycles since Acceptance*, NASA./TM-2005-209984/Ver. 1/Vol. 7, September 2005.

GFO Altimeter Windspeed Monitoring, *GFO Altimeter Engineering Assessment Report, The First 109 Cycles since Acceptance*, NASA/TM-2005-209984/Ver.1/Vol.8, October 2006.

Altimeter Boresight Calibration Maneuvers, *GFO Altimeter Engineering Assessment Report, The First 109 Cycles since Acceptance*, NASA/TM-2005-209984/Ver.1/Vol.8, October 2006.

GFO Wind Speed Correction for Sigma0 Temperature Dependence, *GFO Altimeter Engineering Assessment Report, The First 109 Cycles since Acceptance*, NASA./TM-2005-209984/Ver. 1/Vol. 8, October 2006.

Appendix B
GFO Key Events Log
(Prior to December 26, 2005)

Table B-1 GFO Key Events Log (Prior to December 26, 2005)

Event	Date & Time of Event	Comments
Acceptance	29 Nov 2000 2000334T00:00:00Z	GFO Acceptance. SPAWAR authorizes DD250s.
Trim Burn	04 Dec 2000 2000339T06:55:00Z	ERO Trim Burn. 33.8 mm/sec at 0 deg yaw. Purpose is to raise the SMA and maintain the ERO.
Commanded	06 Dec 2000 2000341T13:34:00Z	A ground system planning error resulted in data outage of about 10.5 hours. The last command in the sequence, for an RA Calibration via CSM was omitted. This command normally sends the RA back to the Track mode. Since this last command was not sent, the RA was left in Standby mode until the next Calibration sequence was executed. Returned to track 06 Dec 2000, 2000341T23:59:00Z.
Moon Intrusion	07 Dec 2000 2000342T11:46:25Z	Moon Intrusion affected GFO pointing. Intrusion resulted in the nadir error exceeding acceptable limits (.27 degrees).
Moon Intrusion	07 Dec 2000 2000342T13:27:10Z	Moon Intrusion affected GFO pointing. Intrusion resulted in the nadir error exceeding acceptable limits (.27 degrees).
Moon Intrusion	07 Dec 2000 2000342T15:07:40Z	Moon Intrusion affected GFO pointing. Intrusion resulted in the nadir error exceeding acceptable limits (.27 degrees).
Trim Burn	08 Dec 2000 2000343T02:19:00Z	ERO Trim Burn. 6.9 mm/sec at 180 deg yaw (-6.9 mm/s). Purpose is to lower the SMA and keep the ground track from exceeding the western limit of the ERO.
Moon Intrusion	14 Dec 2000 2000349T12:48:53Z	Moon Intrusion affected GFO pointing.
Moon Intrusion	14 Dec 2000 2000349T14:48:34Z	Moon Intrusion affected GFO pointing.
Trim Burn	28 Dec 2000 2000363T12:53:00Z	ERO Trim Burn. 27.011 mm/sec at 0 deg yaw. Purpose is to raise the SMA and keep the ground track from exceeding the eastern limit of the ERO.
Moon Intrusion	14 Jan 2001 2001014T05:06:00Z	The maximum pointing error (ADNADER) was 0.55 degrees.Other intrusions at around this time may have occurred. None exceeded 0.27 degrees.

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Commanded	19 Jan 2001 2001019T18:02:00Z	The attitude changed from above.25 to below.20 degrees and the Receiver Temperature started to increase from 35 degrees. Explanation: Navsoc started the battery reconditioning sequence. Among other things, this sequence turns on the second horizon scanner, which would explain the improved pointing. In addition to the horizon scanner, a GPS Receiver and the catbed heaters are also turned on - this would explain the increase in Temperatures. Battery deep discharge reconditioning was initiated on Jan 19 at 18:02z.
Behavior	20 Jan 2001 2001020T15:28:00Z	"Anomalous behavior in GFO reaction wheel 3 torques". Wheel torque for wheel 3 displaying unusually large swings in the applied wheel torque. Does not appear to be affecting the satellite pointing.
Variations	21 Jan 2001 2001021T00:00:00Z	Doppler problem (noise/degraded orbits). The Doppler Beacon Signal is rather noisy.
Commanded	24 Jan 2001 2001024T03:13:00Z	"GFO reaction wheel 3". Commanded spacecraft to run with horizon scanner 2 instead of the 2 horizon scanner configuration. During the horizon scanner switch there were transient nadir pointing errors in the order of 0.58 degrees. The attitude returned back to above.25 from below.20 degrees at this time. The Receiver Temperature did not change.
Power Cycled	24 Jan 2001 2001024T23:57:42Z	Reaction wheel 3 was power cycled. No change was seen in the satellites behavior.
Commanded	25 Jan 2001 2001025T18:10:00Z	Extra Loads used for battery deep discharge conditioning were shed. This should return the satellite to normal power and thermal balance. The satellite is being kept in the 1 failed cell configuration at VT 7.5.
Variations	26 Jan 2001 2001026T00:00:00Z	Doppler problem (noise/degraded orbits). The Doppler Beacon Signal noise has subsided and tracks are good/improving. The oscillator on beacon 1 can not handle increased temperature adequately.
Commanded	26 Jan 2001 2001026T17:39:54Z	Switched to the redundant wheel (wheel 4) and disabled wheel 3. This involves putting the satellite into acquire sun and the radar altimeter in stand-by. Running on redundant wheel, in point state and the radar altimeter back in track.
Maneuver	30 Jan 2001 2001030T01:47:00Z	The magnitude will be 29.4 mm/s and the yaw will be 0 degrees. GFO has drifted out of the ERO and is currently about 1.3 km east of the centerline (300 m out of limits). After the maneuver, GFO should drift back into the ERO by 1/31 at 16:15Z. Satellite had drifted 300 m out of ERO.

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Moon Intrusion	05 Feb 2001 2001036T12:31:35Z	GFO horizon scanner has experienced a moon intrusion event which has caused excursions from acceptable nadir pointing limits (.27 degrees). The time of this excursion and maximum amplitude is: 12:31:35 - 12:31:45Z (0.40 degrees max)
Moon Intrusion	05 Feb 2001 2001036T14:12:00Z	The time of this excursion and maximum amplitude is: 14:12:00 - 14:12:30Z (0.95 degrees max)
Moon Intrusion	05 Feb 2001 2001036T15:52:50Z	The time of this excursion and maximum amplitude is: 15:52:50 - 15:53:10Z (0.47 degrees max)
Moon Intrusion	10 Feb 2001 2001041T06:30:00Z	The time of the excursion and maximum amplitude is: 06:30:00 - 06:30:15Z (0.43 degrees max)
Moon Intrusion	10 Feb 2001 2001041T08:10:50Z	The time of the excursion and maximum amplitude is: 08:10:50 - 08:11:20Z (0.86 degrees max)
Moon Intrusion	10 Feb 2001 2001041T09:51:45Z	The time of the excursion and maximum amplitude is: 09:51:45 - 09:52:10Z (0.87 degrees max)
Moon Intrusion	11 Feb 2001 2001042T04:32:25Z	The time of the excursion and maximum amplitude is: 04:32:25 - 04:32:40Z (0.35 degrees max)
Moon Intrusion	11 Feb 2001 2001042T13:47:05Z	The time of the excursion and maximum amplitude is: 13:47:05 - 13:47:10Z (0.60 degrees max)
Under Voltage	12 Feb 2001 2001043T21:57:00Z	GFO apparently suffered an under-voltage (UV1) event. As a consequence, the payload bus was powered off. Due to the load shedding effect of the UV1, GFO is in a safe power configuration. The payloads are off and GFO is not collecting data.
Payloads On	15 Feb 2001 2001045T06:49:00Z	Payloads turned back on. GFO in standby mode.
In Operation	16 Feb 2001 2001047T19:00:00Z	GFO collecting data, payloads switched from standby mode to track mode. The reconditioning reset, the battery voltages, temperatures and pressures appeared normal. The payloads were turned back on, software patches installed and then set to track and produce data over the weekend to test the batteries under load. Examination of the battery and other satellite data yesterday and today indicates that the bus voltages is about 27.8 (28 volt bus), the NiH battery temperatures are in the normal range of 8 to 9 deg C, and the pressures are running between 495 and 620 psi as they should. The system will be left in this condition (VT is 6.0) and closely monitored.
Trim Maneuver	01 Mar 2001 2001060T23:06:00Z	The purpose of the maneuver will be to raise the semi-major axis and maintain the ERO. The burn magnitude will be 28.719 mm/sec with a 0 degree yaw offset.
Moon Intrusion	06 Mar 2001 2001065T00:54:00Z	The time of the excursion and maximum amplitude is: 00:54:00Z - 00:54:20Z (0.34 degrees max)

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Moon Intrusion	06 Mar 2001 2001065T02:34:10Z	The time of the excursion and maximum amplitude is: 02:34:10Z - 02:34:40Z (0.39 degrees max)
Moon Intrusion	06 Mar 2001 2001065T04:14:35Z	The time of the excursion and maximum amplitude is: 04:14:35Z - 04:15:10Z (0.48 degrees max)
Moon Intrusion	06 Mar 2001 2001065T05:54:55Z	The time of the excursion and maximum amplitude is: 05:54:55Z - 05:55:05Z (0.40 degrees max)
Moon Intrusion	06 Mar 2001 2001065T19:52:45Z	The time of the excursion and maximum amplitude is: 19:52:45Z - 19:53:15Z (0.63 degrees max)
Moon Intrusion	12 Mar 2001 2001071T04:12:30Z	The time of the excursion and maximum amplitude is: 04:12:30Z - 04:12:45Z (0.49 degrees max)
Moon Intrusion	12 Mar 2001 2001071T05:52:35Z	The time of the excursion and maximum amplitude is: 05:52:35Z - 05:53:10Z (0.67 degrees max)
Moon Intrusion	12 Mar 2001 2001071T07:33:05Z	The time of the excursion and maximum amplitude is: 07:33:05Z - 07:33:40Z (0.86 degrees max)
Moon Intrusion	12 Mar 2001 2001071T09:13:40Z	The time of the excursion and maximum amplitude is: 09:13:40Z - 09:14:05Z (0.74 degrees max)
Moon Intrusion	12 Mar 2001 2001071T18:10:20Z	The time of the excursion and maximum amplitude is: 18:10:20Z - 18:10:40Z (0.41 degrees max)
Moon Intrusion	12 Mar 2001 2001071T19:50:43Z	The time of the excursion and maximum amplitude is: 19:50:43Z - 19:51:10Z (0.59 degrees max)
Test Support	14 Mar 2001 2001073T21:48:30Z	Due to a Momentum Wheel 3 Testing support, the satellite yaw was about 0.47 degrees. GFO experienced pointing errors that exceeded the.27 degrees limit. The time of the excursion is: 21:48:30Z - 21:53:00Z
Trim Maneuver	21 Mar 2001 2001080T00:55:00Z	The burn magnitude will be 30.4 mm/sec with a 0 degree yaw offset.
Trim Maneuver	30 Mar 2001 2001089T01:13:00Z	The burn magnitude will be 36 mm/sec with a 0 degree yaw offset.
Trim Maneuver	03 Apr 2001 2001093T00:51:00Z	The next burn will be in 100 minutes.
Trim Maneuver	03 Apr 2001 2001093T02:31:00Z	The total burn magnitude will be 70 mm/sec with a 0 degree yaw offset.
Trim Maneuver	04 Apr 2001 2001094T03:22:00Z	The burn magnitude will be 40 mm/sec with a 180 degree yaw offset.
Moon Intrusion	10 Apr 2001 2001100T19:53:33Z	The time of the excursion and maximum amplitude is: 19:53:33Z - 19:53:45Z (0.33 degrees max)

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Moon Intrusion	10 Apr 2001 2001100T21:33:50Z	The time of the excursion and maximum amplitude is: 21:33:50Z - 21:34:40Z (0.59 degrees max)
Moon Intrusion	10 Apr 2001 2001100T22:38:13Z	The time of the excursion and maximum amplitude is: 22:38:13Z - 22:38:48Z (0.40 degrees max)
Moon Intrusion	10 Apr 2001 2001100T23:14:35Z	The time of the excursion and maximum amplitude is: 23:14:35Z - 23:15:03Z (0.72 degrees max)
Moon Intrusion	11 Apr 2001 2001101T00:18:45Z	The time of the excursion and maximum amplitude is: 00:18:45Z - 00:19:20Z (0.68 degrees max)
Moon Intrusion	11 Apr 2001 2001101T00:55:02Z	The time of the excursion and maximum amplitude is: 00:55:02Z - 00:55:07Z (0.31 degrees max)
Moon Intrusion	11 Apr 2001 2001101T01:59:20Z	The time of the excursion and maximum amplitude is: 01:59:20Z - 01:59:47Z (0.74 degrees max)
Trim Maneuver	13 Apr 2001 2001103T00:30:00Z	The burn magnitude will be 30 mm/sec with a 0 degree yaw offset.
CSM Upload	30 Apr 2001 2001120T00:00:00Z	CSM Time Tag Anomaly. A CSM upload was planned on Wednesday (Day 115) to be uploaded on Friday (Day 117) with commands for Monday and Tuesday (Days 120 and 121). The times in the ASCII CSM.dat file are correct. The ground system uses the SCC on the ground system at HQ to convert the times to VTCW when building the CSM command. All of the commands in that CSM were 3 days 3 hours and 40 minutes earlier than they should have been. The commands for Day 121 executed on Day 118. The commands for Day 120 were changed to Day 116 which was in the past, so GFO interpreted that as 6 days and 8.7 hours in the future from Day 116 or Day 123-124. (CSM commands can be uploaded a maximum of 6 days 8.7 hours before they execute.)
Trim Maneuver	02 May 2001 2001122T05:39:00Z	The burn magnitude will be 30.9 mm/sec with a 0 degree yaw offset. GFO out of point: 122T05:32:00Z - 122T05:44:00Z.
Trim Maneuver	08 May 2001 2001128T05:05:00Z	The purpose of the maneuver will be a small “stopping” maneuver. The burn magnitude will be 4.4 mm/sec with a 180 degree yaw offset. GFO out of point: 128T04:58:00Z - 128T05:10:00Z.
Trim Maneuver	31 May 2001 2001151T23:49:00Z	The burn magnitude will be 16.8 mm/sec with a 0 degree yaw offset. GFO out of point: 151T23:42:00Z - 151T23:54:00Z
Reconditioning	04 Jun 2001 2001155T00:00:00Z	Battery reconditioning. This will continue until 14 June. Expected to have no affect on normal operations.
Moon Intrusion	11 Jun 2001 2001162T01:00:27Z	The time of the excursion and maximum amplitude is: 01:00:27Z - 01:00:29Z (0.31 degrees max)

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Moon Intrusion	11 Jun 2001 2001162T02:41:02Z	The time of the excursion and maximum amplitude is: 02:41:02Z - 02:41:25Z (0.63 degrees max)
Moon Intrusion	11 Jun 2001 2001162T04:21:42Z	The time of the excursion and maximum amplitude is: 04:21:42Z - 04:21:50Z (0.52 degrees max)
Antenna Swap	20 Jun 2001 2001171T00:00:00Z	The doppler system antenna at Headquarter has been swapped yesterday (6/20) afternoon (Pacific Time). As a result, the doppler system is out of degraded mode, and working nominally.
Antenna Swap	28 Jun 2001 2001179T00:00:00Z	The doppler system antenna at Headquarter is now back up and functioning again.
Trim Maneuver	29 Jun 2001 2001180T00:03:00Z	The burn magnitude will be 14.6 mm/sec with a 0 degree yaw offset. GFO out of point: 179T23:56:00Z - 180T00:08:00Z
Moon Intrusion	02 Jul 2001 2001183T02:48:53Z	The time of the excursion and maximum amplitude is: 02:48:53Z - 02:49:00Z (0.28 degrees max)
Moon Intrusion	02 Jul 2001 2001183T04:29:37Z	The time of the excursion and maximum amplitude is: 04:29:37Z - 04:29:42Z (0.29 degrees max)
Moon Intrusion	02 Jul 2001 2001183T17:29:02Z	The time of the excursion and maximum amplitude is: 17:19:02Z - 17:19:33Z (1.07 degrees max)
Moon Intrusion	02 Jul 2001 2001183T18:59:45Z	The time of the excursion and maximum amplitude is: 18:59:45Z - 19:00:15Z (0.92 degrees max)
Moon Intrusion	02 Jul 2001 2001183T20:40:23Z	The time of the excursion and maximum amplitude is: 20:40:23Z - 20:40:55Z (0.95 degrees max)
Moon Intrusion	02 Jul 2001 2001183T22:20:52Z	The time of the excursion and maximum amplitude is: 22:20:52Z - 22:20:58Z (0.34 degrees max)
Moon Intrusion	31 Jul 2001 2001212T07:55:22Z	The time of the excursion and maximum amplitude is: 07:55:22Z - 07:55:25Z (0.31 degrees max)
Moon Intrusion	01 Aug 2001 2001213T10:08:07Z	The time of the excursion and maximum amplitude is: 10:08:07Z - 10:08:30Z (0.94 degrees max)
Moon Intrusion	01 Aug 2001 2001213T11:48:34Z	The time of the excursion and maximum amplitude is: 11:48:34Z - 11:49:03Z (0.98 degrees max)
Moon Intrusion	01 Aug 2001 2001213T13:28:59Z	The time of the excursion and maximum amplitude is: 13:28:59Z - 13:29:36Z (0.51 degrees max)
Moon Intrusion	01 Aug 2001 2001213T15:09:59Z	The time of the excursion and maximum amplitude is: 15:09:59Z - 15:10:12Z (0.61 degrees max)
Moon Intrusion	07 Aug 2001 2001219T16:59:40Z	The time of the excursion and maximum amplitude is: 16:59:40Z - 16:59:55Z (0.28 degrees max)

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Moon Intrusion	07 Aug 2001 2001219T18:39:27Z	The time of the excursion and maximum amplitude is: 18:39:27Z - 18:39:48Z (0.90 degrees max)
Moon Intrusion	07 Aug 2001 2001219T20:20:17Z	The time of the excursion and maximum amplitude is: 20:20:17Z - 20:20:45Z (0.81 degrees max)
Moon Intrusion	07 Aug 2001 2001219T22:00:58Z	The time of the excursion and maximum amplitude is: 22:00:58Z - 22:01:03Z (0.29 degrees max)
Moon Intrusion	08 Aug 2001 2001220T23:28:25Z	The time of the excursion and maximum amplitude is: 23:28:25Z - 23:28:33Z (0.29 degrees max)
Trim Maneuver	14 Aug 2001 2001226T00:55:00Z	The burn magnitude will be 18.6 mm/sec with a 0 degree yaw offset. GFO out of point: 226T00:48:00Z - 226T01:00:00Z
Point Test	27 Aug 2001 2001239T17:05:40Z	GFO normally uses the vector method in point mode, but this method does not allow the use of the Target Table (Table 39) to generate offsets for the upcoming ABCAL maneuvers. The quaternion method does allow the use of the Target Table, but can be susceptible to coupling between Z-axis rotation and nadir pointing errors. A test was performed on GFO today (Day 239) to determine the amount of coupling between Z-axis rotation and nadir errors while in quaternion point mode. GFO was placed in quaternion point mode for one rev (239/17:05:40 through 239/18:45:34) in order to collect the necessary data, then switched back into vector point mode.
Trim Maneuver	31 Aug 2001 2001243T00:27:00Z	The burn magnitude will be 23.6 mm/sec with a 0 degree yaw offset. GFO out of point: 243T00:20:00Z - 243T00:32:00Z
Moon Intrusion	07 Sep 2001 2001250T04:06:15Z	The time of the excursion and maximum amplitude is: 04:06:15Z - 04:06:40Z (0.39 degrees max)
Moon Intrusion	07 Sep 2001 2001250T05:46:45Z	The time of the excursion and maximum amplitude is: 05:46:45Z - 05:47:13Z (0.49 degrees max)
Moon Intrusion	07 Sep 2001 2001250T07:27:02Z	The time of the excursion and maximum amplitude is: 07:27:02Z - 07:27:35Z (0.46 degrees max)
Moon Intrusion	07 Sep 2001 2001250T09:07:34Z	The time of the excursion and maximum amplitude is: 09:07:34Z - 09:08:05Z (0.67 degrees max)
Moon Intrusion	07 Sep 2001 2001250T10:48:10Z	The time of the excursion and maximum amplitude is: 10:48:10Z - 10:48:35Z (0.68 degrees max)
Moon Intrusion	07 Sep 2001 2001250T12:28:45Z	The time of the excursion and maximum amplitude is: 12:28:45Z - 12:28:50Z (0.37 degrees max)
Trim Maneuver	15 Sep 2001 2001258T02:44:00Z	The burn magnitude will be 32.0 mm/sec with a 0 degree yaw offset. GFO out of point: 258T02:37:00Z - 258T02:49:00Z

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Trim Maneuver 1 of 2	28 Sep 2001 2001271T01:03:00Z	The total burn magnitude will be 48.8 mm/sec with a 0 degree yaw offset. GFO out of point: 271T00:56:00Z - 271T01:08:00Z
Trim Maneuver 2 of 2	28 Sep 2001 2001271T02:43:00Z	The total burn magnitude will be 48.8 mm/sec with a 0 degree yaw offset. GFO out of point: 271T02:36:00Z - 271T02:48:00Z
Moon Intrusion	05 Oct 2001 2001278T01:54:20Z	The time of the excursion and maximum amplitude is: 01:54:20Z - 01:55:10Z (0.83 degrees max)
Moon Intrusion	05 Oct 2001 2001278T03:35:05Z	The time of the excursion and maximum amplitude is: 03:35:05Z - 03:35:35Z (0.71 degrees max)
Moon Intrusion	06 Oct 2001 2001279T20:52:20Z	The time of the excursion and maximum amplitude is: 20:52:20Z - 20:52:30Z (0.30 degrees max)
Moon Intrusion	06 Oct 2001 2001279T22:32:25Z	The time of the excursion and maximum amplitude is: 22:32:25Z - 22:33:00Z (0.42 degrees max)
Moon Intrusion	07 Oct 2001 2001280T00:13:05Z	The time of the excursion and maximum amplitude is: 00:13:05Z - 00:13:25Z (0.34 degrees max)
Trim Maneuver 1 of 2	11 Oct 2001 2001284T02:46:00Z	The total burn magnitude will be 42.2 mm/sec with a 0 degree yaw offset. GFO out of point: 284T02:39:00Z - 284T02:51:00Z
Trim Maneuver 2 of 2	11 Oct 2001 2001284T04:26:00Z	The total burn magnitude will be 42.2 mm/sec with a 0 degree yaw offset. GFO out of point: 284T04:19:00Z - 284T04:31:00Z
Trim Maneuver 1 of 2	23 Oct 2001 2001296T03:29:00Z	The total burn magnitude will be 46.3 mm/sec with a 0 degree yaw offset. GFO out of point: 296T03:22:00Z - 296T03:34:00Z
Trim Maneuver 2 of 2	23 Oct 2001 2001296T05:09:00Z	The total burn magnitude will be 46.3 mm/sec with a 0 degree yaw offset. GFO out of point: 296T05:02:00Z - 296T05:14:00Z
Configuration	24 Oct 2001 2001297T18:46:50Z	As a result of the Wheel 3 patch activation and configuration change performed on GFO today, the satellite radar altimeter was out of track 1 mode between the following times: 297T18:46:50Z - 297T18:53:12Z. As a result, payload data will be affected accordingly. Also, the Satellite was out of point state during the following times: 297T18:47:02Z - 297T18:51:52Z.
Moon Intrusion	27 Oct 2001 2001300T21:16:00Z	The time of the excursion and maximum amplitude is: 21:16:00Z - 21:16:10Z (0.33 degrees max).
Moon Intrusion	27 Oct 2001 2001300T22:56:35Z	The time of the excursion and maximum amplitude is: 22:56:35Z - 22:56:40Z (0.30 degrees max).

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Moon Intrusion	28 Oct 2001 2001301T03:30:30Z	The time of the excursion and maximum amplitude is: 03:30:30Z - 03:30:40Z (0.33 degrees max).
Moon Intrusion	28 Oct 2001 2001301T05:11:00Z	The time of the excursion and maximum amplitude is: 05:11:00Z - 05:11:30Z (0.64 degrees max).
Moon Intrusion	28 Oct 2001 2001301T06:51:35Z	The time of the excursion and maximum amplitude is: 06:51:35Z - 06:51:50Z (0.67 degrees max).
Moon Intrusion	28 Oct 2001 2001301T08:32:10Z	The time of the excursion and maximum amplitude is: 08:32:10Z - 08:32:25Z (0.40 degrees max).
Trim Maneuver	01 Nov 2001 2001305T05:28:00Z	The burn magnitude will be 31.5 mm/sec with a 0 degree yaw offset. GFO out of point: 305T05:21:00Z - 305T05:33:00Z.
Moon Intrusion	04 Nov 2001 2001308T06:19:15Z	The time of the excursion and maximum amplitude is: 06:19:15Z - 06:19:45Z (0.65 degrees max).
Moon Intrusion	04 Nov 2001 2001308T07:59:50Z	The time of the excursion and maximum amplitude is: 07:59:50Z - 08:00:20Z (0.63 degrees max).
Moon Intrusion	04 Nov 2001 2001308T09:40:30Z	The time of the excursion and maximum amplitude is: 09:40:30Z - 09:40:35Z (0.33 degrees max).
Moon Intrusion	05 Nov 2001 2001309T05:17:10Z	The time of the excursion and maximum amplitude is: 05:17:10Z - 05:17:20Z (0.29 degrees max).
Moon Intrusion	05 Nov 2001 2001309T06:57:50Z	The time of the excursion and maximum amplitude is: 06:57:50Z - 06:58:00Z (0.35 degrees max).
ERO Violation	06 Nov 2001 2001310T01:45:00Z	Due to a decrease in drag, the GFO ground track is going to exceed the ERO (Tuesday 11/6) for about 6.5 days. The ERO is predicted to exceed 1000 m West on 11/6 at 01:45Z. The maximum excursion of 1227 m West will be on 11/9 at 06:54Z and the ground track will re-enter the ERO on 11/12 at 17:04Z.
Configuration	07 Nov 2001 2001311T19:51:34Z	On GFO rev Det A 19549 a switch of the reaction wheel configuration from 1-2-3 to 1-2-4.
Back in ERO	08 Nov 2001 2001312T21:00:00Z	GFO's ground track has turned around. The average ground track will be back inside the 1 km limit 312T21:00.
Trim Maneuver	15 Nov 2001 2001319T01:21:00Z	The burn magnitude will be 28.2 mm/sec with a 0 degree yaw offset. GFO out of point: 319T01:14:00Z - 305T01:27:00Z.
Moon Intrusion	26 Nov 2001 2001330T22:03:10Z	The time of the excursion and maximum amplitude is: 22:03:10Z - 22:03:45Z (0.67 degrees max).
Moon Intrusion	26 Nov 2001 2001330T23:43:50Z	The time of the excursion and maximum amplitude is: 23:43:50Z - 23:44:25Z (0.78 degrees max).
Moon Intrusion	27 Nov 2001 2001331T01:24:25Z	The time of the excursion and maximum amplitude is: 01:24:25Z - 01:24:40Z (0.54 degrees max).

