NASA/TM–2012-208641 / Vol. 4

ICESat (GLAS) Science Processing Software Document Series

The ICESat/GLAS Instrument Operations Report

Peggy L. Jester

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

December 2012

NASA STI Program ... in Profile

Since its founding, NASA has been dedicated to the advancement of aeronautics and space science. The NASA scientific and technical information (STI) program plays a key part in helping NASA maintain this important role.

The NASA STI program operates under the auspices of the Agency Chief Information Officer. It collects, organizes, provides for archiving, and disseminates NASA's STI. The NASA STI program provides access to the NASA Aeronautics and Space Database and its public interface, the NASA Technical Report Server, thus providing one of the largest collections of aeronautical and space science STI in the world. Results are published in both non-NASA channels and by NASA in the NASA STI Report Series, which includes the following report types:

- TECHNICAL PUBLICATION. Reports of completed research or a major significant phase of research that present the results of NASA Programs and include extensive data or theoretical analysis. Includes compilations of significant scientific and technical data and information deemed to be of continuing reference value. NASA counterpart of peer-reviewed formal professional papers but has less stringent limitations on manuscript length and extent of graphic presentations.

- TECHNICAL MEMORANDUM. Scientific and technical findings that are preliminary or of specialized interest, e.g., quick release reports, working papers, and bibliographies that contain minimal annotation. Does not contain extensive analysis.

- CONTRACTOR REPORT. Scientific and technical findings by NASA-sponsored contractors and grantees.

- CONFERENCE PUBLICATION. Collected papers from scientific and technical conferences, symposia, seminars, or other meetings sponsored or co-sponsored by NASA.

- SPECIAL PUBLICATION. Scientific, technical, or historical information from NASA programs, projects, and missions, often concerned with subjects having substantial public interest.

- TECHNICAL TRANSLATION. English-language translations of foreign scientific and technical material pertinent to NASA's mission.

Specialized services also include organizing and publishing research results, distributing specialized research announcements and feeds, providing help desk and personal search support, and enabling data exchange services. For more information about the NASA STI program, see the following:

- Access the NASA STI program home page at http://www.sti.nasa.gov

- E-mail your question via the Internet to help@sti.nasa.gov

- Fax your question to the NASA STI Help Desk at 443-757-5803

- Phone the NASA STI Help Desk at 443-757-5802

- Write to:

  NASA STI Help Desk
  NASA Center for AeroSpace Information
  7115 Standard Drive
  Hanover, MD 21076-1320

NASA/TM–2012-208641 / Vol. 4

ICESat (GLAS) Science Processing Software Document Series

The ICESat/GLAS Instrument Operations Report

Peggy L. Jester,
Stinger Ghaffarian Technologies, Inc., Wallops Island, VA

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

December 2012

Level of Review: This material has been technically reviewed by technical management.

Available from:

NASA Center for AeroSpace Information
7115 Standard Drive
Hanover, MD 21076-1320

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161 Price Code: A17

Table of Contents

Table of Contents v
List of Figures ix
List of Tables xi
1.0 INTRODUCTION 1
1.1 Purpose 1
1.2 Reference Documents 1
1.3 Document Layout 1
1.4 Description of Terms 1
2.0 MISSION DESCRIPTION 3
2.1 Mission Overview 3
2.2 Instrument Overview 4
2.3 Pre-launch Mission Operations Plan 6
2.4 Issues Impacting Mission Operations 6
2.4.1 Premature Failure of Laser 1 / Rapid Decline of Laser 2 Energy 6
2.4.2 Spacecraft Battery 6
2.4.3 Pre-launch SPCM Failures 6
2.4.4 Solar Array Articulation 7
2.4.5 LRS Lockups 7
2.4.6 CLHP Shutdown 8
2.4.7 Pointing 8
2.5 Post-launch Mission Operations Plan 9
3.0 INSTRUMENT COMMISSIONING 11
3.1 Description 11
3.2 Results 11
3.3 Timeline 11
4.0 LASER 1 OPERATIONS 13
4.1 Overview 13
4.2 Laser 1a and Laser 1b Transmitted Energy Behavior 13
4.3 Laser 1 Configuration 14
4.4 Laser 1 Events 15

5.0 LASER 2 OPERATIONS 19
5.1 Overview 19
5.2 Laser 2 Transmitted Energy Behavior 20
5.3 Laser 2 Configuration 21
5.4 Events During Campaigns L2a-L2c 23
5.5 Events During Campaigns L2d-L2f 26
6.0 LASER 3 OPERATIONS 27
6.1 Overview 27
6.2 Laser 3 Transmitted Energy Behavior 28
6.3 Laser 3 Configuration 30
6.4 Events 32
7.0 INSTRUMENT MISSION ACTIVITIES 35
7.1 Oscillator Frequency Calibration and Monitoring 35
7.2 GLAS Instrument Operations Change Requests 36
7.3 Flight Software Optimization 37
7.4 DEM Update 38
7.5 1064nm Pulse and Return Energy Estimation 39
7.6 Range Bias Saturation Correction 39
8.0 END OF MISSION ACTIVITIES 41
Appendix A: SPCM Feailure and Outgassing Estimate Reference 45
Appendix B: Commissioning History 47
Appendix C: Campaign Start and Stop Times 55
Appendix D: CLHP Anomaly 57
Appendix E: Executed TOOs, Ocean Scans, and Around the World Scans 59
Appendix F: Laser 1 Campaign Command Table 163
Appendix G: Command Tables for the Laser 2 Campaigns (a - c) 169
Appendix H: Command Tables for the Laser 3 Campaigns (a - k) 177
Appendix I: Command Tables for the Laser 2 Campaigns (d - f) 197
Appendix J: ICESat Post Laser Campaign Test Report 203
Appendix K: GLAS Instrument Operations Change Requests 237