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Moon Intrusion	28 Nov 2001 2001332T03:07:55Z	The time of the excursion and maximum amplitude is: 03:07:55Z - 03:08:05Z (0.41 degrees max).
Moon Intrusion	28 Nov 2001 2001332T04:48:35Z	The time of the excursion and maximum amplitude is: 04:48:35Z - 04:49:05Z (0.51 degrees max).
Moon Intrusion	28 Nov 2001 2001332T06:29:15Z	The time of the excursion and maximum amplitude is: 06:29:15Z - 06:29:25Z (0.31 degrees max).
Trim Maneuver	29 Nov 2001 2001333T00:40:00Z	The burn magnitude will be 26.5 mm/sec with a 0 degree yaw offset. GFO out of point: 305T00:33:00Z - 305T00:46:00Z.
Trim Maneuver	13 Dec 2001 2001347T01:22:00Z	The burn magnitude will be 25.7 mm/sec with a 0 degree yaw offset. GFO out of point: 305T01:15:00Z - 305T01:28:00Z.
ABCAL	20 Dec 2001 2001354T16:35:00Z	Performed ABCAL Maneuver: 354T16:35:00Z - 354T16:51:00Z. Each off-nadir excursion angle is 0.6 degrees in magnitude.
Trim Maneuver 1 of 2	26 Dec 2001 2001360T05:53:00Z	The total burn magnitude will be 39.0 mm/sec with a 0 degree yaw offset. GFO out of point: 360T05:46:00Z - 360T05:59:00Z.
Trim Maneuver 2 of 2	26 Dec 2001 2001360T07:34:00Z	The total burn magnitude will be 39.0 mm/sec with a 0 degree yaw offset. GFO out of point: 360T07:27:00Z - 360T07:40:00Z.
Moon Intrusion	27 Dec 2001 2001361T07:40:45Z	The time of the excursion and maximum amplitude is: 07:40:45Z - 07:41:30Z (0.35 degrees max).
Moon Intrusion	27 Dec 2001 2001361T09:21:50Z	The time of the excursion and maximum amplitude is: 09:21:50Z - 09:22:20Z (0.35 degrees max).
Moon Intrusion	27 Dec 2001 2001361T23:22:55Z	The time of the excursion and maximum amplitude is: 23:22:55Z - 23:23:15Z (0.33 degrees max).
Moon Intrusion	28 Dec 2001 2001362T01:03:35Z	The time of the excursion and maximum amplitude is: 01:03:35Z - 01:03:55Z (0.46 degrees max).
Trim Maneuver	03 Jan 2002 2002003T03:23:00Z	The burn magnitude will be 26.9 mm/sec with a 0 degree yaw offset. GFO out of point: 003T03:16:00Z - 003T03:29:00Z.
ERO Violation	03 Jan 2002 2002003T03:23:00Z	The GFO maneuver that executed on 1/3/02 03:23Z was designed to have the ground track turn around at 900 meters west. Post-maneuver analysis has shown that the maneuver was too large and will cause the ground track to drift to 1750 meters west before turning around. The ground track is predicted to exceed 1000 meters west on Sunday 1/6/02. A stopping maneuver will be planned and uploaded at 2002007T16:56Z to execute at 2002007T19:48Z.

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Trim Maneuver	07 Jan 2002 2002007T19:44:00Z	The burn magnitude will be 8.0 mm/sec with a 180 degree yaw offset. GFO out of point: 007T19:37:00Z - 007T19:50:00Z. The ground track has stopped drifting west and is now drifting back into the ERO. The ground track should be within the 1000 meter limit on 1/12 around 17:11Z.
Trim Maneuver 1 of 2	16 Jan 2002 2002016T23:26:00Z	The total burn magnitude will be 37.87 mm/sec with a 0 degree yaw offset. GFO out of point: 016T23:19:00Z - 016T23:32:00Z.
Trim Maneuver 2 of 2	17 Jan 2002 2002017T01:06:00Z	The total burn magnitude will be 37.87 mm/sec with a 0 degree yaw offset. GFO out of point: 017T00:59:00Z - 017T01:12:00Z.
Moon Intrusion	26 Jan 2002 2002026T00:32:07Z	The time of the excursion and maximum amplitude is: 00:32:07Z - 00:32:35Z (0.80 degrees max).
Moon Intrusion	26 Jan 2002 2002026T02:12:55Z	The time of the excursion and maximum amplitude is: 02:12:55Z - 02:13:05Z (0.34 degrees max).
Moon Intrusion	26 Jan 2002 2002026T07:50:10Z	The time of the excursion and maximum amplitude is: 07:50:10Z - 07:50:30Z (0.35 degrees max).
Moon Intrusion	26 Jan 2002 2002026T09:30:50Z	The time of the excursion and maximum amplitude is: 09:30:50Z - 09:31:15Z (0.57 degrees max).
Moon Intrusion	26 Jan 2002 2002026T11:11:30Z	The time of the excursion and maximum amplitude is: 11:11:30Z - 11:11:38Z (0.37 degrees max).
Trim Maneuver 1 of 2	28 Jan 2002 2002028T02:08:00Z	The total burn magnitude will be 46.78 mm/sec with a 0 degree yaw offset. GFO out of point: 028T02:01:00Z - 028T02:14:00Z.
Trim Maneuver 2 of 2	28 Jan 2002 2002028T03:48:00Z	The total burn magnitude will be 46.78 mm/sec with a 0 degree yaw offset. GFO out of point: 028T03:41:00Z - 028T03:54:00Z.
Moon Intrusion	30 Jan 2002 2002030T23:30:20Z	The time of the excursion and maximum amplitude is: 23:30:20Z - 23:30:30Z (0.30 degrees max).
Trim Maneuver	31 Jan 2002 2002031T02:11:00Z	The burn magnitude will be 25.6 mm/sec with a 0 degree yaw offset. GFO out of point: 031T02:04:00Z - 031T02:17:00Z.
Moon Intrusion	31 Jan 2002 2002031T01:10:50Z	The time of the excursion and maximum amplitude is: 01:10:50Z - 01:11:00Z (0.34 degrees max).
Moon Intrusion	31 Jan 2002 2002031T02:50:55Z	The time of the excursion and maximum amplitude is: 02:50:55Z - 02:51:25Z (0.74 degrees max).
Moon Intrusion	31 Jan 2002 2002031T04:31:35Z	The time of the excursion and maximum amplitude is: 04:31:35Z - 04:32:00Z (0.77 degrees max).

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Trim Maneuver 1 of 2	13 Feb 2002 2002044T00:27:00Z	The total burn magnitude will be 56.2 mm/sec with a 0 degree yaw offset. GFO out of point: 044T00:21:00Z - 044T00:33:00Z.
Trim Maneuver 2 of 2	13 Feb 2002 2002044T02:07:00Z	The total burn magnitude will be 56.2 mm/sec with a 0 degree yaw offset. GFO out of point: 044T02:01:00Z - 044T02:13:00Z.
ERO Violation	19 Feb 2002 2002050T09:09:19Z	GFO will be out of the ERO for approximately two days from 2/19/02 09:09:19 to 2/21/02 14:49:21. The excursion should be no more than 50m West.
Moon Intrusion	23 Feb 2002 2002054T06:18:24Z	The time of the excursion and maximum amplitude is: 06:18:24Z - 06:18:26Z (0.28 degrees max).
Moon Intrusion	23 Feb 2002 2002054T07:59:05Z	The time of the excursion and maximum amplitude is: 07:59:05Z - 07:59:12Z (0.31 degrees max).
Moon Intrusion	24 Feb 2002 2002055T02:53:25Z	The time of the excursion and maximum amplitude is: 02:53:25Z - 02:53:31Z (0.36 degrees max).
Moon Intrusion	24 Feb 2002 2002055T04:33:55Z	The time of the excursion and maximum amplitude is: 04:33:55Z - 04:33:59Z (0.30 degrees max).
Trim Maneuver 1 of 2	27 Feb 2002 2002058T01:33:00Z	The total burn magnitude will be 50.1 mm/sec with a 0 degree yaw offset. GFO out of point: 058T01:26:00Z - 058T01:39:00Z.
Trim Maneuver 2 of 2	27 Feb 2002 2002058T03:13:00Z	The total burn magnitude will be 50.1 mm/sec with a 0 degree yaw offset. GFO out of point: 058T03:06:00Z - 058T031:19:00Z.
Moon Intrusion	01 Mar 2002 2002061T22:54:34Z	The time of the excursion and maximum amplitude is: 22:54:34Z - 22:54:43Z (0.40 degrees max).
Moon Intrusion	01 Mar 2002 2002061T23:30:27Z	The time of the excursion and maximum amplitude is: 23:30:27Z - 23:30:39Z (0.345 degrees max).
Moon Intrusion	02 Mar 2002 2002062T00:34:39Z	The time of the excursion and maximum amplitude is: 00:34:39Z - 00:35:11Z (0.55 degrees max).
Moon Intrusion	02 Mar 2002 2002062T01:10:38Z	The time of the excursion and maximum amplitude is: 01:10:38Z - 01:11:21Z (0.61 degrees max).
Moon Intrusion	02 Mar 2002 2002062T02:15:11Z	The time of the excursion and maximum amplitude is: 02:15:11Z - 02:15:38Z (0.725 degrees max).
ABCAL	05 Mar 2002 2002064T21:10:00Z	Performed ABCAL Maneuver: 064T21:10:00Z - 064T21:26:00Z. Each off-nadir excursion angle is 0.6 degrees in magnitude.
Trim Maneuver	07 Mar 2002 2002066T04:06:00Z	The burn magnitude will be 28.2 mm/sec with a 0 degree yaw offset. GFO out of point: 066T03:59:00Z - 066T04:12:00Z.

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Trim Maneuver 1 of 2	19 Mar 2002 2002078T01:32:00Z	The total burn magnitude will be 47.0 mm/sec with a 0 degree yaw offset. GFO out of point: 078T01:25:00Z - 078T01:38:00Z.
Trim Maneuver 2 of 2	19 Mar 2002 2002078T03:12:00Z	The total burn magnitude will be 47.0 mm/sec with a 0 degree yaw offset. GFO out of point: 078T03:05:00Z - 078T03:18:00Z.
Moon Intrusion	26 Mar 2002 2002085T12:02:27Z	The time of the excursion and maximum amplitude is: 12:02:27Z - 12:02:35Z (0.723 degrees max).
Moon Intrusion	26 Mar 2002 2002085T12:02:37Z	The time of the excursion and maximum amplitude is: 12:02:37Z - 12:02:47Z (0.541 degrees max).
Moon Intrusion	26 Mar 2002 2002085T13:42:21Z	The time of the excursion and maximum amplitude is: 13:42:21Z - 13:42:27Z (0.348 degrees max).
Moon Intrusion	31 Mar 2002 2002090T07:52:31Z	The time of the excursion and maximum amplitude is: 07:52:31Z - 07:52:39Z (0.358 degrees max).
Moon Intrusion	31 Mar 2002 2002090T09:33:07Z	The time of the excursion and maximum amplitude is: 09:33:07Z - 09:33:17Z (0.793 degrees max).
Moon Intrusion	31 Mar 2002 2002090T09:33:25Z	The time of the excursion and maximum amplitude is: 09:33:25Z - 09:33:31Z (0.361 degrees max).
Moon Intrusion	31 Mar 2002 2002090T11:13:30Z	The time of the excursion and maximum amplitude is: 11:13:30Z - 11:13:36Z (0.380 degrees max).
Moon Intrusion	31 Mar 2002 2002090T15:39:46Z	The time of the excursion and maximum amplitude is: 15:39:46Z - 15:39:54Z (0.433 degrees max).
Moon Intrusion	31 Mar 2002 2002090T15:40:09Z	The time of the excursion and maximum amplitude is: 15:40:09Z - 15:40:17Z (0.407 degrees max).
Moon Intrusion	31 Mar 2002 2002090T17:20:15Z	The time of the excursion and maximum amplitude is: 17:20:15Z - 17:20:26Z (0.574 degrees max).
Moon Intrusion	31 Mar 2002 2002090T17:20:34Z	The time of the excursion and maximum amplitude is: 17:20:34Z - 17:20:46Z (0.460 degrees max).
Trim Maneuver 1 of 2	04 Apr 2002 2002094T03:20:00Z	The total burn magnitude will be 38.6 mm/sec with a 0 degree yaw offset. GFO out of point: 094T03:13:00Z - 094T03:26:00Z.
Trim Maneuver 2 of 2	04 Apr 2002 2002094T05:00:00Z	The total burn magnitude will be 38.6 mm/sec with a 0 degree yaw offset. GFO out of point: 094T04:53:00Z - 094T05:06:00Z.
ERO Violation	12 Apr 2002 2002102T13:57:00Z	(Exceeding ERO Limits) GFO's ground track is going to exceed the -1000m western limit and get to -1239m before turning around. A stopping maneuver will not be performed and the ground track will be allowed to drift back into the ERO limits on its own.

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
ERO Violation	15 Apr 2002 2002105T00:00:00Z	Over the weekend the drag on GFO increased enough to keep its average ground track from violating the -1000m western ERO limit. The average ground track turned around on 4/13 at -904m. Between 4/12 and 4/15 there were 4 one revolution per day spikes that crossed the -1000m limit. The largest one went to -1033m.
Trim Maneuver	23 Apr 2002 2002113T01:33:00Z	The burn magnitude will be 33.3 mm/sec with a 0 degree yaw offset. GFO out of point: 113T01:26:00Z - 113T01:39:00Z.
Moon Intrusion	24 Apr 2002 2002114T10:40:35Z	The time of the excursion and maximum amplitude is: 10:40:35Z - 10:40:44Z (0.460 degrees max).
Moon Intrusion	24 Apr 2002 2002114T12:21:08Z	The time of the excursion and maximum amplitude is: 12:21:08Z - 12:21:18Z (0.380 degrees max).
Moon Intrusion	24 Apr 2002 2002114T14:01:27Z	The time of the excursion and maximum amplitude is: 14:01:27Z - 14:01:35Z (0.370 degrees max).
Moon Intrusion	30 Apr 2002 2002120T05:07:15Z	The time of the excursion and maximum amplitude is: 05:07:15Z - 05:07:19Z (0.340 degrees max).
Moon Intrusion	30 Apr 2002 2002120T06:47:43Z	The time of the excursion and maximum amplitude is: 06:47:43Z - 06:47:51Z (0.406 degrees max).
Moon Intrusion	30 Apr 2002 2002120T13:58:37Z	The time of the excursion and maximum amplitude is: 13:58:37Z - 13:58:39Z (0.278 degrees max).
Moon Intrusion	30 Apr 2002 2002120T13:58:55Z	The time of the excursion and maximum amplitude is: 13:58:55Z - 13:58:57Z (0.309 degrees max).
Moon Intrusion	30 Apr 2002 2002120T15:39:22Z	The time of the excursion and maximum amplitude is: 15:39:22Z - 15:39:33Z (0.596 degrees max).
Moon Intrusion	30 Apr 2002 2002120T15:39:41Z	The time of the excursion and maximum amplitude is: 15:39:41Z - 15:39:49Z (0.315 degrees max).
Moon Intrusion	30 Apr 2002 2002120T17:20:00Z	The time of the excursion and maximum amplitude is: 17:20:00Z - 17:20:06Z (0.446 degrees max).
Trim Maneuver	23 May 2002 2002143T00:53:00Z	The burn magnitude will be 20.4 mm/sec with a 0 degree yaw offset. GFO out of point: 143T00:46:00Z - 143T00:59:00Z.
Moon Intrusion	23 May 2002 2002143T13:00:36Z	The time of the excursion and maximum amplitude is: 13:00:36Z - 13:00:45Z (0.438 degrees max).
Moon Intrusion	23 May 2002 2002143T14:41:26Z	The time of the excursion and maximum amplitude is: 14:41:26Z - 14:41:30Z (0.371 degrees max).
Moon Intrusion	23 May 2002 2002143T14:41:45Z	The time of the excursion and maximum amplitude is: 14:41:45Z - 14:41:47Z (0.275 degrees max).
Moon Intrusion	23 May 2002 2002143T17:28:10Z	The time of the excursion and maximum amplitude is: 17:28:10Z - 17:28:21Z (0.908 degrees max).

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Moon Intrusion	23 May 2002 2002143T17:28:25Z	The time of the excursion and maximum amplitude is: 17:28:25Z - 17:28:35Z (0.581 degrees max).
Moon Intrusion	23 May 2002 2002143T19:08:52Z	The time of the excursion and maximum amplitude is: 19:08:52Z - 19:08:54Z (0.623 degrees max).
Moon Intrusion	23 May 2002 2002143T19:08:56Z	The time of the excursion and maximum amplitude is: 19:08:56Z - 19:09:06Z (0.619 degrees max).
Moon Intrusion	23 May 2002 2002143T19:09:08Z	The time of the excursion and maximum amplitude is: 19:09:08Z - 19:09:23Z (0.798 degrees max).
Moon Intrusion	23 May 2002 2002143T20:49:23Z	The time of the excursion and maximum amplitude is: 20:49:23Z - 20:49:34Z (0.744 degrees max).
Moon Intrusion	23 May 2002 2002143T20:49:50Z	The time of the excursion and maximum amplitude is: 20:49:50Z - 20:50:04Z (0.637 degrees max).
Moon Intrusion	23 May 2002 2002143T20:50:15Z	The time of the excursion and maximum amplitude is: 20:50:15Z - 20:50:17Z (0.277 degrees max).
Moon Intrusion	23 May 2002 2002143T22:30:41Z	The time of the excursion and maximum amplitude is: 22:30:41Z - 22:30:45Z (0.312 degrees max).
Trim Maneuver	13 Jun 2002 2002164T23:04:00Z	The burn magnitude will be 13.6 mm/sec with a 0 degree yaw offset. GFO out of point: 164T22:57:00Z - 164T23:10:00Z.
ABCAL	18 Jun 2002 2002169T03:30:00Z	Performed ABCAL Maneuver: 169T03:30:00Z - 169T03:46:00Z.
Moon Intrusion	08 Jul 2002 2002189T18:33:32Z	The time of the excursion and maximum amplitude is: 18:33:32Z - 18:38:32Z (0.291 degrees max).
Moon Intrusion	21 Jul 2002 2002202T15:26:09Z	The time of the excursion and maximum amplitude is: 15:26:09Z - 15:26:30Z (0.580 degrees max).
Moon Intrusion	21 Jul 2002 2002202T17:06:37Z	The time of the excursion and maximum amplitude is: 17:06:37Z - 17:07:02Z (0.650 degrees max).
Moon Intrusion	21 Jul 2002 2002202T18:47:00Z	The time of the excursion and maximum amplitude is: 18:47:00Z - 18:47:32Z (0.400 degrees max).
Moon Intrusion	21 Jul 2002 2002202T20:27:56Z	The time of the excursion and maximum amplitude is: 20:27:56Z - 20:28:03Z (0.350 degrees max).
Trim Maneuver	24 Jul 2002 2002205T19:48:00Z	The burn magnitude will be 20.3 mm/sec with a 0 degree yaw offset. GFO out of point: 205T19:41:00Z - 205T19:54:00Z.
Moon Intrusion	27 Jul 2002 2002208T04:21:45Z	The time of the excursion and maximum amplitude is: 04:21:45Z - 04:21:51Z (0.330 degrees max).
Moon Intrusion	27 Jul 2002 2002208T06:02:07Z	The time of the excursion and maximum amplitude is: 06:02:07Z - 06:02:17Z (0.440 degrees max).

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Trim Maneuver	08 Aug 2002 2002220T23:44:00Z	The burn magnitude will be 16.0 mm/sec with a 0 degree yaw offset. GFO out of point: 220T23:37:00Z - 220T23:50:00Z.
Trim Maneuver	22 Aug 2002 2002234T23:11:00Z	The burn magnitude will be 32.7 mm/sec with a 0 degree yaw offset. GFO out of point: 234T23:04:00Z - 234T23:17:00Z.
Moon Intrusion	25 Aug 2002 2002237T12:46:30Z	The terminology for moon intrusions has changed. Recent analysis of these events has shown that the angles being measured are only the horizon sensor outputs as a result of the moon intrusions. By the time the attitude control system analysis has begun to respond (start to spin up the momentum wheels) and with the satellite inertia to be overcome, any momentary moon intrusion has likely ended before anything more than a negligible spacecraft motion occurs.
Moon Intrusion	25 Aug 2002 2002237T14:26:53Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	27 Aug 2002 2002239T16:04:53Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	27 Aug 2002 2002239T17:45:27Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	27 Aug 2002 2002239T19:26:03Z	Momentary horizon sensor measurements errors have resulted.
ERO Violation	31 Aug 2002 2002243T17:42:00Z	(Exceeding ERO Limits) The current ground track prediction for GFO indicates that the satellite will violate the ERO between 1742Z on 8/31/02 and 2322Z on 9/2/02. It is predicted to only drift to a maximum of 25m west of the boundary. Historically, we have not performed stopping maneuvers for violations of such small magnitude.
Trim Maneuver	13 Sep 2002 2002256T00:00:00Z	The burn magnitude will be 35.2 mm/sec with a 0 degree yaw offset. GFO out of point: 255T23:53:00Z - 256T00:06:00Z.
Moon Intrusion	15 Sep 2002 2002258T17:28:52Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	15 Sep 2002 2002258T19:09:20Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	15 Sep 2002 2002258T20:49:47Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	24 Sep 2002 2002267T05:29:50Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	24 Sep 2002 2002267T07:10:13Z	Momentary horizon sensor measurements errors have resulted.

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Trim Maneuver	02 Oct 2002 2002275T23:25:00Z	The burn magnitude will be 35.7 mm/sec with a 0 degree yaw offset. GFO out of point: 275T23:18:00Z - 275T23:31:00Z.
Anomaly	15 Oct 2002 2002288T00:00:00Z	An apparent satellite encryptor anomaly prevented the ground system from re-acquiring telemetry following the swap to transmitter 2 (omni) at the beginning of today's planned swap to wheel 2,3,4 configuration support. No further commanding was attempted until the following support. On the following support, XM2 was shut off and XM1 was powered on, resulting in the successful re-acquisition of telemetry.
Configuration	16 Oct 2002 2002289T21:13:35Z	The GFO reaction wheel configuration will be modified from wheels 1-2-4 to 2-3-4 during a support between 21:13:15z and 21:24:58z.
Moon Intrusion	17 Oct 2002 2002290T05:23:54Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	17 Oct 2002 2002290T07:04:27Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	17 Oct 2002 2002290T08:44:58Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	17 Oct 2002 2002290T10:25:38Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	17 Oct 2002 2002290T17:40:04Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	17 Oct 2002 2002290T19:20:39Z	Momentary horizon sensor measurements errors have resulted.

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Wheel Alarms	18 Oct 2002 2002291T08:00:00Z	At about 291/0800z, during the first DSU dump (DC 24479) following the recent GPS 4 turn on, NAVSOC DSMs received incoming alarms indicating out-of-limit wheel 1 -15V values. The DSMs notified the GFO lead engineer of these alarms, which reported a value of around -17.55V. Prior to the GPS 4 turn on, this telemetry point had been around -15.5V. Upon arrival to NAVSOC, GFO engineers immediately began evaluating the latest available DSU data. This data confirmed their suspicion that the GFO wheel 1 $\pm$15V telemetry had begun a steady increase temporally concurrent with the turn on of GPS 4, which occurred at approximately 290/2050z. Ball Aerospace was contacted regarding this situation, and it was decided that on the next available support, (rev DA 24481 @ 291/1142z) GPS 4 should be immediately turned off, the CSM cleared (it still commands), and the in-progress Cal 3 terminated. In addition, Ball directed GFO engineers to perform the recently prepared wheel swap (to wheels 2-3-4) if they observe either wheel 1 +15V or -15V telemetry exceeding 19.0V in magnitude during this or any subsequent supports. The wheel 1 -15V telemetry point was around -18.3V on the first recovery support (DA 24481), so no wheel swap was performed. On the following two supports, GFO engineers continued to monitor wheel 1 $\pm$15V telemetry closely. DSU dumps were performed on both of these supports, and the data retrieved was immediately analyzed for wheel 1 $\pm$15V trending. The DSU data indicated that at approximately 291/1400z the wheel 1 +15V and -15V telemetry peaked in magnitude at 18.55V and 18.79V, respectively, before decreasing again. The most recent support (LP 24484 @ 291/1645z) showed the wheel 1 +15V and -15V down to 18.07V and 18.31V in magnitude, respectively. Ball has approved the prepared wheel swap planning products for implementation as soon as practical. This support has been planned for rev DC 24486 @ 291/2013z.
Configuration	18 Oct 2002 2002291T20:13:35Z	The GFO reaction wheel configuration will be modified from wheels 1-2-4 to 2-3-4 during a support between 21:13:15z and 21:24:58z.
Calibration	21 Oct 2002 2002294T00:00:00Z	TTCS/GPS calibration is going to be performed at Det C. The plan is to turn on the GPS receiver Thursday, and begin the calibration Friday.
Trim Maneuver	24 Oct 2002 2002297T00:05:00Z	The burn magnitude will be 26.1 mm/sec with a 0 degree yaw offset. GFO out of point: 296T23:58:00Z - 297T00:11:00Z.
ABCAL	13 Nov 2002 2002317T18:30:00Z	Performed ABCAL Maneuver: 317T18:30:00Z - 169T18:46:00Z.

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Commanded	14 Nov 2002 2002318T00:00:00Z	Time Bias Correction. 15 microsecond change to bias.
Commanded	14 Nov 2002 2002318T00:00:00Z	Battery heater duty cycle is approximately 33%. Per battery management request the VT level was changed to 5.5 this afternoon.
Trim Maneuver	14 Nov 2002 2002318T23:55:00Z	The burn magnitude will be 22.1 mm/sec with a 0 degree yaw offset. GFO out of point: 318T23:48:00Z - 319T00:01:00Z.
Moon Intrusion	15 Nov 2002 2002319T22:16:04Z	Momentary horizon sensor measurements errors has been caused.
Moon Intrusion	15 Nov 2002 2002319T23:56:44Z	Momentary horizon sensor measurements errors has been caused.
Moon Intrusion	16 Nov 2002 2002320T01:37:18Z	Momentary horizon sensor measurements errors has been caused.
Moon Intrusion	16 Nov 2002 2002320T03:17:21Z	Momentary horizon sensor measurements errors has been caused.
Moon Intrusion	17 Nov 2002 2002321T06:44:21Z	Momentary horizon sensor measurements errors has been caused.
Moon Intrusion	17 Nov 2002 2002321T08:25:05Z	Momentary horizon sensor measurements errors has been caused.
Commanded	26 Nov 2002 2002330T00:00:00Z	The VT level was changed from 5.5 to 6.0 on Tuesday.
Reaction Wheel	27 Nov 2002 2002331T08:00:00Z	In discussions with Mike Weiss this morning he advised us that Ball had some very informative conversations with Interpoint - the mfgr of the wheel controller electronics. Although the good news is that this is a mfgr that is being very open and cooperative in discussions, the bad news is that we basically need to consider Wheel One LOST. After reviewing the events and confirming lot numbers of parts the conclusion is that the erratic behavior we saw earlier was a result of a radiation induced failure to an optical isolator/coupler and that based on prior experience/history this will only continue to get worse and possibly fry the electronics in that wheel. Current plan is to continue as is on wheels 2, 3, and 4 and to modify the onboard ROM so that wheel one does not inadvertently come on.
ERO Maneuver	11 Dec 2002 2002345T01:26:00Z	The burn magnitude will be 26.3 mm/sec with a 0 degree yaw offset. GFO out of point: 345T01:19:00Z - 345T01:32:00Z.
Moon Intrusion	16 Dec 2002 2002350T07:55:01Z	Momentary horizon sensor measurements errors have resulted.

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Moon Intrusion	16 Dec 2002 2002350T09:35:33Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	16 Dec 2002 2002350T11:16:35Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	16 Dec 2002 2002350T12:57:13Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	17 Dec 2002 2002351T02:58:17Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	17 Dec 2002 2002351T04:39:02Z	Momentary horizon sensor measurements errors have resulted.
Trim Maneuver	27 Dec 2002 2002361T01:30:05Z	The burn magnitude will be 24.2 mm/sec with a 0 degree yaw offset. GFO out of point: 361T01:23:05Z - 361T01:36:05Z.
Moon Intrusion	14 Jan 2003 2003014T21:28:33Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	14 Jan 2003 2003014T23:08:55Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	15 Jan 2003 2003015T00:49:14Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	15 Jan 2003 2003015T02:29:40Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	15 Jan 2003 2003015T04:10:40Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	15 Jan 2003 2003015T18:08:45Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	20 Jan 2003 2003020T19:51:12Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	20 Jan 2003 2003020T21:31:21Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	20 Jan 2003 2003020T23:11:54Z	Momentary horizon sensor measurements errors have resulted.
ERO Maneuver	23 Jan 2003 2003023T02:32:00Z	The burn magnitude will be 28.2 mm/sec with a 0 degree yaw offset. GFO out of point: 023T02:25:00Z - 023T02:30:00Z.
ERO Maneuver	18 Feb 2003 2003049T02:28:00Z	The burn magnitude will be 27.6 mm/sec with a 0 degree yaw offset. GFO out of point: 049T02:21:00Z - 049T02:34:00Z.
Moon Intrusion	19 Feb 2003 2003050T14:51:35Z	Momentary horizon sensor measurements errors have resulted.

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Moon Intrusion	19 Feb 2003 2003050T16:32:08Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	19 Feb 2003 2003050T18:12:27Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	19 Feb 2003 2003050T22:37:44Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	20 Feb 2003 2003051T00:17:46Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	20 Feb 2003 2003051T01:58:17Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	20 Feb 2003 2003051T03:38:48Z	Momentary horizon sensor measurements errors have resulted.
Wheel 1 Test	27 Feb 2003 2003058T21:50:00Z	A wheel 1 test was performed today, causing an expected but minimal increase in attitude error. The test occurred during a support between 058/2150z and 058/2200z, and the spacecraft was over land throughout the duration of the test. The spacecraft measured nadir error remained below 0.2 degrees throughout the test. As a result of Wheel 1 test, the GFO DTU was out of Cal Mode between 21:48:37Z and 21:56:19Z.
ERO Violation	04 Mar 2003 2003063T00:13:00Z	(Exceeding ERO Limits) GFO exceeded the western 1 km ERO limit today (3/4) at 00:13Z. It is currently predicted to drift out to 1.2 km west before drifting back into the ERO on 3/13.
ABCAL	06 Mar 2003 2003065T23:30:00Z	Performed ABCAL Maneuver: 065T23:30:00Z - 065T23:46:00Z.
ERO Return	11 Mar 2003 2003070T04:58:00Z	GFO's ground track drifted back within the -1000 meter limit. The maximum excursion of the average ground track was 117 meters. The largest once per day spike in the ground track was 256 meters outside the limit.
Moon Intrusion	21 Mar 2003 2003080T00:51:35Z	Momentary horizon sensor measurements errors have resulted.
ERO Maneuver	21 Mar 2003 2003080T01:50:00Z	The burn magnitude will be 20.4 mm/sec with a 0 degree yaw offset. GFO out of point: 080T01:43:00Z - 080T01:56:00Z. The maneuver will cause a 13 minute data outage in RA full waveform data collection.
Moon Intrusion	21 Mar 2003 2003080T02:32:15Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	21 Mar 2003 2003080T04:12:33Z	Momentary horizon sensor measurements errors have resulted.

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Moon Intrusion	13 Apr 2003 2003103T13:06:05Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	13 Apr 2003 2003103T14:46:42Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	13 Apr 2003 2003103T16:27:26Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	14 Apr 2003 2003104T06:59:48Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	14 Apr 2003 2003104T08:40:20Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	14 Apr 2003 2003104T10:20:56Z	Momentary horizon sensor measurements errors have resulted.
Battery Reconditioning	16 Apr 2003 2003106T13:10:00Z	Mort Rau consulted with the representative for the PEO for C4I and received authorization to proceed with the battery reconditioning evolution. This will involve having the RA payloads in standby and satellite in sun pointing mode from approximately 106T13:10Z Wednesday (April 16) as part of the deep discharge process. RA was placed back into track on Thursday (April 17) at 107T01:25Z with a resultant data gap.
Moon Intrusion	20 Apr 2003 2003110T09:53:22Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	20 Apr 2003 2003110T11:33:48Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	20 Apr 2003 2003110T23:40:56Z	Momentary horizon sensor measurements errors have resulted.
Commanded	21 Apr 2003 2003111T22:10:00Z	In preparation for a second GFO battery discharge, the VT level was raised from 5.5 to 6.0 and the catbed heaters were turned on. DDL will cease operations on Tuesday, April 22, around 112T10:10Z in preparation for the discharge.
Battery Reconditioning	22 Apr 2003 2003112T21:30:00Z	The RA payloads put in standby, the satellite put into Acquire Sun mode and the battery will be slowly discharged down to 25.6 volts from approximately 112T21:30Z. On Wednesday 4/23 around 113T14:30Z, the satellite will be put back to it's original configuration: Point state, RA in Track 1, catbed heaters off, and VT 5.5, with a resultant data gap.

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
2nd Battery Discharged	23 Apr 2003 2003113T21:07:00Z	The support to put GFO back into point and the RA back into Track 1 mode at 14:30Z today failed because the ground station at Laguna Peak was not functioning. The next available support was at 21:07Z at Det C. During this support, GFO was put back into point, the RA was put back to Track 1 mode, and the power configuration was put back to normal including going to VT 5.5 and turning the catbed heaters off. Due to the LP ground station not functioning, CSM was uploaded to resume DDL mode and 10 minute RA calibrations on Thursday 4/23. The 7 hour full waveform RA data collection will be resumed when LP has demonstrated that it is functioning again.
ERO Maneuver	29 Apr 2003 2003119T01:58:00Z	The burn magnitude will be 17.1 mm/sec with a 0 degree yaw offset. GFO out of point: 119T01:51:00Z - 119T02:04:00Z. The maneuver will cause a 13 minute data outage in RA full waveform data collection.
ERO Maneuver	09 May 2003 2003129T01:52:00Z	The burn magnitude will be 5.4 mm/sec with a 180 degree yaw offset. GFO out of point: 129T01:45:00Z - 129T01:58:00Z.
Moon Intrusion	11 Jun 2003 2003162T17:51:10Z	Momentary horizon sensor measurements errors have resulted.
ERO Maneuver	12 Jun 2003 2003163T00:56:00Z	The burn magnitude will be 16.8 mm/sec with a 0 degree yaw offset. GFO out of point: 163T00:49:00Z - 163T01:02:00Z.
Moon Intrusion	12 Jun 2003 2003163T06:40:12Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	12 Jun 2003 2003163T08:20:50Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	12 Jun 2003 2003163T10:01:40Z	Momentary horizon sensor measurements errors have resulted.
ICV Error	17 Jun 2003 2003168T00:00:00Z	(Per email from SATOPS.MUGU.NAVY.MIL): This morning an ICV was uploaded and enabled into GFO past its epoch time. It was enabled into the satellite at about 14:35:00Z on Day 168. A new ICV was subsequently uploaded and enabled with an epoch time of 17:55:00Z on Day 168. As a result, between 14:35:00Z and 17:55:00Z on Day 168 the on board orbit propagator was unable to produce the information necessary for the satellite to correct for differences between geodetic and geocentric (measured) nadir. According to the OOH, this can potentially introduce an additional payload pointing error of up to 0.3 degrees during the effected period. Normal spacecraft pointing for GFO is better than 0.27 degrees off-Nadir (geodetic).

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Moon Intrusion	18 Jun 2003 2003169T02:14:25Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	18 Jun 2003 2003169T03:54:50Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	18 Jun 2003 2003169T08:49:03Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	18 Jun 2003 2003169T10:29:52Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	16 Jul 2003 2003197T02:57:05Z	Momentary horizon sensor measurements errors have resulted.
ERO Maneuver	18 Jul 2003 2003199T02:21:00Z	The burn magnitude will be 16.5 mm/sec with a 0 degree yaw offset. GFO out of point: 199T02:13:00Z - 199T02:27:00Z.
ERO Maneuver	22 Aug 2003 2003234T04:24:00Z	The burn magnitude will be 18.5 mm/sec with a 0 degree yaw offset. GFO out of point: 234T04:17:00Z - 234T04:30:00Z.
Anomaly	06 Sep 2003 2003249T11:27:00Z	GFO experienced an anomalous event approximately 1127z on Day 249 (6 September) which took the altimeter (and wvr) offline. The suspected cause of the CPU reset is an anomaly in the Attitude Control subsystem, apparently momentum wheel glitch. Satellite went into a tumble as a result. The satellite is not in Point nor is the payload turned on.
1st Recovery Step	10 Sep 2003 2003253T11:27:00Z	Satellite de-tumbled, put in safe mode.
2nd Recovery Step	22 Sep 2003 2003265T21:32:00Z	ERO Maneuver. Burn one of two burn maneuver to put the satellite back into ERO after the recovery from tumble
2nd Recovery Step	22 Sep 2003 2003265T22:22:00Z	ERO Maneuver. Burn two of two burn maneuver. The total burn magnitude for 21:32Z & 22:22Z will be -71 mm/sec with a 0 degree yaw offset.
Anomaly	02 Oct 2003 2003275T20:50:00Z	GFO experienced a second anomalous event approximately 2050Z on Day 275 (2 October). Apparently another momentum wheel glitch with wheel #3. Satellite again went into a tumble as a result.
Recovery Step	06 Oct 2003 2003279T22:25:00Z	ERO Maneuver. Burn one of two burn maneuver. The burn magnitude will be 33.9 mm/sec with a 0 degree yaw offset.
Recovery Step	07 Oct 2003 2003280T00:05:00Z	ERO Maneuver. Burn two of two burn maneuver. The burn magnitude will be 33.9 mm/sec with a 0 degree yaw offset.

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Payload Operations Resumed	20 Oct 2003 2003293T22:00:00Z	As of approximately 2200 UTC on day 293 the GFO RA was placed in Track One and has resumed collecting data. Initial review of the raw data reveals no unusual characteristics. The RA patch is in place and the space craft appears to be maintaining a proper nadir point. NAVO ADFC will start producing NGDRs today and anticipate the first to be available early tomorrow morning. Barring any anomalous events we will start collecting full waveform data over Greenland (Cal 3) next Monday (27 October). In order to hold temperatures down we do not plan on activating the DDL (direct downlink) until mid to late November.
ERO Maneuver	7 Nov 2003 2003311T01:50:00Z	The burn magnitude will be 34.9 mm/sec with a 0 degree yaw offset. GFO out of point: 311T01:43:00Z - 311T01:56:00Z.
ABCAL	12 Nov 2003 2003316T20:20:00Z	Performed ABCAL Maneuver: 316T20:10:00Z - 316T20:26:00Z.
Nadir Error Excursion	14 Nov 2003 2003311T03:37:40Z	A nadir error excursion occurred on GFO, peaking at 0.34 degrees and lasting for approximately 10 seconds. These values were derived from the "ADNADER" telemetry point, which represents spacecraft measured nadir error.
Nadir Excursion	18 Nov 2003 2003322T04:54:30Z	Spacecraft nadir pointing exceeds nominal limits. Excursion typically lasts two minutes or less. This behavior appears to be associated with rapid yaw movements just prior to the end of an orbital eclipse.
Nadir Excursion	19 Nov 2003 2003323T04:23:00Z	Spacecraft nadir pointing exceeds nominal limits.
Nadir Excursion	21 Nov 2003 2003325T05:00:40Z	Spacecraft nadir pointing exceeds nominal limits.
Nadir Excursion	22 Nov 2003 2003326T06:12:00Z	Spacecraft nadir pointing exceeds nominal limits.
Nadir Excursion	23 Nov 2003 2003327T05:39:30Z	Spacecraft nadir pointing exceeds nominal limits.
Nadir Excursion	24 Nov 2003 2003328T05:08:00Z	Spacecraft nadir pointing exceeds nominal limits.
Nadir Excursion	25 Nov 2003 2003329T06:19:00Z	Spacecraft nadir pointing exceeds nominal limits.
Nadir Excursion	26 Nov 2003 2003330T05:47:00Z	Spacecraft nadir pointing exceeds nominal limits.
Nadir Excursion	27 Nov 2003 2003331T05:15:30Z	Spacecraft nadir pointing exceeds nominal limits.

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Nadir Excursion	28 Nov 2003 2003332T06:27:00Z	Spacecraft nadir pointing exceeds nominal limits.
Nadir Excursion	29 Nov 2003 2003333T05:54:30Z	Spacecraft nadir pointing exceeds nominal limits.
Nadir Excursion	30 Nov 2003 2003334T05:23:00Z	Spacecraft nadir pointing exceeds nominal limits.
Nadir Excursion	01 Dec 2003 2003335T06:34:00Z	Spacecraft nadir pointing exceeds nominal limits.
Nadir Excursion	02 Dec 2003 2003336T06:02:00Z	Spacecraft nadir pointing exceeds nominal limits.
CPU Reset	02 Dec 2003 2003336T22:18:25Z	GFO experienced a CPU reset on Day 336 (02 December) @ 22:18:25 GMT. The cause of the reset was that an "attitude fault protection" was detected and the CPU reset. Currently the satellite is in sun acquire mode, thus no altimetry payload data is being collected.
ERO Maneuver	5 Dec 2003 2003339T01:02:00Z	The burn magnitude will be 22.8 mm/sec with a 0 degree yaw offset. GFO out of point: 339T00:55:00Z - 339T01:08:00Z.
Payload Operations Resumed	06 Dec 2003 2003340T17:40:00Z	As of approximately 1740 UTC on day 340 the GFO RA was placed in Track One and has resumed collecting data.
CPU Reset	20 Dec 2003 2003354T03:00:00Z	GFO had a spontaneous reset on 12/20 between 02:15Z & 03:09Z. This caused the satellite to go into Acquire Sun mode and turn the payload off.
Payload Operations Resumed	20 Dec 2003 2003354T22:10:00Z	Payload operations have been restored and GFO is back to its nominal Point state configuration (IAP 1). The WVR has been reinitialized, the software patch for the RA was uploaded, and the RA has started collection of data in TRK1 mode.
ERO Maneuver	13 Jan 2004 2004013T22:22:51Z	The burn magnitude will be 2600 mm/sec with a -90 degree yaw offset. GFO out of point: 013T22:15:51Z - 013T22:31:22Z.
Trim Maneuver 1 of 2	15 Jan 2004 2004015T03:07:00Z	The burn magnitude will be 35.0 mm/sec with a 0 degree yaw offset. GFO out of point: 015T03:00:00Z - 015T03:13:00Z.
Trim Maneuver 2 of 2	15 Jan 2004 2004015T04:47:00Z	The burn magnitude will be 35.0 mm/sec with a 0 degree yaw offset. GFO out of point: 015T04:40:00Z - 015T04:53:00Z.
DDL Off	7 Feb 2004 2004038T00:00:00Z	The Direct Down Link turned off for thermal management.
Moon Intrusion	8 Feb 2004 2004039T05:42:35Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	9 Feb 2004 2004040T09:32:06Z	Momentary horizon sensor measurements errors have resulted.

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Payload Secured	22 Feb 2004 2004053T19:57:00Z	The GFO payload package secured in an effort to reduce momentum wheel temperatures in preparation for solstice season. Any shift in doppler data on this date should be due to the thermal effects of turning off the payload.
Payload Powered Off	22 Feb 2004 2004053T22:00:00Z	Payloads powered off as a preventative measure and for additional satellite maintenance.
ERO Maneuver	01 Apr 2004 2004092T23:56:00Z	Maneuver to maintain the ERO during the solstice period.
Payload Powered On	09 Apr 2004 2004100T15:49:13Z	Satellite back in earth point and all payloads on and operating.
ERO Maneuver	15 Apr 2004 2004106T01:32:00Z	The burn magnitude will be 6.0 mm/sec with a 180 degree yaw offset. GFO out of point: 106T01:25:00Z - 106T01:38:00Z.
Moon Intrusion	2 May 2004 2004123T02:21:00Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	2 May 2004 2004123T04:01:50Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	2 May 2004 2004123T10:08:10Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	2 May 2004 2004123T11:48:50Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	2 May 2004 2004123T13:29:20Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	2 May 2004 2004123T15:10:20Z	Momentary horizon sensor measurements errors have resulted.
ABCAL	26 Nov 2004 2004147T07:10:00Z	Performed ABCAL Maneuver: 316T07:10:00Z - 316T07:26:00Z.
Trim Maneuver	27 May 2004 2004148T01:32:00Z	The burn magnitude will be 13.54 mm/sec with a 0 degree yaw offset. GFO out of point: 148T01:25:00Z - 148T01:38:00Z.
DDL Off	19 Jul 2004 2004201T22:05:00Z	The Direct Down Link turned off for thermal management. GFO has resumed the powering-off of the transmitter in order to reduce Wheel 1 temperature and voltage. The satellite is in continual Mode 2 and will not support DDL-mode until further notice. Payload collection will continue unaffected.
Trim Maneuver	22 Jul 2004 2004204T01:05:00Z	The burn magnitude will be 13.54 mm/sec with a 0 degree yaw offset. GFO out of point: 204T00:58:00Z - 204T01:11:00Z.

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
DDL On	22 Jul 2004 2004204T10:17:00Z	DDL mode switching turned on and full waveform data collection resumed.
Moon Intrusion	2 Aug 2004 2004215T13:16:45Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	2 Aug 2004 2004215T14:57:05Z	Momentary horizon sensor measurements errors have resulted.
WVR Turn Off DDL Off	18 Aug 2004 2004231T20:20:00Z	Per SPAWAR's request, the operation of the Water Vapor Radiometer (WVR), the DDL mode switching, and the collection of full waveform data, was suspended to control temperatures of the wheels, due to extremely high wheel voltage.
Trim Maneuver	26 Aug 2004 2004239T01:43:00Z	The burn magnitude will be 13.38 mm/sec with a 0 degree yaw offset. GFO out of point: 239T01:36:00Z - 239T01:49:00Z.
WVR Turn On	9 Sep 2004 2004253T21:45:00Z	Service restored to the Water Vapor Radiometer (WVR).
DDL On	20 Sep 2004 2004264T09:22:00Z	DDL mode switching turned on and full waveform data collection resumed.
DDL Off	21 Sep 2004 2004265T15:57:00Z	The Direct Down Link turned off and full waveform data interrupted for thermal management (high wheel temperatures).
FWF Restored	29 Sep 2004 2004273T15:22:00Z	Full waveform data collection resumed.
DDL On	05 Oct 2004 2004279T23:54:00Z	DDL mode switching turned on.
DDL Off	15 Oct 2004 2004289T16:46:00Z	The Direct Down Link turned off and full waveform data suspended due to ground system problems.
FWF Restored	20 Oct 2004 2004294T00:00:00Z	Full waveform data collection resumed.
FWF Suspended	23 Oct 2004 2004297T15:35:00Z	Full waveform data collection suspended.
Moon Intrusion	24 Oct 2004 2004298T18:49:45Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	24 Oct 2004 2004298T20:30:20Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	24 Oct 2004 2004298T22:10:50Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	25 Oct 2004 2004299T17:14:30Z	Momentary horizon sensor measurements errors have resulted.

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Moon Intrusion	25 Oct 2004 2004299T18:55:15Z	Momentary horizon sensor measurements errors have resulted.
DDL On	27 Oct 2004 2004301T01:56:00Z	DDL mode switching turned on.
FWF Restored	27 Oct 2004 2004301T16:51:00Z	Full waveform data collection resumed.
Trim Maneuver	28 Oct 2004 2004302T01:00:00Z	The burn magnitude will be 12.07 mm/sec with a 0 degree yaw offset. GFO out of point: 302T00:53:00Z - 302T01:06:00Z.
FWF Suspended	05 Nov 2004 2004310T00:00:00Z	Due to extended power outages at NAVSOC, commanding capability will be lost at NAVSOC HQ. Full waveform collection is being suspended.
FWF Restored	08 Nov 2004 2004313T00:00:00Z	Resumed collection of seven-hour full waveform data.
Trim Maneuver	24 Nov 2004 2004329T02:03:00Z	The burn magnitude will be 17.21 mm/sec with a 0 degree yaw offset. GFO out of point: 329T01:58:25Z - 329T02:09:00Z.
Reduced Support	22 Dec 2004 2004357T00:00:00Z	Due to ground systems issues at LP and Det C, DDL mode turned off and full waveform collection is being suspended.
Support Resumed	31 Dec 2004 2004366T00:00:00Z	Resumed DDL mode-switching operations and collection of seven-hour full waveform data.
Trim Maneuver	07 Jan 2005 2005007T06:11:00Z	The burn magnitude was 12.32 mm/sec with a 0 degree yaw offset. GFO out of point: 007T06:04:25Z - 007T06:17:00Z.
CPU Reset	18 Jan 2005 2005018T14:50:00Z	GFO experienced a CPU reset on Day 18 (18 January) @ 14:50:00 GMT. Assessment at this time is that there was probably a failure of the raw drive temperature sensor on wheel 1 and that approximately 20 minutes after that the wheel commenced to take off (overspeed) and the system was shutdown by a preprogrammed wheel over speed sensor set at 3,000 rpm. The satellite was placed in sun acquire mode, thus no altimetry payload data is being collected.
Payload Operations Resumed	19 Jan 2005 2005019T19:55:00Z	The GFO RA was placed in Track One and has resumed collecting data with the exception of full waveform data. operations are in 3 wheel nadir pointing mode.
Support Resumed	21 Jan 2005 2005021T22:30:00Z	Resumed DDL mode-switching operations and collection of seven-hour full waveform data.
Moon Intrusion	22 Jan 2005 2005029T11:16:12Z	Momentary horizon sensor measurements errors have resulted.

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Yaw Maneuver	08 Feb 2005 2005039T20:08:00Z	Yaw was increased from 10 degrees to 20 degrees.
RA Reset	18 Feb 2005 2005049T01:30:00Z	The RA was powered off and on over land in an attempt to eliminate some minor telemetry errors observed since the prior reset (18 Jan).
Trim Maneuver	18 Feb 2005 2005049T08:16:00Z	The burn magnitude was 5.27 mm/sec with a 0 degree yaw offset. GFO out of point: 049T08:09:00Z - 049T08:22:00Z.
Wheel Speed Test	01 Mar 2005 2005060T22:00:00Z	Wheel 1 underwent two successful commanded speed tests. Table 32 in RAM was first modified to command Wheel 1 to remain at +100 rpm for approximately 60 seconds, then modified again to command Wheel 1 to maintain -100 rpm for 60 seconds. Finally, the satellite's standard Table 32 was uploaded, returning GFO to its pre-pass software and hardware configuration.
Yaw Maneuver	03 Mar 2005 2005062T22:40:00Z	Yaw was decreased from 20 degrees to 10 degrees.
Reduced Support	14 Mar 2005 2005073T00:00:00Z	The second RA-CAL, that occurs over Africa, discontinued.
Wheel Speed Test	17 Mar 2005 2005076T22:10:00Z	Wheel 1 underwent a successful commanded speed test. The spacecraft did not exceed nominal nadir pointing error limits.
Data Outage	24 Mar 2005 2005083T16:58:00Z	Satellite in a diagnostic mode with the ground stations obtaining a Fault Frame Dump. Due to a ground system computer outage, the satellite remained in that mode until 083T23:32:00.
Yaw Maneuver	06 Apr 2005 2005096T00:00:00Z	Yaw decreased from 10 degree down to 5 degree.
Yaw Maneuver	07 Apr 2005 2005097T18:00:00Z	Yaw decreased from 5 degree down to 0 degree.
Reduced Support	26 Apr 2005 2005116T00:00:00Z	Due to Det A & Det C being down on Day 116, full waveform collection is being suspended.
Support Resumed	27 Apr 2005 2005117T00:00:00Z	Resumed collection of seven-hour full waveform data.
Trim Maneuver	27 Apr 2005 2005117T01:30:00Z	The burn magnitude was 10.90 mm/sec with a 0 degree yaw offset. GFO out of point: 117T01:24:59Z - 117T01:36:00Z.
Yaw Maneuver	27 Apr 2005 2005117T17:50:00Z	Point-state yaw modification from 0 degrees to -5 degrees.
ABCAL	04 May 2005 2005124T06:30:00Z	Performed ABCAL maneuver: 124T06:30:00Z - 124T06:46:00Z.

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Reduced Support	07 May 2005 - 2005127T00:00:00	Due to ground station limitations, full waveform collection is being suspended.
Support Resumed	08 May 2005 - 2005128T00:00:00	Resumed collection of seven-hour full waveform data.
Wheel Speed Test	25 May 2005 2005145T19:55:00Z	Wheel 1 underwent a successful commanded speed test. The wheel commanded to maintain approximately +100 rpm from approximately 19:55z to 20:03z. The spacecraft did not exceed nominal nadir pointing error limits.
Wheel Speed Test	26 May 2005 2005146T17:36:00Z	Wheel 1 underwent a successful commanded speed test. The wheel commanded to maintain approximately +100 rpm from approximately 17:36z to 17:51z. The spacecraft did not exceed nominal nadir pointing error limits.
Trim Maneuver	09 Jun 2005 2005160T02:44:00Z	The burn magnitude was 10.53 mm/sec with a 0 degree yaw offset. GFO out of point: 160T02:39:15Z - 160T02:44:15Z.
Yaw Maneuver	29 Jun 2005 2005180T23:30:00Z	Point-state yaw modification from -5 degrees to 0 degrees.
Yaw Maneuver	01 Jul 2005 200512T08:35:12Z	GFO experienced a large end-of-eclipse yaw excursion on Day 182 (01 Jul 05). This excursion seemed to couple to x-y errors such that the satellite also exceeded 0.27 degrees of nadir error for about 5 seconds.
Trim Maneuver	13 Jul 2005 2005194T00:21:00Z	The burn magnitude was 1.70 mm/sec with a 180 degree yaw offset. GFO out of point: 194T00:15:37Z - 194T00:27:00Z.
Yaw Maneuver	14 Jul 2005 2005195T19:40:00Z	Point-state yaw modification from 0 degrees to 5 degrees.
Trim Maneuver	16 Jul 2005 2005197T00:30:00Z	The burn magnitude was 10.00 mm/sec with a 180 degree yaw offset. GFO out of point: 197T00:24:03Z - 197T00:36:00Z.
Trim Maneuver	26 Jul 2005 2005207T02:04:00Z	The burn magnitude was 13.67 mm/sec with a 0 degree yaw offset. GFO out of point: 207T01:59:15Z - 207T02:04:15Z.
Yaw Maneuver	08 Aug 2005 2005220T22:40:00Z	Point-state yaw modification from +5 degrees to 0 degrees.
Trim Maneuver	09 Aug 2005 2005221T01:37:00Z	The burn magnitude was 3.00 mm/sec with a 0 degree yaw offset. GFO out of point: 221T01:31:45Z - 221T01:37:15Z.
Yaw Maneuver	30 Aug 2005 2005242T16:55:00Z	Point-state yaw modification from 0 degrees to -5 degrees, and the VT level changed from 7.0 to 7.5. GFO was taken out of RA CALCAL mode for approximately 5 minutes during this modification support.
Shut Down	10 Sep 2005 2005253T12:21:56Z	Spacecraft autonomously shut down its payload.

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Payloads Restored	10 Sep 2005 2005253T19:50:00Z	Payload operations restored.
Moon Intrusion	15 Sep 2005 2005258T02:15:00Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	15 Sep 2005 2005258T03:56:00Z	Momentary horizon sensor measurements errors have resulted.
Trim Maneuver	16 Sep 2005 2005259T02:07:00Z	The burn magnitude was 4.78 mm/sec with a 180 degree yaw offset. GFO out of point: 259T02:01:45Z - 259T02:07:15Z.
Shut Down	03 Oct 2005 2005276T05:32:00Z	Spacecraft autonomously shut down its payload.
Payloads Restored	03 Oct 2005 2005276T15:54:59Z	Payload operations restored.
DDL Off	07 Oct 2005 2005280T17:20:00Z	Due to the state of GFO's battery and the anomalies of 10 Sep 05 and 03 Oct 05 which we wish to prevent from happening again, NAVSOC is turning off GFO's transmitter, and will remain off for about 5 weeks. Because of the above action, Direct Downlink (DDL) mode will be unavailable and will remain unavailable for the next 5 weeks. Radar altimeter, water vapor radiometer, and full waveform mode will remain on. For about a month the number of full CALCAL periods will be occasionally reduced to support battery maintenance.
Trim Maneuver	2 Nov 2005 2005306T01:16:00Z	The burn magnitude was15.610 mm/s with a 0 degree yaw. GFO out of point: 01:10:45z - 01:16:15z.
Moon Intrusion	19 Nov 2005 2005323T20:01:00Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	19 Nov 2005 2005323T21:41:00Z	Momentary horizon sensor measurements errors have resulted.
Moon Intrusion	19 Nov 2005 2005323T23:22:00Z	Momentary horizon sensor measurements errors have resulted.
Yaw Maneuver	6 Dec 2005 2005340T18:55:00Z	Point-state yaw modification from +5 degrees to 0 degrees.
Shut Down	9 Dec 2005 2005343T19:00:00Z	Between 1900z and 2252z, GFO shed its payload in between passes. Without TLM during the time of the payload shut-down, cause is unknown.
Payloads Restored	10 Dec 2005 2005344T01:00:00Z	The payload is back on, the WVR will be thermally stabilized about 1900z. Final payload calibration completed as of 18:33:00z.
Yaw Maneuver	13 Dec 2005 2005347T18:32:00Z	Point-state yaw modification from +5 degrees to 0 degrees.

Table B-1 GFO Key Events Log (Prior to December 26, 2005) (Continued)

Event	Date & Time of Event	Comments
Trim Maneuver	15 Dec 2005 2005349T00:54:00Z	The burn magnitude was 13.806 mm/s with a 0 degree yaw. GFO out of point: 00:48:45z - 00:54:15z.
Yaw Maneuver	16 Dec 2005 2005350T22:40:00Z	Due to a continuing decrease in battery voltage trending, a change made to put GFO's yaw back to 0 degrees
Yaw Maneuver	19 Dec 2005 2005353T22:47:00Z	Yaw changed to positive 2.5 degrees to manage the space-craft's thermal environment.

Appendix C
GFO Ground Processing Incident Log (Prior to December 13, 2005)

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005)

Data Type	Data Date	Comments
	29 November 2000 - 2000334	Acceptance
RA	02 December 2000 - 2000337	Segment data for ra 00337_14_28_34 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 14:28 to 20:46.
RA	04 December 2000 - 2000339	Segment data for ra 00339_09_40_47 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 09:40 to 15:09.
RA	06 December 2000 - 2000341	Segment data for ra 00341_09_59_50 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 09:59 to 14:07.
RA	15 December 2000 - 2000341	Segment data for ra 00350_02_11_25 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 02:11 to 11:57.
RA	Unknown	Segment data for ra 03246_13_20_01 with time of 11:47 to 16:33 received. No data was received for ra data segment 01009_11_47_42 which this appears to coincide with. Received this data segment on 2001010.
SDR	09 January 2001 - 2001009	Data segment for sdr01009_11_47_42_16871 appears to be bad. The Receiver Temperature is at a constant value of 34.633205. Segment time is 11:47 to 16:33.
SDR	10 January 2001 - 2001010	Data segment for sdr01010_17_38_13_23271 appears to be bad. The Receiver Temperature is at a constant value of 41.799999. Segment time is 17:38 to 23:59.
SDR	16 January 2001 - 2001016	Data segment for sdr01016_00_38_03_11687 appears to be bad. The Receiver Temperature is at a constant value of 41.799999. Segment time is 00:38 to 03:59.Data segment for sdr01016_14_35_10_12139 appears to be bad. The Receiver Temperature is at a constant value of 41.799999. Segment time is 14:35 to 17:53.
RA	21 January 2001 - 2001021	Segment data for ra 01021_14_26_17 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 14:26 to 17:00.
NGDR	21 January 2001 - 2001021	ngdr_gfoo_2001021_00001_86175. SSH anomaly due to Doppler problem.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
RA	22 January 2001 - 2001022	Segment data for ra 01022_04_12_37 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 04:12 to 11:43.
SDR	22 January 2001 - 2001022	Data segment for sdr01022_04_12_37_27597 appears to be bad. The Receiver Temperature is at a constant value of 30.540167. Segment time is 04:12 to 11:43.
NGDR	22 January 2001 - 2001022	ngdr_gfoo_2001022_00289_86399. SSH anomaly due to Doppler problem.
NGDR	23 January 2001 - 2001023	ngdr_gfoo_2001023_00000_86400. SSH anomaly due to Doppler problem.
NGDR	24 January 2001 - 2001024	ngdr_gfoo_2001024_00001_86399. SSH anomaly due to Doppler problem.
NGDR	25 January 2001 - 2001025	ngdr_gfoo_2001025_00000_86399. SSH anomaly due to Doppler problem.
RA	Unknown	Segment data for ra 00122_20_39_02 with time of 15:53 to 16:30 received. Received this data segment on 2001024.
NGDR	29 January 2001 - 2001029	ngdr_gfoo_2001029_00304_86400. SSH anomaly.
NGDR	30 January 2001 - 2001030	ngdr_gfoo_2001030_00001_86319. SSH anomaly.
NGDR	30 January 2001 - 2001030	"Implementation of CR ADFC-2001-005: Modify Land/Quality Flag Filtering on GFO NGDRs". The Change Request to modify the land and quality flag filtering on GFO NGDRs was implemented on the operational processing systems at NAVOCEANO. Starting with the NGDRs for Day 030, we will no longer filter the data for land and quality flags as we have in the past. It will be up to the user to filter NGDR data for land and quality flags from this date forward. During testing of the software change on the backup system at NAVOCEANO, there was a 1 to 1 correlation between the number of SDR records collected and the number of NGDR records produced on any given day.
SDR	Unknown	Segment data for sdr01032_02_32_49_298 received. Received this data segment on 2001031.
RA	31 January 2001 - 2001031	Segment data for ra 01031_00_09_49 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 00:09 to 04:34.
SDR	31 January 2001 - 2001031	Data segment for sdr01031_00_09_50_15584 appears to be bad. The Receiver Temperature is at a constant value of 38.043720. Segment time is 00:09 to 04:34.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
RA	04 February 2001 - 2001035	Segment data for ra 01035_05_48_09 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 05:48 to 18:03.
SDR	05 February 2001 - 2001036	Data segment for sdr01036_02_02_24_11393 appears to be bad. The Receiver Temperature is at a constant value of 41.799999. Segment time is 02:02 to 05:18.
RA	06 February 2001 - 2001037	Segment data for ra 01037_18_43_54 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 18:43 to 19:55.
RA	07 February 2001 - 2001038	Segment data for ra 01038_18_15_42 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 18:15 to 22:01.
RA	08 February 2001 - 2001039	Segment data for ra 01039_19_21_21 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 19:21 to 21:05.
RA	21 February 2001 - 2001052	Segment data for ra 01052_07_03_33 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 07:03 to 17:30.
SDR	21 February 2001 - 2001052	Data segment for sdr01052_07_03_33_38237 appears to be bad. The Receiver Temperature is at a constant value of 33.525787. Segment time is 07:03 to 17:30.
RA	02 March 2001 - 2001061	Segment data for ra 01061_02_27_45 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 02:27 to 07:24.
RA	07 March 2001 - 2001066	Segment data for ra 01066_06_29_42 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 06:29 to 16:55.
RA	07 March 2001 - 2001066	Segment data for ra 01066 NORMS includes FINEL,CAL1,&CAL2.
SDR	08 March 2001 - 2001067	New SDR Software. Modified to improve record timing.
RA	08 March 2001 - 2001067	Segment data for ra 01067 NORMS includes FINEL,CAL1,&CAL2.
RA	09 March 2001 - 2001068	Segment data for ra 01068 NORMS includes FINEL,CAL1,&CAL2.
RA	10 March 2001 - 2001069	Segment data for ra 01069 NORMS includes FINEL,CAL1,&CAL2.
RA	11 March 2001 - 2001070	Segment data for ra 01070 NORMS includes FINEL,CAL1,&CAL2.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
RA	12 March 2001 - 2001071	Segment data for ra 01071 NORMS includes FINEL,CAL1,&CAL2.
RA	13 March 2001 - 2001072	Segment data for ra 01072 NORMS includes FINEL,CAL1,&CAL2.
SDR	13 March 2001 - 2001072	New SDR Software modified at 1700Z. Revision to correct Cal/Val file errors and lack of full waveform data caused by incorrect SDR software.
SDR	Unknown	Segment data for sdr01080_18_08_19_1413 received. Received this data segment on 2001079.
RA	04 April 2001 - 2001094	Segment data for ra 01094_22_55_14 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 22:55 to 095T07:45.
SDR	Unknown	Segment data for sdr01099_08_35_45_4333 received. Received this data segment on 2001098.
RA	03 May 2001 - 2001123	Segment data for ra 01123_10_34_23 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 10:34 to 16:04.
RA	04 May 2001 - 2001124	Segment data for ra 01124_23_13_24 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 23:14 to 125T07:43.
RA	22 May 2001 - 2001142	Segment data for ra 01142_02_38_13 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 02:38 to 08:55.
SDR	Unknown	Segment data for sdr01145_11_29_27_35696 received. Received this data segment on 2001145. Data is actually for day 144 time 11:29 to 21:22. The Receiver Temperature is at a constant value of 37.16.
RA	07 June 2001 - 2001158	Segment data for ra 01158_04_21_18 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 04:21 to 10:38.
SDR	Unknown	Segment data for sdr01161_13_13_27_4401 received. Received this data segment on 2001160. Data is actually for day 160 time 13:13 to 14:35. The Receiver Temperature is at a constant value of 38.0566.
RA	15 June 2001 - 2001166	Segment data for ra 01166_03_34_05 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 03:34 to 11:31.
RA	20 June 2001 - 2001171	The start of full waveform data. Erroneous CAL/VAL data generated.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
RA	25 June 2001 - 2001176	Segment data for ra 01176_05_04_43 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 05:44 to 08:11.Segment data for ra 01176_14_37_56 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 176t14:37 to 177t01:13.
RA	02 July 2001 - 2001183	Segment data for ra 01183_01_50_19 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 01:50 to 02:45.
RA	05 July 2001 - 2001186	Segment data for ra 01186_04_56_05 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 04:56 to 09:52.
RA	12 July 2001 - 2001193	Segment data for ra 01193_04_59_32 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 04:59 to 09:24.
RA	23 July 2001 - 2001204	Segment data for ra 01204_04_43_23 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 08:13 to 12:17.
RA	28 July 2001 - 2001209	Segment data for ra 01209_17_33_24 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 209t17:33 to 210t09:14.
RA	30 July 2001 - 2001211	New software patch installed. Modified to capture all full waveform data.
RA	Unknown	Segment data for 00122_20_39_03 received. Received this data segment on 2001209.
RA	03 August 2001 - 2001215	Segment data for ra 01215_15_31_02 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 215t15:31 to 216t04:23.
RA	07 August 2001 - 2001219	Segment data for ra 01219_17_24_50 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 219t17:24 to 220t02:53.
RA	08 August 2001 - 2001220	Segment data for ra 01220_18_32_47 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 220t18:32 to 221t05:09.
RA	09 August 2001 - 2001221	Segment data for ra 01221_18_01_38 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 221t18:01 to 222t04:18.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
SDR	27 August 2001 - 2001239	The ADFC has implemented the software patch, provided by Ball, to correct the generation of anomalous SDR files due to the presence of duplicate VTCW in the RA frames. The first sdr produced with the new s/w mod is sdr01239_15_29_41_17989.dat.
RA	Unknown	Segment data for 08080_07_49_27 received. Received this data segment on 2001246.
RA	05 September 2001 - 2001248	Segment data for ra 01248_20_45_07 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 248t20:45 to 249t06:42.
RA	13 September 2001 - 2001256	Segment data for ra 01256_21_37_32 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 256t21:37 to 257t07:50.
RA	17 September 2001 - 2001260	Segment data for ra 01260_21_12_39 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 260t21:12 to 261t07:26.
RA	04 October 2001 - 2001277	Segment data for ra 01277_22_31_01 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 277t22:31 to 278t08:39.
RA	05 October 2001 - 2001278	Segment data for ra 01278_12_21_47 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 278t12:21 to 278t18:39.
RA	14 October 2001 - 2001287	Segment data for ra 01287_23_56_24 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 287t23:56 to 288t10:09.
RA	16 October 2001 - 2001289	Segment data for ra 01289_13_20_55 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 289t13:20 to 288t18:01.
RA	21 October 2001 - 2001294	Segment data for ra 01294_12_27_22 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 294t12:27 to 294t20:25.
RA	25 October 2001 - 2001298	Segment data for ra 01298_19_59_38 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 298t19:59 to 298t23:15.
RA	09 November 2001 - 2001313	Segment data for ra 01313_14_23_10 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 313t14:23 to 313t17:30.
RA	25 November 2001 - 2001329	Segment data for ra 01329_16_00_39 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 329t16:00 to 329t19:07.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
RA	30 November 2001 - 2001334	Segment data for ra 01334_09_43_19 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 334t09:34 to 334t13:02.
RA	Unknown	Segment data for 00135_08_01_19 received. Received this data segment on 2001345.
RA	12 December 2001 - 2001346	Segment data for ra 01346_17_12_33 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 346t18:10 to 346t23:31.
SDR	19 December 2001 - 2001353	Data segment for sdr01353_23_16_37_2656 appears to be bad. The Receiver Temperature is at a constant value of 35.248192. Segment time is 23:16 to 23:59.
RA	01 January 2002 - 2002001	Segment data for ra 02001_12_43_44 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 001t12:40 to 001t17:46.
RA	04 January 2002 - 2002004	Segment data for ra 02004_18_39_55 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 004t19:36 to 004t21:46. Time gaps 0.0000000199 apart.
RA	09 January 2002 - 2002009	The last three hours (19:20z to ~22:30z) of the full waveform data for 1/9/02 was not performed due to a ground station problem during a GFO support that left the DTU in "Normal" rather than "Cal" format.
RA	12 January 2002 - 2002012	Segment data for ra 02012_13_37_49 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 012t15:39 to 012t18:38.
RA	16 January 2002 - 2002016	Segment data for ra 02016_19_07_26 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 016t19:07 to 016t23:55. Time gaps 0.0000000199 apart.
RA	09 February 2002 - 2002040	A personnel error occurred during the DC20898 DSU dump support, resulting in the initial loss of 00:38:40 of DSU data (data gap: 23:17:17 - 23:55:57 on Day 040). In an effort to recover the lost data, this section was re-dumped during rev DC20904. Therefore, a majority of the lost DSU data should now be recoverable. Note that a portion of the DC20904 dump file will be out of sequence with the preceding dump file (DC20898), so some programmer able data files at both NAVSOC and the POC.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
SCC Clock Pairs	10 February 2002 - 2002041	Edward Grucza (NAVSOC Programmer) identified and corrected the problem that was preventing HQ ISCS from generating SCC.DAT files throughout the weekend. As a result, a new SCC was generated at 10-Feb-2002 20:46:52. The previous SCC was computed on day 040 (9-Feb.-2002) at around 0800Z. This time correlates with the last LP support run prior to the LP antenna being stowed due to high winds. For the remainder of the weekend, only the DetA TTCS was available to generate SCC clock pairs. However, the process_rng_files process at the DetA TTCS crashed, apparently as a result of excessive .rng files in the DOC_recv directory. This resulted in a core dump in the TTCS. Once the older .rng files were moved to the raw_archive directory, leaving only the latest .rng file, the process_rng_files process ran successfully. This produced the .dat file used by HQ ISCS to generate the latest SCC.dat.
RA	16 February 2002 - 2002047	Due to an ACU crash in the middle of rev DC 20998, a segment of DSU data was initially lost. Greg Mayer (GD) ran a data recovery support on the following pass (DC 20999) in which he was able to recover a majority of the lost data, with the exception of the following segment: 16-FEB-02 23:59:44 to 17-FEB-02 00:02:57. Due to an operator error, the DSU dump on rev DC 21019 was not performed. The POC Listener was down at HQ this entire weekend starting at about 2/16/02 00:00:00z. As a result, HQ was unable to ingest DSU data from the remote sites, process SCCs from clock pairs, or receive SCC alarms. All data to be ingested and all SCC processing to be brought up to date. GFO will be drifting 140m outside of the western 1 km boundary of the ERO over the next few days. It will exit the boundary at approximately 2/19/02 03:00:00z and re-enter the boundary at approximately 2/23/02 10:00:00z. The DOC has been dropping all HQ Doppler passes throughout the weekend due to RMS exceeding limits. Investigation into the cause of this problem will continue on Tuesday.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
TTCS	25 February 2002 - 2002056	This morning, around 15:00z we received an alarm stating that 15 hours had passed since a gfo clock pair was collected. Apparently, a noisy file was created and sent to the DOC at 00:00z today for Day 056. At 00:40z today, a noisy .RAW file came to the DOC and the makeranges script attached a range that was more than 10000m. This was greater than the format of the .RNG file so asterisks were placed in the field instead of a valid range. When the TTCS ran the process_range_files script on the file, the script crashed and no more files were processed until it was restarted this morning. A total of seven noisy files were created and sent to the DOC. The entire SCC generation process is now running again and a valid SCC was generated this morning. We will monitor this closely to ensure that SCC generation.
RA	25 February 2002 - 2002056	Missing eng_data02056_20_02_12. We have investigated the lack of delivery of the file and have found a problem with the contents of that file, as well as the next eng_data file, eng_data02057_01_43_37. Neither of those files passed our UNCLASS to CLASS security check and were not released. We have plotted the files and found significant noise at the tail end of eng_data02056_20_02_12 and the beginning of eng_data02057_01_43_37 and believe this condition is the culprit. We have forwarded the POC datafiles to Ball for their inspection. Also, NAVSOC delivered the following email regarding poor data quality and those suspect data times correlate to the rejected eng_data files. At approximately 2000Z, the DTU on GFO was commanded to NORM and the RA commanded to TRK1 in preparation for some table uploads. Some problems occurred during the last GFO pass which prevented us from sending the commands to switch the DTU to CAL and the RA to TRK3 at the conclusion of the pass. The impact: From 2000Z to 0025Z, the RA will be in normal data collection mode (TRK 1 and DTU NORM) instead of full waveform (TRK 3 and DTU CAL). From 0025Z to 0235Z, commands stored in CSM will switch the RA to TRK3, but since the DTU will remain in NORM, data will be degraded for this period of time. Unfortunately, there are no passes available prior to 0235Z to remedy this. Table 42 was planned to be uploaded on this same pass, but was not able to be sent.
Table Change	26 February 2002 - 2002057	Inserted an attitude bias change to lower off-nadir. Starting segment 2002057T19:33:00

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
RA	06 March 2002 - 2002065	Due to the sequence of passes in the current NRHSCC file, the system is currently not correctly identifying TMON path delay pass types. The SCC's generated and distributed during JD 65 all have this flaw and will generate significant timing errors if used (potentially on the order of 40+ microseconds). We should be able to get the system back on line after the post maneuver orbit is generated and we have more DSU path delay type data (before noon local west coast time 3/7).
RA	10 March 2002 - 2002069	POC sender is operating intermittently. As a result, not all GFO payload data is being sent out.NAVSOC did not send the Payload Operational Center the following Orbits the were on are schedule for day 069 Orbit rev 21309, and for day 070 orbit rev 21321. NAVSOC report that they are having processing problems and are looking into the problem. It appears were are missing data for the following approximate times: day 069 16:11 - 20:00 and for day 070 05:42 - 15:52.
RA	13 March 2002 - 2002072	Segment data for ra 02072_20_07_17 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 072t20:07 to 072t23:00.
RA	13 April 2002 - 2002103	Segment data for ra 02103_04_00_26 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 103t05:28 to 103t08:36.
RA	13 April 2002 - 2002103	Segment data for ra 02103_22_25_29 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 104t02:46 to 104t07:06.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
RA	25 April 2002 - 2002115	The ADFC has not received the latest GFO DSU dumps because of commanding problems at Det A, Prospect Harbor, ME. For the two scheduled DSU dumps; orbits 21975 & 21976, Det A was unable to command the satellite to download data. Due to the duration (~19.5 hrs) from the last successful DSU dump, ~23:00 04/25/02, orbit 21955, to next available dump time, ~18:24, Det C orbit 21981, NAVSOC projects a loss of approximately 4.5 hours of RA data. During this time span, the satellite was in a ra_cal cycle utilizing more storage resources than in normal ra collection. NAVSOC will attempt another Det C download, also orbit 21981 @ ~ 20:00. If this second DSU dump is successfully delivered to the POC and problems at Det A are resolved, then normal operations will resume with the next Det A download @ ~23:57. In addition, it should be noted that in order to maximize our recovery efforts on the 1824z pass (Rev 21981) today, we will be leaving the satellite in Mode 2 until the next planned DSU dump at 2000z (since we currently do not have any DDL users). We are anticipating the RA data loss from approximately 25 April 2300z to 26 April 0330z and will notify the appropriate parties of the actual times when they are available to us.
RA	27 April 2002 - 2002117	Segment data for ra 02117_05_15_31 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 117t05:15 to 117t06:34.
RA	28 April 2002 - 2002118	Due to commanding problems at DetA, the following DSU supports will be cancelled: Day 119, Rev. 22018, Rev. 22019.
RA	16 May 2002 - 2002136	Segment data for ra 02136_07_51_06 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 136t08:25 to 136t20:13.
RA	27 May 2002 - 2002147	Segment data for ra 02147_01_13_06 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 147t01:13 to 147t07:27.
RA	29 May 2002 - 2002149	Segment data for ra 02149_01_50_45 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 149t01:50 to 149t05:32.
RA	03 June 2002 - 2002154	Segment data for ra 02154_02_42_12 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 154t02:42 to 154t09:06.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
Data FTP	05 June 2002 - 2002156	We have been experiencing trouble transferring flux data into and doppler data out from NAVSOC. The Pt. Mugu base firewall administrators have been notified of the problem and are working this issue. In the mean-time, our orbit prediction capability is slightly degraded since we do not have the most up-to-date flux informa-tion. Our last orbit prediction with up-to-date flux data indicated that our next maneuver should occur around 13-14 June. We continue to work with our network administrators to resolve this issue and inform you of any changes.
RA	06 June 2002 - 2002157	Segment data for ra 02157_07_45_38 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 157t07:45 to 157t07:43.
RA	08 June 2002 - 2002159	Segment data for ra 02159_22_57_28 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 159t22:57 to 160t02:30.
RA	09 June 2002 - 2002160	Segment data for ra 02160_02_48_42 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 160t02:48 to 160t07:50.
RA	11 June 2002 - 2002162	Segment data for ra 02162_03_26_46 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 162t03:26 to 162t09:25.
SDR	11 June 2002 - 2002162	The ADFC has implemented the new VATT software modification. The first sdr produced with the new s/w chg is sdr02162_03_26_47_21350.dat.
Data FTP	12 June 2002 - 2002163	As of 10:00 today, 12 June 2002, the communication disruption between NAVO and your facilities has been corrected. NAVO has successfully delivered altimetry products to your respective servers and have attempted to catch-up the missed data. Please take a moment to verify you are receiving data and/or are able to deliver data successfully. After verification of receipt capabil-ity, please try to determine what data was not delivered and notify NAVO. NAVO will try to get everyone caught up.The latest word received about the cause indicated a problem somewhere between NAVO and the facilities in the Maryland/D.C. area. Apparently, there was a router/switch that was causing all the problems.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
RA	14 June 2002 - 2002165	Due to ground system difficulties and subsequent efforts to recover impacted data, DSU data files representing times between 165/23:11:55z and 166/12:44:34z will include some redundant, some out-of-sequence, and some lost segments. It is currently estimated that the total amount of unrecoverable data is around 4 hours and 15 minutes. Any estimates communicated prior to the receipt of this message should be disregarded. On Monday, NAVSOC programmers and General Dynamics engineers will evaluate and manipulate the DSU data files from the affected period in an effort to ensure the minimum loss of DSU data. The POC should expect not to receive DSU data files from revs 22687 and 22699, which were previously scheduled as DSU dumps. The POC will however receive a file from rev 22701, which was not previously scheduled as a DSU dump.
RA	19 June 2002 - 2002170	Segment data for ra 02170_08_34_14 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 170t08:34 to 170t10:50.
RA	20 June 2002 - 2002171	Segment data for ra 02171_23_26_37 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 171t23:26 to 172t04:57.
Antenna Failure	21 June 2002 - 2002172	Due to a hardware failure of the antenna at Det A on 06/21/2002, operations and data collection for GFO will be modified for this weekend and possibly for at least a week. All passes at Det A after and including Rev#22787 have been nulled. All feasible passes at Det C after and including Rev#22792 will be DSU Dumps. Revised schedules will be sent via e-mail. Because of the pass interval at Det C and GFO's DSU capacity restrictions, we will not be able to perform full waveform collection until further notice. We will, however, plan RA CAL 1 sequences twice a day until further notice. From approximately 1114Z on Day 173 to 0008Z on Day 174, GFO remained in Mode 2 to facilitate commanding, but thereafter will continue to perform normal DDL mode switching. Another consequence of the Det A antenna problem is that SCCs cannot be produced from the site. We are currently investigating the feasibility of generating operational SCCs from Det C during the interim and will notify you of the results.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
Antenna Failure	22 June 2002 - 2002173	(Notification at 6:14PM) The contents of the CSM have been cleared and filled with commands to perform DSU Dumps at Det C, DDL mode-switching, and RA1 Calibrations through Monday 06/24/2002. The Det A antenna was tested on UFO 6 and is possibly operational again. We will attempt to run telemetry monitor supports at Det A for the remainder of the weekend. The Det C TTCS has been brought up to operational status as of Rev#22799 in response to Detachment Alfa's antenna failure but is not producing completely reliable data. We will continue to investigate this and ensure operational SCCs are distributed. (Notification at 7:51PM) DET A has been successfully restored. DET A is tracking and generating timing data normally now. We will monitor its performance over the weekend. If it remains stable over Sunday, then we will resume normal operations late zulu Monday.
RA	22 June 2002 - 2002173	Segment data for ra 02173_11_19_09 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 173t11:19 to 173t21:43.
RA	23 June 2002 - 2002174	Segment data for ra 02174_19_35_14 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 174t19:35 to 175t02:05.
RA	25 June 2002 - 2002176	Segment data for ra 02176_14_34_43 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 176t14:34 to 176t23:51.
RA	26 June 2002 - 2002177	Segment data for ra 02177_08_56_59 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 177t10:33 to 177t21:45.
RA	28 June 2002 - 2002179	Segment data for ra 02179_03_00_04 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 179t03:00 to 179t04:21.
RA	29 June 2002 - 2002180	Segment data for ra 02180_01_45_25 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 180t01:45 to 180t04:25.
RA	29 June 2002 - 2002180	Segment data for ra 02180_04_25_57 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 180t04:45 to 180t08:17.
RA	29 June 2002 - 2002180	Segment data for ra 02180_08_17_28 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 180t08:17 to 180t09:23.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
RA	30 June 2002 - 2002181	Segment data for ra 02181_00_54_06 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 181t00:54 to 181t03:28.
Data Loss	02 July 2002 - 2002183	Prior to the Det A Rev 22931 (0411Z) DSU Dump, the antenna's counter-balance experienced a malfunction which caused that pass and the next Det A Rev 22932 pass (0549Z) to fail. No data was lost on these two passes, however, as a consequence of not dumping on these two passes, the DSU overwrote by approximately 42 minutes. It is estimated that the loss was between 0024Z and 0106Z on 07/02/2002. On the Det C Rev 22936 pass (1241Z), we manually switched GFO out of DDL mode in order to jump the record pointer and dump DSU data ahead of it before it was overwritten. On the subsequent Det A Rev 22937 pass (1349Z), we experienced another antenna failure (this time due to cable wrap) during the DSU dump. As a consequence, the small portion of data dumped during the time that the antenna was off-track (approximately 97 pages) will need to be recovered this afternoon on the Det C Rev 22942 pass (2345Z).
RA	02 July 2002 - 2002183	Segment data for ra 02183_07_48_52 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 183t08:37 to 184t08:02.
Antenna Failure	03 July 2002 - 2002184	We have been having significant antenna problems at both Det A and Det C (LP is down for a 6 month overhaul). We stopped all but two cal ones a day (that is what we were supposed to do but blew it and was only doing one) so we did not overwrite or at least minimally overwrite data. Hopefully we will be back to normal this week. You can't believe how many times the antenna at Det A wrapped the cable around itself and if it were not for the safety we would have more problems.
RA	03 July 2002 - 2002184	Stopped receiving full waveforms and started receiving one cal per day.
RA	10 July 2002 - 2002191	Segment data for ra 02191_06_44_12 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 191t06:44 to 191t13:11.
SDR	10 July 2002 - 2002191	Data segment for sdr02191_06_44_12_23047 appears to be bad. The Receiver Temperature is at a constant value of 32.652637. Segment time is 06:44 to 13:10.
RA	11 July 2002 - 2002192	Started receiving two cals per day.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
RA	13 July 2002 - 2002194	Segment data for ra 02194_04_23_59 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 194t04:23 to 194t13:19.
RA	18 July 2002 - 2002199	Started receiving full waveforms.
RA	18 July 2002 - 2002199	Segment data for ra 02199_21_44_26 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 199t21:44 to 200t05:10.
RA	20 July 2002 - 2002201	Segment data for ra 02201_06_34_41 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 201t06:34 to 201t10:30.
RA	23 July 2002 - 2002204	Segment data for ra 02204_12_47_37 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 204t13:16 to 204t16:24.
RA	24 July 2002 - 2002205	Segment data for ra 02205_06_16_25 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 205t06:16 to 205t10:54.
RA	27 July 2002 - 2002208	Segment data for ra 02208_06_20_08 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 208t06:20 to 208t10:46.
Antenna Failure	27 July 2002 - 2002208	On Friday evening (Day 208) Det A experienced another two HPA failures during GFO supports. Given the recent frequency of problems with this HPA, it was subsequently decided by NAVSOC that Det A's commanding capability should be considered unreliable throughout this weekend for GFO operations purposes. As such, GFO has been placed in permanent mode 2 and has had its CSM cleared of commands. A new CSM will be uploaded on rev 23302 at 209/0150z which will contain playback safeties for all supports, and occur until reflect the changes appropriate for this reduced operations mode.
RA	28 July 2002 - 2002209	Stopped receiving full waveforms and started receiving one cal per day.
RA	29 July 2002 - 2002210	Started receiving two cals per day.
Antenna Failure	30 July 2002 - 2002211	A CSM was sent out this morning that will return GFO to normal ops starting Tuesday zulu. Full waveform data will be collected again via the Cal 3 sequence and the satellite will be performing DDL mode switching.
RA	30 July 2002 - 2002211	Started receiving full waveforms.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
RA	30 July 2002 - 2002211	Segment data for ra 02211_10_34_53 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 211t10:49 to 211t16:08.
RA	31 July 2002 - 2002212	Segment data for ra 02212_13_36_43 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 212t13:36 to 212t17:15.
RA	02 August 2002 - 2002214	Segment data for ra 02214_07_13_46 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 214t07:13 to 214t10:53.
RA	02 August 2002 - 2002214	Segment data for ra 02214_10_53_56 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 214t10:55 to 214t16:15.
RA	03 August 2002 - 2002215	Segment data for ra 02215_06_03_31 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 215t06:03 to 215t07:42.
RA	03 August 2002 - 2002215	Segment data for ra 02215_14_34_47 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 215t14:34 to 215t17:21.
RA	06 August 2002 - 2002218	Segment data for ra 02218_06_10_43 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 218t06:10 to 218t07:30.
RA	11 August 2002 - 2002223	Segment data for ra 02223_06_54_57 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 223t06:54 to 223t08:34.
RA	21 August 2002 - 2002233	Segment data for ra 02233_08_23_06 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 233t08:23 to 233t13:53.
RA	24 August 2002 - 2002236	Segment data for ra 02236_08_30_29 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 236t08:30 to 236t13:42.
Data Loss	29 August 2002 - 2002241	During processing of the remote site Doppler data between 1200Z 29-Aug 2002 and 1200Z 30-Aug-2002, we discovered that none of the Doppler data from the six Det A passes during that period were collected, the cause of which, is unknown. The impact of this is a slight degradation in that particular orbit run. It appears that Doppler data is now being collected from Det A.
RA	02 September 2002 - 2002245	Segment data for ra 02245_08_51_04 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 245t08:51 to 245t14:00.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
RA	08 September 2002 - 2002251	Segment data for ra 02251_09_07_14 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 251t09:07 to 251t11:37.
RA	09 September 2002 - 2002252	Segment data for ra 02252_16_10_32 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 252t16:10 to 252t19:55.
Antenna Failure	11 September 2002 - 2002254	The Det C Helix antenna is down and the omni antenna is currently collecting doppler data. The previous pass was unusable as further passes will likely be. They have identified a problem and should have parts to repair it by the end of the week. Currently, Det A and HQ are collecting doppler data and, as long as this holds, there should be no problems with the orbit determination. However, tomorrow we will plan a trim maneuver. If the Det A or HQ RDCC goes down, we may not be able to plan this maneuver since we need at least two RDCCs to get a reliable post-maneuver orbit quickly. As it stands now, our ability to determine orbits and plan trim maneuvers is not impacted.
Distribution System	16 September 2002 - 2002259	Unclassified DPSR change. NAVOCEANO is upgrading their automated product distribution system with improved hardware. If your server is running "wrappers", you will have to include the two (2) new IP addresses. NAVO maintains two systems for redundancy purposes, so both machines should be allowed access.We are in the process of transferring the unclassified DPSR function to two new machines for DPD-2002-015. In order to do this, we will need you to add 2 machines into your hosts.allow file if you are running tcp wrappers. Those machines are: UDPS1 128.160.131.66 & UDPS2 128.160.131.67. Change will be Monday, 16 Sept 2002 @ ~ 1400 GMT. The distribution mechanism will remain the same, but new servers will be implemented.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
HPA	19 September 2002 - 2002262	The HPA was installed today and it appears to be working properly from tests performed at Det A. Unfortunately, when we tried to communicate with it remotely, we couldn't. As there is only one other Det A pass today and it is below 10 degrees, we will clear the CSM and upload a new table which will put the satellite in 'safe' mode. This is a precautionary measure since we cannot test the command capability of Det A until tomorrow. If the HPA is working properly tomorrow, we will load Wednesday's CSM “Command Storage Memory”, as well as Friday's CSM, which will bring GFO into normal operations through the weekend. If, however, the HPA is still not working properly, we will plan and upload a new CSM that will keep GFO in 'safe' mode.
RA	20 September 2002 - 2002263	No full waveforms received today.
DSU Loss	20 September 2002 - 2002263	1) We discovered a gap in DSU data from 14:47:08 to 15:16:50 on 20-Sep-2002. The POC has confirmed that data received by them was noisy and unusable during this interval as well. The cause for this data loss is unknown and is currently being investigated. 2) Due to a ground system hardware failure, the DSU dump scheduled on Rev 24136 (Det A) was not run. As a consequence, we rescheduled Rev 24141 (Det C) and Rev 24142 (Det A) as DSU dumps (they were not previously planned as such) in order to prevent the DSU from overfilling. GFO was also taken out of DDL mode for the time span between these passes (1739Z to 1856Z) to facilitate dumping.
RA	29 September 2002 - 2002272	Segment data for ra 02272_03_35_15 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 272t03:35 to 272t10:16.
RA	05 October 2002 - 2002278	Segment data for ra 02278_11_47_32 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 278t11:47 to 278t17:50.
RA	05 October 2002 - 2002278	Segment data for ra 02278_17_50_58 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 278t17:50 to 278t18:21.
POC Computer	10 October 2002 - 2002283	Due to failure of the Primary POC Computer, Susie, we have been instructed by the POC to route payload data to Calvin. This change will be effective starting with the DSU dump on REV 24371 at Det C and will continue until further notice.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
RA	18 October 2002 - 2002291	At about 291/0800z, during the first DSU dump (DC 24479) following the recent GPS 4 turn on, NAVSOC DSMs received incoming alarms indicating out-of-limit wheel 1 -15V values. At 291/1142z) GPS 4 was immediately turned off, the CSM cleared, and the in-progress Cal 3 terminated. Stopped receiving full waveforms at this time.
RA	25 October 2002 - 2002298	Segment data for ra 02298_18_54_29 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 298t19:41 to 298t22:49.
RA	26 October 2002 - 2002299	Segment data for ra 02299_22_21_46 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 299t22:21 to 300t10:35.
Data Loss	28 October 2002 - 2002301	Due to commanding problems, a small amount of DSU data was lost today. The lost data was from 18:33:23Z to 18:46:37Z (28-Oct-2002). Due to the small size of this data loss, it has been decided that a recovery attempt is not worth the risk in additional data loss.
SDR	29 October 2002 - 2002302	SWH bounds limit test. The change to the SWH lower bounds, from 0.01 to - 0.01, has been incorporated into operational processing. The next Payload Data that will incorporate the change will be a DC DSU Dump rev # 24644. The first sdr produced with the new s/w mod is 02302_11_32_45_12119.dat.
RA	29 October 2002 - 2002302	Segment data for ra 02302_11_32_45 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 302t12:16 to 302t15:01.
LP Support	31 October 2002 - 2002304	The LP support today (10/31) at 16:42:00 failed. The planned DSU dump did not occur. The RA was configured from Cal 3 mode (Track 3) back to normal data collection mode (Track 1). The RA wasn't returned to Cal 3 mode at the end of the support as planned. So the last 3 hours of the planned RA Cal 3 for today will be collected as normal data instead of full waveform data. The approximate time period of this is from 16:45:00 to 19:55:00.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
SCC Generation	31 October 2002 - 2002304	Since Det A is slated to go down due to new hardware installation, we have begun the transition from using Det A to using Det For collection vitamin data for SCC generation. The Rev 24673 Det A pass will be the last one today to generate an SCC using Det A timing. We have reconfigured Det C to collect timing data overnight. After analyzing the SCCs generated by Det C tomorrow morning, we will notify the POC as to whether the SCCs are valid for use. If valid, we will continue to use SCCs generated by Det C while Det A is down, staying with the current 15-microsecond offsetting path delay until the next 17-day repeat orbit.
DSU Dump	01 November 2002 - 2002305	The DSU Dump at LP rev 24684 at 16:11z this morning failed because the antenna lost telemetry in the middle of the pass. The DSM running the support was able to stop the dump as the signal was getting intermittent and before telemetry was completely lost. Analysis of the support shows that the time of the affected data is approximately 11/1 14:27:00 to 14:45:00. The data in this period will be intermittent with noisy and missing data. During the next support (Det A rev 24687 20:49) the DSU playback pointer will be moved until just before the affected data. No DSU data will be collected by the ground station during this support. Then on Det C rev 24687 21:18, the DSU data will be recollected at the start of the next DSU dump. This will recover the affected data but as some of the data will have been dumped twice, some manual reprocessing may have to be done.
Data Loss	01 November 2002 - 2002305	The DSU Dump at LP rev 24684 at 16:11z this morning failed because the antenna lost telemetry in the middle of the pass. The DSM running the support was able to stop the dump as the signal was getting intermittent and before telemetry was completely lost. Analysis of the support shows that the time of the affected data is 4:27:00 to 14:45:00. The data in this period will be intermittent with noisy and missing data. During the next support (Det A rev 24687 20:49) the DSU playback pointer will be moved until just before the affected data. No DSU data will be collected by the ground station during this support. Then on Det C rev 24687 21:18, the DSU data will be recollected at the start of the next DSU dump. This will recover the affected data but as some of the data will have been dumped twice, some manual reprocessing may have to be done.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
RA	01 November 2002 - 2002305	Segment data for ra 02305_12_52_54 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 305t12:52 to 306t04:48.
RA	03 November 2002 - 2002307	Missing waveforms. Data lost from ~15:00 to 17:00 due to corrupted data.
RA	11 November 2002 - 2002315	Missing waveforms. Waveform data lost from ~17:41 to 18:44. Missing CSM files. On Day 315, there was a table upload support at LP rev# 24828, AOS 17:41z - LOS 17:49z. The support was performed during RA Cal sequence (during full waveform data collection). Since we need to perform a vote-and-compare (verification) for the uploaded table, and since we cannot perform a vote-and-compare during RA Cal sequence, we have commanded the satellite to stop RA Cal (switch to NORM) for the duration of the table upload (~8 minutes), and intended to command the satellite to restart RA Cal sequence once the table upload was finished.The table upload support was not successful due to NCEU problems (refer to the weekly summary 02317ws.txt). The commanding capability could not be recovered, and RA Cal sequence could not be restarted. The satellite started "Cal I / Cal II" at 18:44z by the commands in the CSM as scheduled.Thus, this explains data that was lost was between 17:41z to 18:44z on Day 315.
Timing Bias	14 November 2002 - 2002318	During the recent calibration of the three ground sites (as a result of the upgrades in progress) we found that there existed about a 15 microsecond bias in the ground based time tagging system that had not been taken out previously. We will be adjusting the time system for that bias as of 0001Z on 14 November which is the beginning of a new data cycle, at least as the Navy measures those cycles (from the acceptance of the sat by the Navy).
RA	14 November 2002 - 2002318	Segment data for ra 02318_17_57_20 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 318t17:57 to 318t21:01.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
RA	18 November 2002 - 2002322	Missing waveforms. Waveform data lost from ~17:25 to 18:37. During a table upload at LP this morning, the satellite was brought out of the cal configuration and brought into the normal configuration so that we could perform our table uploads. The LP NCEU dropped a command during the CSM upload and, as a result, the satellite was not brought back to the cal configuration. Full waveform data collection began at 13:46:58z and was interrupted around 17:25z. The CSM will command the satellite back into the cal configuration for the second full waveform data collection starting at 18:36:58z. As a result roughly one hour of full waveform data will not be collected today.
RA	21 November 2002 - 2002325	Missing waveforms. Waveform data lost from ~17:32 to 18:33. During a table upload at LP today, we interrupted the Cal sequence. Due to NCEU commanding problems, we could not command the DTU and the RA back to the Cal state. This will result in about an hour less full waveform data than expected from the first data collection period today.
PSK Demod	24 November 2002 - 2002328	The PSK Demod at Det C was swapped out this weekend. The PSK demod is one of the pieces of equipment that can cause a timing shift. As a result, we have halted the production of clock pairs from Det C until we can validate the quality of the resulting SCCs.
PSK Demod	25 November 2002 - 2002329	We have confirmed that the PSK demod switch at Det C has not significantly affected timing. From this point on, all SCCs generated from Det C should be fine.
LP Antenna	25 November 2002 - 2002329	Change in GFO RA Cal data collection. NAVSOC just called and they are going to have to secure the LP antenna for a day or two due to high winds. With only Det C available to retrieve data we are going to temporarily stop the long RA Cal passes and only due the 10 minute ones twice per day.
RA	25 November 2002 - 2002329	Missing waveforms. Waveform data lost from ~17:53 to 18:49. DSU data was lost from about 17:53 to 18:49. It is believed this loss was caused from the modulation of GFO's transmitter spontaneously changing from low to high in the middle of a DSU dump.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
Transmitter Anomaly	25 November 2002 - 2002329	During an LP DSU pass on November 25, 2002, XM1 toggled between Mod Low and Mod High three times. The satellite started the pass in Mod Low and during the DSU dump, XM1 switched to Mod High. Our DSU data from that pass starts out fine then becomes noisy around the time the transmitter toggled to Mod High. After this, XM1 toggled back to Mod Low and then to Mod High again. Our DSU contact report also shows a two second period of data that correlates with this. During XM1's second and third switch, XM2 mirrored XM1. That is, XM2 went to Mod High and then to Mod Low. No command was issued out of CSM or from the ground to make these changes. Also, there is only one command to change phase modulation index (XMODHI/LO) and this affects both transmitters simultaneously. There is no way for us to command the satellite's transmitters into the configuration we saw.
RA	25 November 2002 - 2002329	Segment data for ra 02329_17_14_14 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 329t17:14 to 329t18:48.
Downtime	26 November 2002 - 2002330	Full waveform data discontinued. Due to downtime at LP, GFO was placed into "data safe mode" for prevention of overwriting payload data. (No DDL mode switching and 2 10 minute RA calibrations instead of 7 hours of full waveform data). The current plan is to leave the satellite in this mode until at least Monday 12/2.
RA	27 November 2002 - 2002331	Segment data for ra 02331_12_25_34 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 331t12:25 to 331t23:02.
RA	02 December 2002 - 2002336	Segment data for ra 02336_04_40_03 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 336t04:40 to 336t12:30.
RA	03 December 2002 - 2002337	Return of full waveform data. The commanding for the return of full waveform data was done on day 2002336 during the full waveform time span.
Reduced Support	05 December 2002 - 2002339	Due to an approaching typhoon near Guam, we are planning to null all supports at Det C from today through Sunday. GFO operations will be reduced to the two 10-minute RA calibrations each day instead of the normal 7-hour full waveform collection. We will still continue to perform DDL mode-switching while Det C is down.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
Reduced Support	05 December 2002 - 2002339	The support designed to put GFO into reduced operations mode (Two 10 minute RA Calibrations and DDL mode switching) failed. The CSM was cleared but the new CSM was unable to be uploaded. GFO is now in Mode 2 mode with no CSM commands. Therefore it will not be doing any DDL mode switching tonight and the two 10 minute RA Calibrations that should have occurred tomorrow will not execute. A CSM upload will be attempted tomorrow morning to improve the level of operation.
Reduced Support	06 December 2002 - 2002340	We were successful running a CSM upload this morning at 14:50z Dec. 6. The short RA CAL sequences and DDL mode switching were restored. None of the short RA CAL sequences will be lost.
Reduced Support	09 December 2002 - 2002343	As a direct result of the large typhoon that occurred on Guam this past weekend, there is no longer a Det C SGLS antenna. The condition of the Det C Doppler antenna is presently unknown. A full Det C damage assessment will be forthcoming. In addition, Det A is still having ACU issues which make it somewhat unreliable for DSU dumps. In response to these circumstances, we have placed GFO into permanent mode 2, cleared the 'full normal ops' commands out of CSM, and uploaded DA/LP playback safeties and 10-minute cals into CSM. These operations where completed on 12/9/02 (Day 343) at around 1820Z. GFO will continue to operate in permanent mode 2 with 10-minute RA calibrations until further notice.
RA	11 December 2002 - 2002345	Segment data for ra 02345_05_20_22 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 345t05:20 to 345t17:01.
RA	28 December 2002 - 2002362	Segment data for ra 02362_20_08_15 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 362t20:08 to 363t05:47.
Data Loss	03 January 2003 - 2003003	NAVSOC has experienced problems downloading the data (gaps, overlaps, and irregularities). For Day 003 NAVSOC's DSU had overwritten. NAVSOC said there where out of order data and up to eight hours of missing data sent out for Day 003. NAVSOC said download Center LP is currently experiencing high winds which is causing problems downloading the data.
Data Loss	04 January 2003 - 2003004	NAVSOC has experienced problems downloading the data (gaps, overlaps, and irregularities). NAVSOC said download Center LP is currently experiencing high winds which is causing problems downloading the data.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
Data Loss	05 January 2003 - 2003005	NAVSOC has experienced problems downloading the data (gaps, overlaps, and irregularities). On day 005 NAVSOC said the DSU had overwritten again, and several hours of data was lost. NAVSOC said download Center LP is currently experiencing high winds which is causing problems downloading the data.
Data Loss	06 January 2003 - 2003006	NAVSOC has experienced problems downloading the data (gaps, overlaps, and irregularities).NAVSOC said due to high winds download center LP will not be used until the weather improves (LP has been "pinned"). Det A will be the only DSU center downloading GFO data.
Operational	08 January 2003 - 2003008	We have successfully performed two DSU dumps at LP this afternoon and verified data collection. Thus, LP appears to be back to operational status.
RA	22 January 2003 - 2003022	Segment data for ra 03022_08_17_23 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 022t08:17 to 022t18:53.
Data Loss	30 January 2003 - 2003030	NAVSOC notified the ADFC of ground station download problems which resulted in two missed DSU dumps, LP orbits, 25953 & 25954, times 07:56 GMT & 09:36 GMT, respectively. The next available data retrieval will be orbit 25959 and will commence at 18:29Z. Due to the problems, NAVSOC indicated the DSU will begin overwriting at 1700Z resulting in approximately 1 1/2 hours of missed data
RA	4 February 2003 - 2003035	Segment data for ra 03035_08_26_29 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 035t08:26 to 035t09:38.
Hardware Failure	12 February 2003 - 2003043	An LP hardware failure early Wednesday has rendered the SGLS antenna unusable until a replacement part is received. It is presently estimated that the required part will be received some time on Friday, February 14. As a result, the DSU dumps originally planned for LP have been nulled, and replacement dumps have been planned for other sites. The attached provides an up-to-date schedule for supports between now and Friday. Additionally, the planned shift back to 7-hour RA calibrations is on hold until LP is returned to operational status.
RA	18 February 2003 - 2003049	Segment data for ra 03049_06_40_52 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 049t06:40 to 049t17:40.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
RA	22 February 2003 - 2003053	Now that full operability of all three remote sites has been retained, GFO has resumed collection of seven-hour full waveform data. Full waveform collection began at 2039Z on 22 Feb 2003.
RA	28 February 2003 - 2003059	Segment data for ra 03059_17_26_42 is missing data from 17:26 thru 20:53.
RA	01 March 2003 - 2003060	Missing data from 00:46 thru 16:58. Raw data set was too noisy.
NGDR	10 March 2003 - 2003069	The database method of NGDR generation has bitten us for the last time this past weekend. These files were created from using the flat file method and we will be implementing the operational distribution of the flat file NGDRs today. All subsequent NGDRs will be generated and release utilizing that new software.
RA	15 March 2003 - 2003074	Segment data for ra 03074_08_26_43 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 074t08:26 to 074t11:25.
RA	27 March 2003 - 2003086	Segment data for ra 03086_02_20_57 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 086t02:20 to 086t04:30.
RA	1 April 2003 - 2003091	Segment data for ra 03091_00_28_33 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 091t03:57 to 092t03:04.
RA	5 April 2003 - 2003095	Segment data for ra 03095_14_19_30 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 095t14:19 to 095t20:31.
Data Loss	15 April 2003 - 2003105	NAVSOC reported Det C was shutdown because of a typhoon. Also NAVSOC reported that site LP had problems and the DSU on the satellite overwrote during 4:10 - 6:27 for Day 105, thus the data was not recoverable.
SCC Timing Jump	17 April 2003 - 2003107	Between 0130-0930Z on 17 April, GFO experienced a large jump in timing (on the order of 30 microseconds). This timing jump seems to have occurred after completion of the deep discharge by turning on the RA and putting the spacecraft back in Point state. Preliminary data suggests that the sharp temperature rise after transitioning out of Acquire Sun state may have affected the oscillator frequency. However, since 0930Z on 17 April, timing seems to have stabilized.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
Reduced Support	19 April 2003 - 2003109	Michael D. Joyce Asst. Dept. Head, Satellite Engineering Dept. Constellation Support Manager: GFO, Coriolis Naval Satellite Operations Center 661 13th Street Point Mugu, CA., reported that the LP antenna being down and will go to 10 minute RA calibrations over the weekend of April 19.
RA	19 April 2003 - 2003109	Segment data for ra 03109_11_43_32 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is109t11:43 to 109t18:29.
DSU Loss	19 April 2003 - 2003109	DSU data from 11:39:24Z to 11:44:17Z on 19-Apr-2003 was lost due to noisy telemetry at the beginning of a DSU dump.
Timing Drift	22 April 2003 - 2003112	Another large drift in SCCs occurred around 2200Z on 22 April. This swing coincided with when the satellite was put in Acquire Sun state and it is believed that the associated drop in overall compartment temperatures affected the oven controlled crystal oscillator frequency. The satellite requires approximately 18 hours to reach thermal equilibrium after significant thermal events such as going to Acquire Sun, and therefore SCCs have since stabilized. As of approximately 2110Z 4/23, GFO is back in Point State. Consequently, we expect another large SCC drift, which will stabilize around 1500Z on 24 April.
Support Resumed	23 April 2003 - 2003113	CSM was uploaded to resume DDL mode and 10 minute RA calibrations.
RA	23 April 2003 - 2003113	Segment data for ra 03113_03_21_12 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 113t03:21 to 113t09:25.
GFP Timing	24 April 2003 - 2003114	Since 2110Z yesterday, when GFO was reconfigured to Point State and the catbed heaters turned off, GFO has returned back to a stable thermal environment and is producing stable timing data. The total drift in SCCs between pre- and post- Acquire Sun states was on the order of 400 microseconds. Preliminary data shows that 4-6 hours are required after Point-to-Acquire Sun or Acquire Sun-to-Point state transitions for the SCCs to stabilize. This large drift in oscillator frequency (and consequently SCCs) was an expected consequence of these state transitions but the recent battery reconditioning cycles have produced valuable data in characterizing the behavior.
Support Resumed	25 April 2003 - 2003115	Resumed collection of seven-hour full waveform data.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
RA	5 June 2003 - 2003156	Segment data for ra 03156_17_21_26 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 156t17:21 to 157t01:39.
RA	2 July 2003 - 2003183	Segment data for ra 03183_10_31_32 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 183t10:31 to 183t13:39.
RA	3 July 2003 - 2003184	Segment data for ra 03184_10_00_32 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 184t10:00 to 184t13:07.
DSU Loss	5 July 2003 - 2003186	NAVSOC missed two DSU dumps which caused a data gap from 2003186t10:05 to 2003186t15:49.
Reduced LP Support	19 July 2003 - 2003200	The NAVSOC antenna at Laguna Peak is not functional and is expected to take at least 10 days to fix. Starting Saturday July 19th, the GFO RA will be put into full waveform mode (RA Track 3 mode) for two 10-minute periods each day rather than the normal 7-hour period. This is being done to reduce the chance of overwriting the DSU and losing payload data.
RA	20 July 2003 - 2003201	Segment data for ra 03201_17_53_34 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 201t17:53 to 202t03:26.
Support Resumed	30 July 2003 - 2003211	Resumed collection of seven-hour full waveform data.
RA	13 August 2003 - 2003225	Segment data for ra 03225_14_26_26 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 225t15:18 to 225t20:05.
Reduced LP Support	15 August 2003 - 2003227	The GFO RA (RA Track 3 mode) changed to the two 10-minute periods each day rather than the normal 7-hour period. Problems with both Det C and LP therefore cut back on the full waveform passes to ensure being able to capture the primary data.
RA	15 August 2003 - 2003227	Segment data for ra 03227_08_07_18 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 227t08:07 to 227t13:22.
RA	15 August 2003 - 2003227	Segment data for ra 03227_13_39_53 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 227t13:39 to 227t17:53.
Support Resumed	20 August 2003 - 2003232	Resumed collection of seven-hour full waveform data.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
Data Loss	25 August 2003 - 2003237	NAVSOC experienced problems downloading data from Det C. the missing times are from 20:31:58 - 22:58:05.
RA	4 September 2003 - 2003247	Segment data for ra 03247_10_50_17 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 247t10:50 to 247t14:07.
Data Loss	6 September 2003 - 2003249	CPU reset in the Attitude Control subsystem and satellite put in safe mode. Payload not on.
Support Resumed	27 October 2003 - 2003300	Resumed collection of seven-hour full waveform data.
RA	10 November 2003 - 2003315	Segment data for ra 03315_11_38_53 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 315t11:38 to 315t15:14.
Data Loss	12 November 2003 - 2003316	During the initial GFO table 34 upload support on 11/12/03 at approximately 1640z a power outage at Det A caused the support to fail. The pass was not recovered in time to command GFO back into RA Cal3 until the following LP pass. Therefore, there is a gap from approximately 1640z-1830z within the RA Cal3 on 11/12/03 where the DTU is in normal mode.
RA	29 November 2003 - 2003333	Segment data for ra 03333_12_22_53 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 333t12:22 to 333t16:15.
RA	30 November 2003 - 2003334	Segment data for ra 03334_13_29_36 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 334t13:29 to 334t17:05.
RA	1 December 2003 - 2003335	Segment data for ra 03335_12_59_18 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 335t12:59 to 335t16:52.
Reduced Support	06 December 2003 - 2003340	The GFO RA (RA Track 3 mode) changed to the two 10-minute periods each day rather than the normal 7-hour period. This was due to the CPU reset on (Day 336) 02 December @ 22:18:25.
Support Resumed	13 December 2003 - 2003347	Resumed collection of seven-hour full waveform data.
RA	17 December 2003 - 2003351	Segment data for ra 03351_15_10_53 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 351t15:10 to 351t18:18.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
SCC Generation Anomaly	10 January 2004 - 2004010	An anomaly was discovered regarding the generation of SCCs. It was found that SCCs generated and distributed after 0615Z on 10-Jan-2004 are invalid due to noisy timing data resulting from a possible hardware failure. Ground system personnel suspect the GPS receiver at DetA. SCCs are generated from timing data originating from only the DetA TTCS.
RA	15 January 2004 - 2004015	Segment data for ra 04015_20_19_07 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 015t20:19 to 015t23:41.
RA	22 January 2004 - 2004022	Segment data for ra 04022_18_35_04 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 022t21:11 to 023t02:11.
RA	5 February 2004 - 2004036	Segment data for ra 04036_17_13_10 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 036t17:13 to 036t21:06.
RA	6 February 2004 - 2004037	Segment data for ra 04037_00_29_59 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 037t00:29 to 037t04:23.
RA	11 February 2004 - 2004042	Segment data for ra 04042_17_43_40 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 042t17:43 to 042t22:41.
RA	12 February 2004 - 2004043	Segment data for ra 04043_18_34_55 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 043t18:34 to 043t22:10.
RA	16 April 2004 - 2004107	Segment data for ra 04107_02_48_33 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 107t02:48 to 107t06:00.
Communications Failure	29 April 2004 - 2004120	A total communication failure on both classified POC machines. NAVO System Administrator has found an issue with the DECnet software (communication software at NAVO).
Communications Restored	30 April 2004 - 2004121	NAVO returned to operational status @ 13:00. NAVSOC sent all Payload data which spanned NAVO's downtime. No loss of data, all data was processed and sent out.
Reduced Support	13 May 2004 - 2004134	NAVSOC experienced some problems with both Det A and Laguna Peak (LP) and will be collecting data from only one station instead of three stations. Due to this anomaly, there will only be an interruption in the full waveform data for 24 hours.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
RA	25 June 2004 - 2004177	Segment data for ra 04177_11_29_03 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 177t11:29 to 177t14:36.
RA	04 July 2004 - 2004186	Received invalid ra segment 04070_07_00_24. Set of CALVAL files corrupted at the beginning of file.
RA	12 July 2004 - 2004194	Segment data for ra 04194_11_00_50 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 194t11:00 to 194t15:49.
Reduced Support	20 July 2004 - 2004202	The GFO RA (RA Track 3 mode) changed to the two 10-minute RA calibrations per day and suspended full waveform data collection. The reduction of FWF data is due to ground station hardware problems at Det A and an unknown cause at Laguna Peak suffering RFI.
Support Resumed	22 July 2004 - 2004204	Resumed collection of seven-hour full waveform data at 204t1017Z.
Reduced Support	18 August 2004 - 2004231	The GFO RA (RA Track 3 mode) changed to the two 10-minute RA calibrations per day and suspended full wave form data collection. The suspension of FWF data is to control temperatures of the wheels, due to extremely high wheel voltage.
RA	19 August 2004 - 2004232	Segment data for ra 04232_14_51_09 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 232t14:59 to 232t19:53.
RA	26 August 2004 - 2004239	Received invalid ra segment 07170_10_10_04. Set of CALVAL files corrupted at the beginning of file.
Support Resumed	20 September 2004 - 2004264	Resumed collection of seven-hour full waveform data at 264t0922Z.
Reduced Support	21 September 2004 - 2004265	During support at DET A Day 2004265 the DDL mode was turned off and RA CAL FWF data collection was interrupted. These configuration changes were made to reduce temperatures on the GFO satellite. RA CAL sequences are planned to be resumed Day 2004266.
Reduced Support	23 September 2004 - 2004267	The GFO RA (RA Track 3 mode) changed to the two 10-minute RA calibrations per day and suspended full waveform data collection. The reduction of FWF data is due to ground station hardware problems at Det A.
RA	27 September 2004 - 2004271	Received invalid ra segment 04067_10_18_38. Set of CALVAL files corrupted at the beginning of file.
Support Resumed	29 September 2004 - 2004273	Resumed collection of seven-hour full waveform data.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
Support Resumed	05 October 2004 - 2004279	Resumed DDL mode-switching operations.
Reduced Support	15 October 2004 - 2004289	Due to the consecutive loss of passes at Det C and LP still being down due to Y-axis motor repair, NAVSOC has only one reliable ground station for GFO OPS. Hence, to minimize risk of losing DSU data, NAVSOC will turn off full waveform data 2004289 (15 OCT 04) and loss of FWF data will take effect 2004290 (16 OCT 04). DDL mode was also suspended.
Support Resumed	20 October 2004 - 2004294	Resumed collection of seven-hour full waveform data.
Reduced Support	23 October 2004 - 2004297	Due to ground systems issues at LP and Dec C, full waveform collection is being suspended.
Support Resumed	27 October 2004 - 2004301	Resumed DDL mode-switching operations and collection of seven-hour full waveform data.
RA	28 October 2004 - 2004302	Received invalid ra segment 04060_11_46_08. Set of CALVAL files corrupted at the beginning of file.
Reduced Support	05 November 2004 - 2004310	Due to extended power outages at NAVSOC, commanding capability will be lost at NAVSOC HQ. Full waveform collection is being suspended.
Support Resumed	08 November 2004 - 2004313	Resumed collection of seven-hour full waveform data.
RA	08 November 2004 - 2004313	Segment data for ra 04313_21_12_02 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 313t21:12 to 314t00:19.
RA	15 November 2004 - 2004320	Received invalid ra segment 04057_19_49_36. Set of CALVAL files corrupted at the beginning of file.
RA	03 December 2004 - 2004338	Segment data for ra 04338_03_37_47 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 338t03:37 to 338t07:42.
RA	15 December 2004 - 2004350	Received invalid ra segment 04070_07_00_29. Set of CALVAL files corrupted at the beginning of file.
Reduced Support	22 December 2004 - 2004357	Due to ground systems issues at LP and Dec C, DDL mode turned off and full waveform collection is being suspended.
Support Resumed	31 December 2004 - 2004366	Resumed DDL mode-switching operations and collection of seven-hour full waveform data.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
RA	09 January 2005 - 2005009	Segment data for RA 05009_18_52_03 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 009t18:52 to 009t22:07
RA	20 January 2005 - 2005020	Segment data for RA 05020_07_52_17 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 020t07:52 to 020t17:38
RA	17 February 2005 - 2005048	Segment data for RA 05048_21_40_56 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 048t21:40 to 049t03:20
RA	19 February 2005 - 2005050	Segment data for RA 05050_04_29_36 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 050t04:29 to 050t15:08
RA	04 March 2005 - 2005063	Segment data for RA 05063_01_28_51 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 063t01:28 to 063t02:23
RA	05 March 2005 - 2005064	Segment data for RA 05064_22_06_57 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 064t22:06 to 065t01:20
RA	11 April 2005 - 2005101	Segment data for RA 05101_08_07_04 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 101t08:07 to 101t11:14
RA	15 April 2005 - 2005105	Segment data for RA 05105_04_33_34 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 105t04:33 to 105t07:43
RA	25 April 2005 - 2005115	Segment data for RA 05115_09_16_59 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 115t09:16 to 105t12:20
Reduced Support	07 May 2005 - 2005127	Due to ground station limitations, full waveform collection is being suspended.
Support Resumed	08 May 2005 - 2005128	Resumed collection of seven-hour full waveform data.
RA	23 June 2005 - 2005174	Segment data for RA 05174_06_41_11 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 174t06:41 to 174t10:01
RA	24 June 2005 - 2005175	Received invalid RARA segment 09063_11_34_59. Set of CALVAL files corrupted at the beginning of file.
RA	28 June 2005 - 2005179	Received invalid RARA segment 10194_04_57_51. Set of CALVAL files corrupted at the beginning of file.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
RA	01 July 2005 - 2005182	Received invalid RARA segment 04060_00_07_15. Set of CALVAL files corrupted at the beginning of file.
RA	18 July 2005 - 2005199	Received invalid RA segment 05104_19_54_23. Set of CALVAL files corrupted at the beginning of file.
RA	22 July 2005 - 2005203	Received invalid RA segment 05105_11_12_00. Set of CALVAL files corrupted at the beginning of file.
RA	26 July 2005 - 2005207	Segment data for RA 05207_11_36_30 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 207t11:36 to 207t15:00
RA	08 August 2005 - 2005220	Segment data for RA 05220_16_37_29 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 220t16:37 to 220t19:44
RA	14 August 2005 - 2005226	Segment data for RA 05226_23_32_36 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 226t23:32 to 227t02:23
Reduced Support	19 August 2005 - 2005231	Full waveform data collection for GFO has been suspended at approximately 1552 zulu due to ground system problems. FWF will resume at approximately 1724 zulu.
Support Resumed	19 August 2005 - 2005231	GFO Full waveform has been restored as of 17:30:43 zulu. The outage times were from 15:51:39 to 17:30:43 zulu time. The outage was caused by ground system problems
RA	19 August 2005 - 2005231	Segment data for RA 05231_14_11_39 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 231t15:51 to 231t17:30
RA	25 August 2005 - 2005237	Segment data for RA 05237_17_49_28 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 237t17:49 to 237t20:56
Support Suspended	29 August 2005 - 2005241	The GFO POC is down due to hurricane Katrina, which caused power and communication outages across the gulf coast, the NAVO ground system is totally out, the satellite remains operational and data is being archived by the Naval Satellite Operations Center.
RA	03 September 2005 - 2005246	Segment data for RA 05246_10_51_44 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 246t10:51 to 246t14:27
Support Resumed	15 September 2005 - 2005258	The GFO POC resumed sending data.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
Reduced Support	20 September 2005 - 2005263	Due to ground system issues (DetA being unavailable), GFO is unable to support the normal 7 hour CAL. The 10 minute CAL time will be 15:30:36 - 15:40:46Z.
RA	06 October 2005 - 2005279	Segment data for RA 05279_14_15_10 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 279t14:15 to 279t17:24
Reduced Support	10 October 2005 - 2005283	For about a month the number of full CALCAL periods will be occasionally reduced to support battery maintenance.
RA	15 October 2005 - 2005288	Segment data for RA 05288_21_24_23 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 288t21:24 to 289t02:34.
Data Loss	15 October 2005 - 2005288	Due to the failure of the DSU support at Rev 40140/ DetA and in order to prevent overwriting data, the DSU support at Rev 40141/DetA had playback initiated at a lower than nominal signal strength. Because of this, there is degradation in the data for Day 288 from 2125 - 2138z.
Reduced Support	15 October 2005 - 2005288 thru 16 October 2005 - 2005289	The ten minute CAL performed but no full waveform data collection.
Reduced Support	18 October 2005 - 2005291	The ten minute CAL performed but no full waveform data collection.
Reduced Support	24 October 2005 - 2005297	The ten minute CAL performed but no full waveform data collection.
Reduced Support	26 October 2005 - 2005299 thru 27 October 2005 - 2005300	The ten minute CAL performed but no full waveform data collection.
Reduced Support	29 October 2005 - 2005302	The ten minute CAL performed but no full waveform data collection.
Reduced Support	01 November 2005 - 2005305	The ten minute CAL performed but no full waveform data collection.
Reduced Support	04 November 2005 - 2005308	The ten minute CAL performed but no full waveform data collection.
Reduced Support	05 November 2005 - 2005309	The ten minute CAL performed but no full waveform data collection.
Reduced Support	07 November 2005 - 2005311	The ten minute CAL performed but no full waveform data collection.
Reduced Support	09 November 2005 - 2005313 thru 13 November 2005 - 2005317	The ten minute CAL performed but no full waveform data collection.

Table C-1 GFO Ground Processing Incident Log (Prior to December 13, 2005) (Continued)

Data Type	Data Date	Comments
Reduced Support	15 November 2005 - 2005319 thru 20 November 2005 - 2005324	The ten minute CAL performed but no full waveform data collection.
RA	21 November 2005 - 2005325	Segment data for RA 05325_05_36_26 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 325t05:36 to 325t16:49.
Reduced Support	21 November 2005 - 2005325 thru 27 November 2005 - 2005331	The ten minute CAL performed but no full waveform data collection.
Reduced Support	29 November 2005 - 2005333	The ten minute CAL performed but no full waveform data collection.
RA	30 November 2005 - 2005334	Segment data for RA 05334_06_00_52 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 334t06:00 to 334t09:14.
Reduced Support	30 November 2005 - 2005334	The ten minute CAL performed but no full waveform data collection.
RA	03 December 2005 - 2005337	Segment data for RA 05337_10_32_03 appears to be bad. Noisy time tagging, plus & minus time gaps and time slips. Segment time is 334t10:32 to 337t15:59.
RA	06 December 2005 - 2005340	Received invalid RA segment 06025_23_33_54. Set of CALVAL files corrupted at the beginning of file.
Reduced Support	06 December 2005 - 2005340	Due to resource constraints, the RA calibration beginning on 12/06/05 at 20:42:29z will be run as a ten-minute calibration rather than the standard 7-hour CALCAL.
Reduced Support	09 December 2005 - 2005343 thru 12 December 2005 - 2005346	The ten minute CAL performed but no full waveform data collection.

Appendix D
GFO ABCAL Note

Notes on editing bad GFO Cal Mode data while processing an ABCAL

Annette Conger
5/19/06

While processing the ABCAL performed on 2006061, George Hayne determined there was no useful content in the output file. The WFF cal data log listing from the daily ra processing for 2006061 was checked and showed an indication of noise during the downlink time of the ABCAL (20:49 - 21:15). This noise was indicated by + and - time gaps in the gfo_raL_06061-17_51_04.log listing, shown below in italics, for the segment in question.

To correct the data, The First Sci frame seconds, shown in **bold** in Listing #1 were found, and checks were made to see if there were Delta SciTime Gaps during the ABCAL time period. These times were out of line with the First Sci frame seconds and the Final Sci frame seconds. The corresponding ra_cal file sent by NAVO, ra_cal_data06061_17_51_04.dat.gz, was unzipped and the unzipped file was edited. See Listing #2 for the ra_cal file being edited. A search was made for 75118.06373567, which was the last good time before the first offending gap time of 161508.13361901. Then the offending time records were deleted until records reached the time of 75141.34767120, which was more in line with the last good time record. This resulted in deleting 8 data records (records 5-12), which corresponded with the number of gaps shown in the list of Delta SciTime Gaps in Listing #1. The edited file was saved and then reprocessed the ABCAL using the saved file by running proc_gfo_ascra with 2 sec average for fine waveforms.

Listing #1 - Daily RA processing log

Mar 3 14:00 2006 gfo_raL_06061_17_51_04.log Page 1

WFF VERSION : asc RA Software = Version 1.0 07/21/97

First Sci frame number ; 0
First Sci frame seconds : 75117.671767130
First Sci frame UTC : 2006-061T20:51:57.671767
First Eng frame number ; 0
First Eng frame seconds : 64264.407182920
First Eng frame UTC : 2006-061T17:51:04.407183

Delta SciTime Gap 75117.671767130 75117.671767130 0.
Delta SciTime Gap 75118.063735670 161508.13361901 86390.1
Delta SciTime Gap 161508.13361901 161511.14777728 3.01416
Delta SciTime Gap 161511.14777728 161509.53643448 -1.61134
Delta SciTime Gap 161509.53643448 161511.14777723 1.61134

Delta SciTime Gap 161511.14777723 161509.76469412 -1.38308
Delta SciTime Gap 161509.76469412 161508.13361890 -1.63108
Delta SciTime Gap 161508.13361890 161508.13361887 -3.0006E-08
Delta SciTime Gap 161508.13361887 161512.79739882 4.66378
Delta SciTime Gap 161512,79739882 75141.347671200 -86371.5
Delta SciTime Gap 75141.347671200 75120.905507570 -20.4422
Delta SciTime Gap 76160.210113250 76160.896058240 0.685945
Delta SciTime Gap 76199.994923090 76199.994923090 0.

Final Sci frame number ; 11020
Final Sci frame seconds : 76199.994923090
Final Sci frame UTC : 2006-061T21:09:59.994923
Final Eng frame number ; 8810
Final Eng frame seconds : 82313.028616800
Final Eng frame UTC : 2006-061T22:51:53.028617

Listing #2 - ra_cal file to be edited

First gunzip ra_cal_data06061_17_51_04.dat.gz and then edit ra_cal_data06061_17_51_04.dat

0:
f9af
adff c900
802401417.13207650
-21.472002
-0.175660
44.179688
0 2
1.132324
1.640625
99 44 192 121
196 117 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 3 20 67
175 209 195 172 218 173 177 202
201 174 227 201 184 202 202 196
204 196 190 181 185 183 170 172
178 161 157 171 161 136 144 150
127 125 144 128 128 116 111 111
4
134.8798
75117.67176713

:

: records **1-3** not shown

:

4:
f9af
adff 48e8
802393124.62629616
-21.358953
-0.058553
44.081055
0 2
1.132324
1.640625
103 43 164 108
204 121 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 2 19 65
150 176 227 207 211 210 208 179
190 217 243 172 232 210 187 191
221 177 196 218 213 218 183 175
174 154 150 158 170 162 151 148
140 136 130 129 124 125 122 112
4
134.8590
75118.06373567

Record 5 begins the bad data as indicated by the time at the end of each record. Bad data continues down thru record 12. These are the records that need to be deleted.

5:
f9af
adff 9054
802388932.97543323
-21.362598
0.058553
44.172852
1 2
1.132324

1.640625
101 38 167 94
197 116 0
0 0 0 0 0 13 124 0
99 0 0 0 0 0 0 139
0 144 0 107 0 140 0 80
0 7 0 87 255 77 127 1
77 79 2 76 79 12 0 64
128 1 0 25 41 0 78 223
234 42 4 165 0 12 2 147
222 183 2 102 121 211 0 0
0
69.8770
161508.13361901

:

: records 6-11 not shown

:

12:
f9af
adff 9054
802338562.38083220
-21.464708
-0.058553
44.054688
0 2
1.144043
1.640625
100 37 169 110
191 115 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 3 15 57
162 175 224 217 233 205 217 175
176 218 201 187 204 159 140 128
118 110 226 92 132 131 71 134
198 66 138 140 137 215 213 27
231 138 183 139 92 205 53 143
48
69.8770
161512.79739882

13:
9af
adff a000
802336438.28172624
-21.492058
-0.058553
43.986328
0 2
1.144043
1.640625
101 36 163 112
199 115 0
0 0 0 0 249 175 173 255
201 0 70 201 28 19 209 243
0 0 176 38 41 39 21 103
37 152 102 201 113 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 1 13 61 142 161
244 243 236 211 204 220 179 195
208
133.6106
75141.34767120

Appendix E
Statistical Indicators for GFO and JASON Based on 1-Minute Track Segments

Table E-1 Statistical Indicators for GFO Based on 1-Minute Track Segments

Time Period			SWH (m)		Noise Level (cm)		
Cycle	Cycle Start Date	Cycle End Date	SWH Mean	STD	Noise Mean	STD	at 2m SWH
01	2000-352	2001-002	2.629	1.221	2.996	1.162	2.542
02	2001-003	2001-019	2.506	1.185	2.903	1.115	2.547
03	2001-020	2001-036	2.552	1.158	3.044	1.271	2.680
04	2001-037	2001-053	2.520	1.144	2.914	1.108	2.545
05	2001-054	2001-070	2.603	1.237	3.006	1.149	2.596
06	2001-071	2001-087	2.644	1.231	3.022	1.123	2.592
07	2001-088	2001-104	2.680	1.242	3.032	1.136	2.573
08	2001-105	2001-121	2.600	1.252	2.962	1.115	2.563
09	2001-122	2001-138	2.605	1.326	3.015	1.212	2.590
10	2001-139	2001-155	2.466	1.258	2.886	1.153	2.560
11	2001-156	2001-172	2.504	1.261	2.906	1.145	2.557
12	2001-173	2001-189	2.674	1.401	3.047	1.282	2.567
13	2001-190	2001-206	2.583	1.379	3.007	1.247	2.599
14	2001-207	2001-223	2.699	1.406	3.059	1.259	2.572
15	2001-224	2001-240	2.561	1.293	2.953	1.161	2.569
16	2001-241	2001-257	2.626	1.435	3.009	1.261	2.572
17	2001-258	2001-274	2.623	1.343	3.006	1.190	2.583
18	2001-275	2001-291	2.612	1.287	2.998	1.164	2.581
19	2001-292	2001-308	2.379	1.141	2.813	1.069	2.552
20	2001-309	2001-325	2.488	1.165	2.898	1.102	2.567
21	2001-326	2001-342	2.404	1.077	2.818	1.023	2.546
22	2001-343	2001-359	2.441	1.143	2.857	1.097	2.555
23	2001-360	2002-011	2.480	1.199	2.922	1.150	2.583
24	2002-012	2002-028	2.453	1.183	2.858	1.108	2.544

Table E-1 Statistical Indicators for GFO Based on 1-Minute Track Segments (Continued)

Time Period			SWH (m)		Noise Level (cm)		
Cycle	Cycle Start Date	Cycle End Date	SWH Mean	STD	Noise Mean	STD	at 2m SWH
25	2002-029	2002-045	2.575	1.198	2.946	1.118	2.553
26	2002-046	2002-062	2.422	1.094	2.820	1.035	2.539
27	2002-063	2002-079	2.500	1.166	2.892	1.074	2.552
28	2002-080	2002-096	2.608	1.161	2.972	1.103	2.554
29	2002-097	2002-113	2.504	1.217	2.910	1.100	2.574
30	2002-114	2002-130	2.558	1.252	2.959	1.158	2.572
31	2002-131	2002-147	2.543	1.289	2.956	1.215	2.564
32	2002-148	2002-164	2.517	1.245	2.935	1.165	2.573
33	2002-165	2002-181	2.612	1.353	2.989	1.231	2.559
34	2002-182	2002-198	2.513	1.314	2.921	1.206	2.559
35	2002-199	2002-215	2.653	1.427	3.026	1.255	2.579
36	2002-216	2002-232	2.634	1.400	2.994	1.221	2.557
37	2002-233	2002-249	2.527	1.299	2.941	1.162	2.582
38	2002-250	2002-266	2.546	1.366	2.959	1.189	2.591
39	2002-267	2002-283	2.415	1.141	2.859	1.092	2.571
40	2002-284	2002-300	2.482	1.196	2.921	1.112	2.597
41	2002-301	2002-317	2.499	1.228	2.905	1.133	2.569
42	2002-318	2002-334	2.497	1.148	2.905	1.101	2.558
43	2002-335	2002-351	2.545	1.197	2.967	1.143	2.587
44	2002-352	2003-003	2.427	1.143	2.856	1.087	2.564
45	2003-004	2003-020	2.515	1.208	2.941	1.139	2.588
46	2003-021	2003-037	2.439	1.128	2.859	1.057	2.562
47	2003-038	2003-054	2.527	1.226	2.954	1.141	2.594
48	2003-055	2003-071	2.479	1.161	2.921	1.119	2.586
49	2003-072	2003-072	2.535	1.220	2.943	1.085	2.597
50	2003-089	2003-105	2.564	1.255	2.988	1.159	2.603
51	2003-106	2003-122	2.510	1.228	2.938	1.145	2.590
52	2003-123	2003-139	2.576	1.285	2.962	1.171	2.565

Table E-1 Statistical Indicators for GFO Based on 1-Minute Track Segments (Continued)

Time Period			SWH (m)		Noise Level (cm)		
Cycle	Cycle Start Date	Cycle End Date	SWH Mean	STD	Noise Mean	STD	at 2m SWH
53	2003-140	2003-156	2.594	1.343	3.014	1.241	2.597
54	2003-157	2003-173	2.513	1.351	2.961	1.233	2.605
55	2003-174	2003-190	2.430	1.296	2.878	1.165	2.583
56	2003-191	2003-207	2.692	1.423	3.032	1.229	2.568
57	2003-208	2003-224	2.582	1.447	2.981	1.251	2.587
58	2003-225	2003-241	2.398	1.355	2.851	1.201	2.577
59	2003-242	2003-258					
60	2003-259	2003-275					
61	2003-276	2003-292					
62	2003-293	2003-309	2.404	1.208	2.842	1.104	2.575
63	2003-310	2003-326	2.473	1.118	2.888	1.071	2.563
64	2003-327	2003-343	2.483	1.186	2.915	1.141	2.573
65	2003-344	2003-360	2.479	1.091	2.898	1.055	2.579
66	2003-361	2004-012	2.367	1.124	2.796	1.057	2.548
67	2004-013	2004-029	2.411	1.175	2.873	1.099	2.592
68	2004-030	2004-046	2.46	1.168	2.877	1.093	2.564
69	2004-047	2004-063	2.536	1.278	2.961	1.182	2.594
72	2004-098	2004-114	2.653	1.307	3.065	1.212	2.61
73	2004-115	2004-131	2.582	1.258	2.979	1.14	2.588
74	2004-132	2004-148	2.444	1.347	2.878	1.194	2.574
75	2004-149	2004-165	2.556	1.332	2.961	1.192	2.581
76	2004-166	2004-182	2.607	1.394	2.991	1.247	2.568
77	2004-183	2004-199	2.51	1.371	2.93	1.198	2.587
78	2004-200	2004-216	2.449	1.375	2.894	1.206	2.587
79	2004-217	2004-233	2.513	1.331	2.936	1.207	2.584
80	2004-234	2004-250	2.448	1.282	2.945	1.199	2.632
81	2004-251	2004-267	2.602	1.395	3.000	1.245	2.588
82	2004-268	2004-284	2.429	1.214	2.859	1.103	2.57

Table E-1 Statistical Indicators for GFO Based on 1-Minute Track Segments (Continued)

Time Period			SWH (m)		Noise Level (cm)		
Cycle	Cycle Start Date	Cycle End Date	SWH Mean	STD	Noise Mean	STD	at 2m SWH
83	2004-285	2004-301	2.456	1.14	2.875	1.079	2.564
84	2004-302	2004-318	2.442	1.11	2.855	1.054	2.557
85	2004-319	2004-335	2.359	1.105	2.802	1.059	2.561
86	2004-336	2004-352	2.481	1.170	2.898	1.122	2.563
87	2004-353	2005-003	2.430	1.159	2.873	1.101	2.578
88	2005-004	2005-020	2.442	1.167	2.863	1.115	2.552
89	2005-021	2005-037	2.418	1.099	2.883	1.054	2.606
90	2005-038	2005-054	2.423	1.115	2.859	1.072	2.568
91	2005-055	2005-071	2.554	1.213	2.970	1.133	2.596
92	2005-072	2005-088	2.438	1.134	2.890	1.068	2.596
93	2005-089	2005-105	2.645	1.268	3.008	1.149	2.574
94	2005-106	2005-122	2.533	1.263	2.961	1.166	2.593
95	2005-123	2005-139	2.468	1.216	2.924	1.136	2.600
96	2005-140	2005-156	2.547	1.346	2.967	1.219	2.585
97	2005-157	2005-173	2.468	1.245	2.901	1.148	2.575
98	2005-174	2005-190	2.511	1.380	2.931	1.211	2.588
99	2005-191	2005-207	2.646	1.420	3.040	1.249	2.595
100	2005-208	2005-224	2.427	1.322	2.887	1.209	2.586
101	2005-225	2005-241	2.498	1.423	2.945	1.262	2.601
102	2005-242	2005-258	2.573	1.331	2.977	1.198	2.580
103	2005-259	2005-275	2.523	1.301	2.945	1.190	2.588
104	2005-276	2005-292	2.528	1.238	2.946	1.140	2.589
105	2005-293	2005-309	2.548	1.195	2.949	1.110	2.587
106	2005-310	2005-326	2.425	1.164	2.871	1.109	2.584
107	2005-327	2005-343	2.392	1.159	2.831	1.099	2.560
108	2005-344	2005-360	2.357	1.156	2.804	1.100	2.556
109	**2005-361**	**2006-012**	**2.447**	**1.186**	**2.881**	**1.109**	**2.573**
110	**2006-013**	**2006-029**	**2.535**	**1.137**	**2.935**	**1.094**	**2.565**

Table E-1 Statistical Indicators for GFO Based on 1-Minute Track Segments (Continued)

Time Period			SWH (m)		Noise Level (cm)		
Cycle	Cycle Start Date	Cycle End Date	SWH Mean	STD	Noise Mean	STD	at 2m SWH
111	**2006-030**	**2006-046**	**2.494**	**1.182**	**2.918**	**1.115**	**2.583**
112	**2006-047**	**2006-063**	**2.431**	**1.146**	**2.847**	**1.077**	**2.549**
113	**2006-064**	**2006-080**	**2.503**	**1.159**	**2.903**	**1.056**	**2.578**
114	**2006-081**	**2006-097**	**2.602**	**1.264**	**2.994**	**1.158**	**2.587**
115	**2006-098**	**2006-114**	**2.483**	**1.196**	**2.900**	**1.090**	**2.580**
116	**2006-115**	**2006-131**	**2.537**	**1.284**	**2.962**	**1.153**	**2.601**
117	**2006-132**	**2006-148**	**2.446**	**1.285**	**2.898**	**1.170**	**2.593**
118	**2006-149**	**2006-165**	**2.606**	**1.420**	**3.020**	**1.262**	**2.599**
119	**2006-166**	**2006-182**	**2.587**	**1.334**	**2.983**	**1.227**	**2.573**
120	**2006-183**	**2006-199**	**2.595**	**1.398**	**2.982**	**1.231**	**2.572**
121	**2006-200**	**2006-216**	**No Data**				
122	**2006-217**	**2006-233**	**No Data**				
123	**2006-234**	**2006-250**	**No Data**				
124	**2006-251**	**2006-267**	**No Data**				
125	**2006-268**	**2006-284**	**No Data**				
126	**2006-285**	**2006-301**	**No Data**				
127	**2006-302**	**2006-318**	**No Data**				
128	**2006-319**	**2006-335**	**No Data**				
129	**2006-336**	**2006-352**	**No Data**				

Note: The statistical indicators since last update are indicated by bold type.

Table E-2 Statistical Indicators for JASON Based on 1-Minute Track Segments

Time Period			SWH (m)		Noise Level (cm)		
Cycle	Cycle Start Date	Cycle End Date	SWH Mean	STD	Noise Mean	STD	at 2m SWH
3	2002-035	2002-044	2.659	1.181	3.145	1.039	2.797
4	2002-044	2002-054	2.557	1.113	3.114	1.027	2.804
5	2002-054	2002-064	2.451	1.067	3.028	0.981	2.798
6	2002-064	2002-074	2.600	1.149	3.100	1.045	2.768
7	2002-074	2002-084	2.699	1.135	3.216	1.079	2.828
8	2002-084	2002-094	3.027	1.462	3.558	1.300	2.954
9	2002-094	2002-104	2.669	1.246	3.222	1.112	2.842
10	2002-104	2002-114	2.683	1.237	3.203	1.108	2.827
11	2002-114	2002-124	2.679	1.250	3.157	1.102	2.779
12	2002-124	2002-134	2.721	1.224	3.208	1.101	2.813
13	2002-134	2002-144	2.597	1.268	3.149	1.123	2.807
14	2002-144	2002-154	2.670	1.286	3.207	1.141	2.814
15	2002-154	2002-163	2.648	1.239	3.204	1.151	2.812
16	2002-163	2002-173	2.701	1.277	3.215	1.145	2.804
17	2002-173	2002-183	2.815	1.371	3.269	1.184	2.791
18	2002-183	2002-193	2.669	1.254	3.219	1.160	2.802
19	2002-193	2002-203	2.690	1.403	3.214	1.189	2.813
20	2002-203	2002-213	2.868	1.376	3.303	1.154	2.827
21	2002-213	2002-223	2.781	1.426	3.249	1.214	2.794
22	2002-223	2002-233	2.823	1.415	3.305	1.180	2.854
23	2002-233	2002-243	2.545	1.175	3.124	1.048	2.824
24	2002-243	2002-253	2.653	1.290	3.150	1.092	2.799
25	2002-253	2002-263	2.598	1.354	3.146	1.151	2.802
26	2002-263	2002-273	2.488	1.119	3.074	1.016	2.815
27	2002-273	2002-282	2.547	1.152	3.113	1.059	2.809
28	2002-282	2002-292	2.602	1.166	3.148	1.071	2.810

Table E-2 Statistical Indicators for JASON Based on 1-Minute Track Segments (Continued)

Time Period			SWH (m)		Noise Level (cm)		
Cycle	Cycle Start Date	Cycle End Date	SWH Mean	STD	Noise Mean	STD	at 2m SWH
29	2002-292	2002-302	2.506	1.125	3.086	1.010	2.825
30	2002-302	2002-312	2.534	1.156	3.045	1.010	2.767
31	2002-312	2002-322	2.701	1.185	3.100	1.056	2.735
32	2002-322	2002-332	2.569	1.116	3.049	1.028	2.737
33	2002-332	2002-342	2.719	1.231	3.132	1.068	2.737
34	2002-342	2002-352	2.616	1.086	3.131	1.031	2.782
35	2002-352	2002-362	2.505	1.033	3.015	0.976	2.755
36	2002-362	2003-007	2.626	1.191	3.072	1.048	2.755
37	2003-007	2003-017	2.644	1.153	3.089	1.014	2.777
38	2003-017	2003-027	2.644	1.205	3.130	1.081	2.781
39	2003-027	2003-036	2.490	1.042	3.070	1.015	2.792
40	2003-036	2003-046	2.564	1.133	3.085	1.024	2.782
41	2003-046	2003-056	2.709	1.218	3.122	1.064	2.747
42	2003-056	2003-066	2.566	1.065	3.101	1.029	2.782
43	2003-066	2003-076	2.625	1.167	3.112	1.049	2.780
44	2003-076	2003-086	2.635	1.195	3.169	1.057	2.846
45	2003-086	2003-096	2.630	1.188	3.140	1.045	2.799
46	2003-096	2003-106	2.874	1.282	2.977	1.032	2.503
47	2003-106	2003-116	2.830	1.252	2.939	0.961	2.528
48	2003-116	2003-126	2.697	1.302	2.882	1.009	2.510
49	2003-126	2003-136	2.744	1.228	2.925	1.017	2.514
50	2003-136	2003-145	2.912	1.415	3.022	1.076	2.525
51	2003-145	2003-155	2.760	1.278	2.971	1.021	2.548
52	2003-155	2003-165	2.736	1.323	2.958	1.055	2.534
53	2003-165	2003-175	2.759	1.363	2.969	1.087	2.537
54	2003-175	2003-185	2.654	1.255	2.904	1.035	2.534
55	2003-185	2003-195	2.771	1.369	2.975	1.130	2.523
56	2003-195	2003-205	2.956	1.419	3.073	1.114	2.556

Table E-2 Statistical Indicators for JASON Based on 1-Minute Track Segments (Continued)

Time Period			SWH (m)		Noise Level (cm)		
Cycle	Cycle Start Date	Cycle End Date	SWH Mean	STD	Noise Mean	STD	at 2m SWH
57	2003-205	2003-215	2.952	1.483	3.048	1.128	2.527
58	2003-215	2003-225	2.762	1.394	2.976	1.086	2.556
59	2003-225	2003-235	2.641	1.413	2.937	1.128	2.561
60	2003-235	2003-245	2.656	1.357	2.907	1.072	2.539
61	2003-245	2003-255	2.660	1.330	2.906	1.017	2.556
62	2003-255	2003-264	2.723	1.359	2.960	1.078	2.558
63	2003-264	2003-274	2.630	1.277	2.894	1.030	2.538
64	2003-274	2003-284	2.527	1.095	2.814	0.921	2.534
65	2003-284	2003-294	2.646	1.211	2.833	0.927	2.508
66	2003-294	2003-304	2.575	1.165	2.800	0.927	2.498
67	2003-304	2003-314	2.636	1.201	2.821	0.945	2.493
68	2003-314	2003-324	2.683	1.088	2.856	0.912	2.495
69	2003-324	2003-334	2.680	1.371	2.805	1.048	2.475
70	2003-334	2003-344	2.701	1.225	2.863	0.953	2.504
71	2003-344	2003-354	2.634	1.096	2.829	0.895	2.491
72	2003-354	2003-364	2.624	1.062	2.845	0.931	2.499
73	2003-364	2004-009	2.485	1.063	2.747	0.875	2.492
74	2004-009	2004-018	2.710	1.300	2.895	1.017	2.507
75	2004-018	2004-028	2.523	1.098	2.804	0.907	2.525
76	2004-028	2004-038	2.555	1.108	2.788	0.920	2.491
77	2004-038	2004-048	2.693	1.184	2.849	0.940	2.491
78	2004-048	2004-058	2.641	1.114	2.840	0.894	2.515
79	2004-058	2004-068	2.749	1.113	2.865	0.882	2.502
80	2004-068	2004-078	2.741	1.176	2.878	0.955	2.477
81	2004-078	2004-088	2.770	1.161	2.935	0.956	2.518
82	2004-088	2004-098	2.837	1.215	2.927	0.963	2.496
83	2004-098	2004-108	2.794	1.263	2.935	0.993	2.505
84	2004-108	2004-118	2.889	1.308	3.003	1.041	2.515

Table E-2 Statistical Indicators for JASON Based on 1-Minute Track Segments (Continued)

Time Period			SWH (m)		Noise Level (cm)		
Cycle	Cycle Start Date	Cycle End Date	SWH Mean	STD	Noise Mean	STD	at 2m SWH
85	2004-118	2004-128	2.800	1.291	2.961	1.058	2.498
86	2004-128	2004-137	2.649	1.233	2.867	0.983	2.514
87	2004-137	2004-147	2.715	1.362	2.938	1.048	2.554
88	2004-147	2004-157	2.880	1.421	3.048	1.128	2.544
89	2004-157	2004-167	2.688	1.205	2.917	0.993	2.525
90	2004-167	2004-177	2.861	1.443	2.999	1.123	2.515
91	2004-177	2004-187	2.854	1.356	2.997	1.097	2.516
92	2004-187	2004-197	2.685	1.318	2.930	1.047	2.550
93	2004-197	2004-207	2.753	1.458	2.973	1.088	2.569
94	2004-207	2004-217	2.686	1.368	2.913	1.027	2.554
95	2004-217	2004-227	2.740	1.335	2.970	1.087	2.539
96	2004-227	2004-237	2.739	1.255	2.926	1.010	2.525
97	2004-237	2004-247	2.644	1.274	2.902	1.041	2.544
98	2004-247	2004-256	2.765	1.380	2.975	1.091	2.548
99	2004-256	2004-266	2.779	1.330	2.937	1.021	2.516
100	2004-266	2004-276	2.582	1.188	2.827	0.938	2.520
101	2004-276	2004-286	2.681	1.152	2.872	0.956	2.504
102	2004-286	2004-296	2.626	1.098	2.811	0.894	2.484
103	2004-296	2004-306	2.675	1.180	2.856	0.942	2.504
104	2004-306	2004-316	2.589	1.059	2.758	0.842	2.475
105	2004-316	2004-326	2.618	1.147	2.795	0.927	2.481
106	2004-326	2004-336	2.516	1.138	2.752	0.921	2.472
107	2004-336	2004-346	2.632	1.161	2.819	0.959	2.466
108	2004-346	2004-356	2.669	1.155	2.813	0.965	2.443
109	2004-356	2004-366	2.522	1.064	2.768	0.902	2.477
110	2004-366	2005-009	2.635	1.153	2.831	0.996	2.449
111	2005-009	2005-019	2.717	1.266	2.808	0.992	2.426
112	2005-019	2005-029	2.563	1.106	2.752	0.924	2.453

Table E-2 Statistical Indicators for JASON Based on 1-Minute Track Segments (Continued)

Time Period			SWH (m)		Noise Level (cm)		
Cycle	Cycle Start Date	Cycle End Date	SWH Mean	STD	Noise Mean	STD	at 2m SWH
113	2005-029	2005-039	2.707	1.120	2.781	0.867	2.446
114	2005-039	2005-049	2.608	1.102	2.806	0.889	2.497
115	2005-049	2005-059	2.597	1.140	2.786	0.884	2.492
116	2005-059	2005-069	2.850	1.270	2.959	1.014	2.493
117	2005-069	2005-079	2.767	1.125	2.914	0.914	2.528
118	2005-079	2005-089	2.586	1.101	2.828	0.900	2.527
119	2005-089	2005-099	2.798	1.231	2.905	0.961	2.497
120	2005-099	2005-109	2.935	1.292	2.955	1.024	2.453
121	2005-109	2005-119	2.789	1.257	2.884	1.000	2.463
122	2005-119	2005-128	2.704	1.276	2.884	1.022	2.498
123	2005-128	2005-138	2.702	1.218	2.883	1.026	2.465
124	2005-138	2005-148	2.755	1.316	2.887	1.022	2.483
125	2005-148	2005-158	2.724	1.261	2.928	1.052	2.507
126	2005-158	2005-168	2.748	1.204	2.896	0.984	2.497
127	2005-168	2005-178	2.659	1.317	2.893	1.057	2.522
128	2005-178	2005-188	2.762	1.349	2.954	1.087	2.522
129	2005-188	2005-198	2.931	1.477	3.051	1.165	2.513
130	2005-198	2005-208	2.889	1.349	2.963	1.058	2.481
131	2005-208	2005-218	2.628	1.260	2.897	1.033	2.545
132	2005-218	2005-228	2.793	1.449	2.960	1.133	2.510
133	2005-228	2005-237	2.791	1.431	2.874	1.036	2.486
134	2005-237	2005-247	2.763	1.279	2.866	0.956	2.511
135	2005-247	2005-257	2.703	1.228	2.816	0.954	2.456
136	2005-257	2005-267	2.757	1.335	2.825	1.023	2.445
137	2005-267	2005-277	2.804	1.416	2.866	1.027	2.475
138	2005-277	2005-287	2.721	1.223	2.847	0.956	2.476
139	2005-287	2005-297	2.732	1.192	2.829	0.913	2.473
140	2005-297	2005-307	2.803	1.209	2.850	0.898	2.442

Table E-2 Statistical Indicators for JASON Based on 1-Minute Track Segments (Continued)

Time Period			SWH (m)		Noise Level (cm)		
Cycle	Cycle Start Date	Cycle End Date	SWH Mean	STD	Noise Mean	STD	at 2m SWH
141	2005-307	2005-317	2.811	1.279	2.834	0.949	2.404
142	2005-317	2005-327	2.614	1.124	2.722	0.850	2.417
143	2005-327	2005-337	2.677	1.166	2.761	0.853	2.431
144	2005-337	2005-347	2.789	1.245	2.788	0.943	2.362
145	2005-347	2005-356	2.680	1.191	2.759	0.916	2.382
146	2005-356	2006-001	2.699	1.300	2.816	0.966	2.431
147	2006-001	2006-011	2.744	1.200	2.838	0.922	2.435
148	2006-011	2006-021	2.806	1.232	2.805	0.950	2.359
149	2006-021	2006-031	2.737	1.096	2.831	0.851	2.444
150	2006-031	2006-041	2.788	1.236	2.858	0.915	2.448
151	2006-041	2006-051	2.722	1.206	2.830	0.888	2.459
152	2006-051	2006-061	2.659	1.157	2.799	0.869	2.451
153	2006-061	2006-071	2.851	1.216	2.889	0.912	2.439
154	2006-071	2006-081	2.743	1.136	2.821	0.841	2.450
155	2006-081	2006-091	2.938	1.307	2.944	0.947	2.455
156	2006-091	2006-101	2.818	1.284	2.905	0.945	2.468
157	2006-101	2006-110	2.745	1.204	2.859	0.915	2.462
158	2006-110	2006-120	2.872	1.263	2.938	0.944	2.474
159	2006-120	2006-130	2.847	1.354	2.943	0.999	2.479
160	2006-130	2006-140	2.712	1.331	2.848	0.949	2.470
161	2006-140	2006-150	2.899	1.390	2.926	1.005	2.446
162	2006-150	2006-160	2.937	1.511	2.990	1.061	2.491
163	2006-160	2006-170	2.925	1.365	2.987	1.023	2.471
164	2006-170	2006-180	2.862	1.310	2.945	0.961	2.488
165	2006-180	2006-190	2.907	1.486	2.977	1.054	2.481
166	2006-190	2006-200	2.887	1.404	2.929	0.998	2.467
167	2006-200	2006-210	2.976	1.549	3.015	1.082	2.495
168	2006-210	2006-220	2.784	1.320	2.918	0.976	2.492

Table E-2 Statistical Indicators for JASON Based on 1-Minute Track Segments (Continued)

Time Period			SWH (m)		Noise Level (cm)		
Cycle	Cycle Start Date	Cycle End Date	SWH Mean	STD	Noise Mean	STD	at 2m SWH
169	2006-220	2006-229	2.781	1.298	2.920	0.976	2.485
170	2006-229	2006-239	2.741	1.354	2.873	0.975	2.478
171	2006-239	2006-249	2.986	1.525	3.031	1.095	2.484
172	2006-249	2006-259	2.994	1.466	3.013	1.031	2.487
173	2006-259	2006-269	2.892	1.298	2.856	0.919	2.431
174	2006-269	2006-279	2.774	1.224	2.828	0.899	2.438
175	2006-279	2006-289	3.000	1.431	2.985	1.016	2.456
176	2006-289	2006-299	2.960	1.322	2.949	0.958	2.448
177	2006-299	2006-309	2.863	1.277	2.899	0.939	2.439
179	2006-319	2006-329	2.717	1.098	2.767	0.843	2.406
180	2006-329	2006-339	2.710	1.194	2.830	0.914	2.442
181	2006-339	2006-348	2.800	1.247	2.878	0.920	2.454
182	2006-348	2006-358	2.663	1.122	2.778	0.855	2.434

Appendix F
GFO Statistical Indicators

Table F-1 Statistical Indicators

year	cycle	limit 1 (m/s)	limit2 (m/s)	$<\sigma_0>$ (dB)	<SWH> (m)	$<U_{gfo}>$ (m/s)	$<U_{ncep}>$ (m/s)	$<U_{gfo}> - <U_{ncep}>$
2001	1	4.865	11.122	11.526	2.334	7.236	7.618	-0.382
2001	2	4.862	10.885	11.543	2.229	7.190	7.521	-0.331
2001	3	5.039	11.055	11.284	2.313	8.051	7.793	0.258
2001	4	4.896	10.846	11.269	2.288	8.103	7.604	0.499
2001	5	4.558	10.960	11.369	2.307	7.803	7.355	0.448
2001	6	4.498	10.902	11.412	2.327	7.673	7.337	0.336
2001	7	4.746	11.207	11.275	2.413	8.115	7.682	0.433
2001	8	4.836	11.054	11.398	2.278	7.678	7.646	0.032
2001	9	4.660	10.990	11.585	2.258	7.067	7.432	-0.365
2001	10	4.667	10.856	11.566	2.124	7.134	7.379	-0.245
2001	11	4.768	11.025	11.537	2.173	7.213	7.578	-0.365
2001	12	4.968	11.353	11.312	2.312	7.949	7.786	0.163
2001	13	4.740	10.997	11.319	2.233	7.952	7.505	0.447
2001	14	4.836	11.223	11.205	2.326	8.334	7.656	0.678
2001	15	4.763	11.150	11.292	2.239	8.031	7.607	0.424
2001	16	4.534	11.256	11.342	2.255	7.899	7.487	0.412
2001	17	4.627	11.230	11.375	2.247	7.775	7.486	0.289
2001	18	4.694	11.024	11.481	2.287	7.390	7.459	-0.069
2001	19	4.648	10.778	11.589	2.104	7.035	7.365	-0.330
2001	20	4.842	10.962	11.433	2.215	7.544	7.578	-0.034
2001	21	4.909	10.871	11.533	2.156	7.182	7.620	-0.438
2001	22	4.789	10.881	11.366	2.191	7.765	7.518	0.247
2002	23	4.729	10.814	11.372	2.210	7.744	7.376	0.368
2002	24	4.819	10.863	11.291	2.199	8.029	7.559	0.470
2002	25	4.777	11.064	11.280	2.309	8.061	7.604	0.457
2002	26	4.668	10.797	11.366	2.150	7.783	7.384	0.399
2002	27	4.710	11.168	11.333	2.219	7.903	7.589	0.314
2002	28	4.796	11.183	11.337	2.337	7.877	7.730	0.147

Table F-1 Statistical Indicators

year	cycle	limit 1 (m/s)	limit2 (m/s)	$<\sigma_0>$ (dB)	<SWH> (m)	$<U_{gfo}>$ (m/s)	$<U_{ncep}>$ (m/s)	$<U_{gfo}> - <U_{ncep}>$
2002	29	4.709	10.966	11.520	2.184	7.259	7.575	-0.316
2002	30	4.917	11.123	11.405	2.251	7.617	7.703	-0.086
2002	31	4.578	11.090	11.551	2.203	7.156	7.430	-0.274
2002	32	4.844	11.079	11.345	2.190	7.823	7.617	0.206
2002	33	5.049	11.397	11.153	2.301	8.477	7.881	0.596
2002	34	4.743	11.058	11.284	2.172	8.053	7.507	0.546
2002	35	4.737	11.418	11.248	2.264	8.186	7.665	0.521
2002	36	4.769	11.349	11.239	2.272	8.210	7.679	0.531
2002	37	4.676	11.142	11.316	2.207	7.958	7.575	0.383
2002	38	4.648	11.198	11.436	2.160	7.554	7.503	0.051
2002	39	4.977	10.996	11.499	2.148	7.300	7.737	-0.437
2002	40	4.642	10.916	11.599	2.173	7.006	7.417	-0.411
2002	41	4.847	11.046	11.468	2.201	7.404	7.662	-0.258
2002	42	4.915	10.957	11.304	2.245	7.970	7.674	0.296
2002	43	4.721	4.721	11.335	2.275	7.881	7.490	0.391
2002	44	4.699	10.811	11.368	2.160	7.768	7.441	0.327
2003	45	4.637	11.076	11.364	2.241	7.793	7.514	0.279
2003	46	4.729	10.813	11.351	2.192	7.815	7.509	0.306
2003	47	4.628	11.081	11.359	2.247	7.807	7.501	0.306
2003	48	4.579	10.955	11.442	2.233	7.534	7.450	0.084
2003	49	4.401	11.073	11.660	2.198	6.869	7.366	-0.497
2003	50	4.597	11.181	11.529	2.258	7.239	7.567	-0.328
2003	51	4.588	10.934	11.551	2.182	7.167	7.437	-0.270
2003	52	4.865	11.147	11.267	2.270	8.089	7.721	0.368
2003	53	4.464	10.986	11.378	2.249	7.751	7.303	0.448
2003	54	4.496	11.133	11.361	2.155	7.822	7.376	0.446
2003	55	4.488	10.810	11.396	2.112	7.704	7.319	0.385
2003	56	4.921	11.556	11.163	2.330	8.465	7.920	0.545
2003	57	4.486	11.334	11.369	2.174	7.799	7.456	0.343
2003	58	4.468	11.093	11.452	2.016	7.514	7.389	0.125
2003	59							

Table F-1 Statistical Indicators

year	cycle	limit 1 (m/s)	limit2 (m/s)	$<\sigma_0>$ (dB)	<SWH> (m)	$<U_{gfo}>$ (m/s)	$<U_{ncep}>$ (m/s)	$<U_{gfo}> - <U_{ncep}>$
2003	60							
2003	61							
2003	62	4.467	10.753	11.378	2.097	7.744	7.263	0.481
2003	63	4.780	10.948	11.302	2.222	7.974	7.560	0.414
2003	64	4.589	11.056	11.379	2.184	7.757	7.451	0.306
2003	65	4.807	10.929	11.341	2.234	7.835	7.571	0.264
2003	66	4.766	10.920	11.372	2.108	7.731	7.554	0.177
2004	67	4.401	10.845	11.515	2.124	7.303	7.220	0.083
2004	68	4.837	11.220	11.322	2.191	7.904	7.710	0.194
2004	69	4.576	11.110	11.439	2.217	7.532	7.463	0.069
2004	70							
2004	71							
2004	72	4.651	11.244	11.223	2.357	8.270	7.661	0.609
2004	73	4.774	10.991	11.271	2.271	8.078	7.572	0.506
2004	74	4.334	10.855	11.454	2.081	7.519	7.176	0.343
2004	75	4.702	11.111	11.317	2.202	7.937	7.540	0.397
2004	76	4.738	11.559	11.229	2.270	8.258	7.808	0.450
2004	77	4.418	11.212	11.413	2.129	7.662	7.424	0.238
2004	78	4.624	11.166	11.368	2.049	7.784	7.523	0.261
2004	79	4.781	11.282	11.358	2.176	7.794	7.699	0.095
2004	80	4.557	11.035	11.470	2.091	7.445	7.377	0.068
2004	81	4.807	11.341	11.322	2.224	7.923	7.705	0.218
2004	82	4.659	11.005	11.337	2.106	7.867	7.476	0.391
2004	83	4.674	10.925	11.342	2.176	7.848	7.520	0.328
2004	84	4.648	10.836	11.380	2.170	7.719	7.454	0.265
2004	85	4.518	10.806	11.461	2.088	7.478	7.352	0.126
2004	86	4.662	11.157	11.371	2.208	7.750	7.570	0.180
2004	87	4.594	11.133	11.429	2.143	7.562	7.511	0.051
2005	88	4.864	11.189	11.354	2.179	7.770	7.717	0.053
2005	89	4.657	10.974	11.468	2.145	7.421	7.497	-0.076
2005	90	4.780	10.923	11.544	2.161	7.156	7.546	-0.390

Table F-1 Statistical Indicators

year	cycle	limit 1 (m/s)	limit2 (m/s)	$<\sigma_0>$ (dB)	<SWH> (m)	$<U_{gfo}>$ (m/s)	$<U_{ncep}>$ (m/s)	$<U_{gfo}> - <U_{ncep}>$
2005	91	4.617	11.229	11.457	2.277	7.481	7.577	-0.096
2005	92	4.403	10.655	11.502	2.147	7.343	7.164	0.179
2005	93	4.882	11.364	11.177	2.365	8.400	7.868	0.532
2005	94	4.254	10.839	11.484	2.195	7.445	7.144	0.301
2005	95	4.431	10.797	11.417	2.161	7.619	7.291	0.328
2005	96	4.392	11.013	11.431	2.176	7.598	7.322	0.276
2005	97	4.544	10.911	11.423	2.143	7.596	7.371	0.225
2005	98	4.609	11.319	11.399	2.126	7.670	7.536	0.134
2005	99	4.769	11.509	11.338	2.271	7.864	7.783	0.081
2005	100	4.617	11.075	11.491	2.051	7.376	7.450	-0.074
2005	101	4.584	11.093	11.460	2.108	7.464	7.412	0.052
2005	102	4.793	11.146	11.317	2.251	7.926	7.633	0.293
2005	103	4.605	11.077	11.352	2.203	7.831	7.524	0.307
2005	104	4.581	11.085	11.311	2.221	7.960	7.483	0.477
2005	105	4.674	11.183	11.273	2.254	8.087	7.590	0.497
2005	106	4.428	10.951	11.412	2.131	7.629	7.298	0.331
2005	107	4.584	10.988	11.430	2.109	7.542	7.428	0.114
2005	108	4.471	10.876	11.557	2.073	7.144	7.295	-0.151
2005	**109**	**4.697**	**11.069**	**11.429**	**2.155**	**7.548**	**7.562**	**-0.014**
2006	**110**	**4.988**	**11.084**	**11.254**	**2.298**	**8.117**	**7.794**	**0.323**
2006	**110**	**4.984**	**11.158**	**11.247**	**2.300**	**8.143**	**7.798**	**0.345**
2006	**111**	**4.802**	**10.990**	**11.378**	**2.240**	**7.708**	**7.584**	**0.124**
2006	**112**	**4.659**	**10.880**	**11.317**	**2.159**	**7.939**	**7.485**	**0.454**
2006	**113**	**4.637**	**11.032**	**11.241**	**2.242**	**8.200**	**7.523**	**0.677**
2006	**114**	**4.427**	**11.065**	**11.324**	**2.279**	**7.930**	**7.352**	**0.578**
2006	**115**	**4.468**	**10.949**	**11.393**	**2.191**	**7.707**	**7.438**	**0.269**
2006	**116**	**4.357**	**10.936**	**11.480**	**2.176**	**7.442**	**7.262**	**0.180**
2006	**117**	**4.399**	**10.820**	**11.523**	**2.110**	**7.290**	**7.236**	**0.054**
2006	**118**	**4.525**	**11.205**	**11.436**	**2.231**	**7.561**	**7.500**	**0.061**
2006	**119**	**4.889**	**11.346**	**11.310**	**2.244**	**7.939**	**7.813**	**0.126**
2006	**120**	**4.886**	**11.296**	**11.331**	**2.223**	**7.872**	**7.747**	**0.125**

Note: The Cycle Summaries since last year's report are indicated by bold type.

Appendix G
GFO Cal-1 Range/Temperature

Cycle	Height	Receiver Temperature	Delta
1	276.831	40.0637	-10.842
2	274.780	38.2449	-8.791
3	272.172	36.0790	-6.183
4	269.492	33.5545	-3.503
5	269.686	33.3710	-3.697
6	268.989	33.1150	-3.000
7	268.550	33.1054	-2.561
8	269.159	35.3211	-3.170
9	272.336	39.0266	-6.347
10	270.380	37.1025	-4.391
11	271.634	38.7464	-5.645
12	268.684	36.1972	-2.695
13	266.097	33.1176	-0.108
14	265.512	32.6153	0.477
15	265.989	32.7665	0.000
16	265.647	32.6617	0.342
17	265.695	33.0689	0.294
18	268.192	36.5319	-2.203
19	269.229	39.2658	-3.240
20	267.281	38.0647	-1.292
21	269.920	40.2279	-3.931
22	266.125	36.2464	-0.136
23		36.8650	
24	264.832	34.0343	1.157
25	264.878	34.1293	1.111
26	264.737	33.9819	1.252

Cycle	Height	Receiver Temperature	Delta
27	264.865	34.2849	1.124
28	265.432	35.6671	0.557
29	266.747	39.1780	-0.758
30	265.875	37.4204	0.114
31	266.693	39.3904	-0.704
32	264.666	34.8931	1.323
33	263.923	33.0151	2.066
34	263.753	32.7030	2.236
35	263.802	32.7728	2.187
36	263.652	32.8282	2.337
37	263.636	32.9787	2.353
38	264.943	35.3044	1.046
39	266.078	40.2298	-0.089
40	265.821	39.6559	0.168
41	265.892	39.5634	0.097
42	264.418	35.1745	1.571
43	264.179	34.2667	1.810
44	264.273	34.1646	1.716
45	264.477	34.5896	1.512
46	264.326	34.4158	1.663
47	264.107	34.1845	1.882
48	264.542	35.3161	1.447
49	264.925	39.6180	1.064
50	264.440	38.9790	1.549
51	264.570	38.8574	1.419
52	263.453	34.2729	2.536
53	263.524	32.7238	2.465
54	263.654	32.5173	2.335
55	263.712	32.7218	2.277
56	263.696	32.7176	2.293

Cycle	Height	Receiver Temperature	Delta
57	263.542	32.7498	2.447
58	263.718	34.1312	2.271
59	264.308	37.1837	1.681
62	262.939	31.7246	3.050
63	262.515	34.0940	3.474
64	262.601	34.3102	3.388
65	262.443	35.0099	3.546
66	262.467	35.0313	3.522
67	262.556	34.8621	3.433
68		34.2017	
69	262.573	34.2018	3.416
72	262.626	31.3293	3.363
73	262.239	32.9373	3.750
74	262.250	32.8648	3.739
75	262.239	33.1143	3.750
76	262.234	32.9512	3.755
77	262.092	32.8839	3.897
78	262.590	31.5295	3.399
79	262.072	33.4986	3.917
80	261.746	32.9856	4.243
81	261.857	33.0478	4.132
82	262.216	32.0706	3.773
83	261.828	33.7939	4.161
84	261.516	34.3160	4.473
85	261.304	34.7806	4.685
86	260.942	34.9699	5.047
87	260.648	35.2120	5.341
88	260.422	35.8758	5.567
89	259.814	36.7137	6.175
90	259.443	38.3405	6.546

Cycle	Height	Receiver Temperature	Delta
91	259.928	36.4145	6.061
92	260.560	34.2022	5.429
93	260.765	33.1537	5.224
94	260.480	33.0967	5.509
95	260.339	33.3251	5.650
96	260.127	33.1637	5.862
97	259.767	33.3927	6.222
98	259.785	33.9238	6.204
99	259.463	34.7834	6.526
100	259.291	35.0616	6.698
101	259.273	34.2373	6.716
102	259.132	33.8069	6.857
103	258.952	33.6973	7.037
104	259.468	31.9595	6.521
105	259.573	31.8320	6.416
106	259.394	36.9417	6.595
107	258.587	34.4974	7.402
108	257.601	36.4970	8.388
109	257.657	35.3995	8.332
110	255.380	34.4174	10.609
111	256.114	35.7867	9.875
112	256.706	34.1399	9.283
113	257.069	30.4907	8.920
114	257.142	30.8437	8.847
115	256.446	33.4769	9.543
116	256.183	33.4494	9.806
117	255.842	33.9651	10.147
118	255.483	34.4750	10.506
119	255.376	34.4311	10.613
120	255.389	34.2448	10.600

Cycle	Height	Receiver Temperature	Delta
121	255.429	33.8060	10.560
126	256.739	29.2502	9.250
127	255.799	30.6180	10.190
128	255.190	31.3719	10.799

Abbreviations & Acronyms

ABCAL	Altimeter Boresight Calibration
ADFC	Altimetry Data Fusion Center
CAL	Calibration Mode or Calibration Mode data
Cal/Val	Calibration and Validation
CPU	Central Processing Unit
CSM	Command Storage Memory
DC####	Support run at Detachment Charlie for rev ####
DDL	Direct Downlink Mode (mode 4)
Det A	Detachment Alfa (Prospect Harbor, ME)
Det C	Detachment Charlie (Guam)
DSU	Digital Storage Unit
DTU	Digital Telemetry Unit
EDAC	Error Detection and Correction Circuits
EEPROM	Electrically Erasable Programmable Read Only Memory
ENG	Engineering Data
ERO	Exact Repeat Orbit
FTP	File Transfer Protocol
FWF	Full Waveform
GEOSAT	Geodetic Satellite
GFO	GEOSAT Follow-On
GMT	Greenwich Mean Time
GPS	Global Positioning System
GPSR	GPS Receiver
GSFC	Goddard Space Flight Center
HPA	High Power Amplifier
HQ	Headquarters

HQ ISCS	Integrated Satellite Control System (NAVSOC's ground system at HQ for controlling satellites)
HQ RDCC	Remote Doppler Collection Computer at HQ
HW	Hardware
IAP	Integrated Avionics Processor
ICV	Initial Condition Vector
IDL	Interactive Data Language
LP	Laguna Peak, California
MOE	Medium-accuracy Orbit Ephemerides
NAVO	NAVOCEANO
NAVOCEANO	Naval Oceanographic Office
NAVSOC	Naval Satellite Operations Center
NCEP	National Centers for Environmental Prediction
NCEU	NAVSOC Command Encoder Unit
NGDR	NOAA Geophysical Data Record
NHRSCC	an ascii file of the 1200 clock pairs used to compute an SCC
NSI	NASA Science Internet
OODD	Operational Orbit Determination Data
OOH	Orbit Operations Handbook
POC	Payload Operations Center
POE	Precision Orbit Ephemerides
PSK	Phase Shift Key
QSCAT	NASA QuikSCAT satellite
RA	Radar Altimeter
RAM	Read Access Memory
RASE	Radar Altimeter System Evaluator
RMS	Root Mean Square
SCC	Satellite Clock Coefficient
SCI	Science Data

SDR	Science Data Record
SDT	Science Definition Team
SMA	Semi-Major Axis of the orbit
SW	Software
TMON	Telemetry Monitor Support
TRK	Track Mode
TTCS	Time Tag Correction System
UTC	Universal Time Code
VTCW	Vehicle Time Code Word
WF	Waveform Data
WFF	Wallops Flight Facility
WVR	Water Vapor Radiometer
XM	Transmitter
XMMODHI/LO	Transmitter has a modulation setting of either High or Low

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14. ABSTRACT

The initial GFO Altimeter Engineering Assessment Report, March 2001 (NASA/TM-2001-209984/Ver.1/Vol.1) covered the GFO performance from Launch to Acceptance (10 February 1998 to 29 November 2000). The second of the series covered the performance from Acceptance to the end of Cycle 20 (29 November 2000 to 21 November 2001). The third of the series covered the performance from Acceptance to the end of Cycle 42 (29 November 2000 to 30 November 2002). The fourth of the series covered the performance from Acceptance to the end of Cycle 64 (29 November 2000 to 17 December 2003). The fifth of the series covered performance from Acceptance to the end of Cycle 86 (29 November 2000 to 17 December 2004). The sixth of the series covered performance from Acceptance to the end of Cycle 109 (29 November 2000 to 26 December 2005). In this year's GFO report, we have begun the inclusion of analyses of the JASON altimeter. In past years, JASON and TOPEX were compared during our assessment of the TOPEX altimeter; however, with the end of the TOPEX mission, we have developed methods to report on JASON as it relates to GFO. We see no change trend between the three altimeters and conclude all three are stable based on our cross comparison analyses.

15. SUBJECT TERMS

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