Appendix L: GLAS Flight Software Configuration Change Request Documentation .. 283

Appendix M: Precision Range Determination (PRD) Working Group Status Report to ICESat Science Team Task I&II 289

List of Figures

Figure 2-1 ICESat Nadir (Earth-facing) and Zenith Views....3
Figure 2-2 GLAS Components....5
Figure 2-3 Component Axes....5
Figure 2-4 Operations Timeline....9
Figure 4-1 Laser 1 Energy Trend....14
Figure 5-1 Laser 2 Energy Trend....21
Figure 6-1 Laser 3 Energy Trend....29
Figure 7-1 GLAS On-Orbit Oscillator Frequency....35
Figure 7-2 GLAS Oscillator Aging Rate....36

List of Tables

Table 2-1 Laser Reference System (LRS) Flight Software History 7
Table 4-1 Laser 1 Operations 13
Table 4-2 Start and Stop Energy 13
Table 4-3 Laser 1 Configuration 15
Table 4-4 Major Events During Laser 1 Campaigns 16
Table 5-1 Laser 2 Operations During Campaigns 19
Table 5-2 Laser 2 Start and Stop Emery 20
Table 5-3 Laser 2a-c Configuration 22
Table 5-4 Laser 2d-f Configuration 22
Table 5-5 Major Events During L2a-L2c Campaigns 24
Table 5-6 Major Events During L2d - L2f Campaigns 26
Table 6-1 Laser 3 Operations 27
Table 6-2 Laser 3 Start and Stop Energy 28
Table 6-3 Laser 3a-c Configuration 30
Table 6-4 Laser 3d-f Configuration 30
Table 6-5 Laser 3g-i Configuration 31
Table 6-6 Laser 3j-k Configuration 32
Table 6-7 Laser 3 Events 33
Table 7-1 GLAS Operations Change Request Summary 36
Table 7-2 GLAS Flight Software Versions 38
Table 8-1 Post Laser Campaign Tests 41

1.0 INTRODUCTION

1.1 Purpose

The ICESat/GLAS Instrument Operations Report shall describe the ICESat mission with respect to operating the GLAS instrument. ICESat was launched on January 12, 2003. The actual instrument operations will be detailed within this report. Overall spacecraft operations will not be addressed except where said operations impacted instrument operations. This document shall cover the health and performance of the instrument where it affects the operation of GLAS. This document shall not discuss science results.

1.2 Reference Documents

1. GLAS Instrument User's Guide, GLAS-425-SPEC-001, Final, January 2002
2. Independent GLAS Anomaly Review Board (IGARB) Report, Laser 1 On-orbit Anomaly, January 16, 2004
3. GARB2's GLAS Lasers 1 & 2 – Gradual Energy Decline Hypothesis & Laser 3 Turn-on Proposal, August 2004
4. End of Mission Report for the ICESat Spacecraft, August 2010, NASA/GSFC Code 428
5. Recommendation for Future Laser Missions from the GARB and GLAS Instrument Science Team, August 16, 2007.
6. ICESat (GLAS) Science Processing Software Document Series, The Algorithm Theoretical Basis Document for Level 1A Processing, NASA/TM-2012-208641/Vol 5, June 2012.

1.3 Document Layout

This document shall discuss the mission operations background including the pre-launch plans and the reasons for deviating from the original plan. The in-flight operations shall be organized by laser with an overview of the laser operations and significant events. Detailed tables of events and executed commands are in the Appendices.

1.4 Description of Terms

Science Campaign - Science operations are not continuous, the period between science campaigns are referred to as a hiatus. See Appendix C for the science campaign schedule.

Hiatus - The operations periods between science campaigns.

Cal/Val - Calibration/Validation

IGARB/GARB2/GARB - Independent GLAS Anomaly Review Board / GLAS Anomaly Review Board 2 / GLAS Anomaly Review Board; the IGARB was formed to investigate the root cause of the Laser 1 failure; the GARB2 was formed to investigate the root cause of the rapid decline in output energy of Laser 2. During Laser 3 operations the GARB monitored the laser performance and made recommendations for its operation.

2.0 MISSION DESCRIPTION

2.1 Mission Overview

The Ice, Cloud, and land Elevation Satellite (ICESat) is a planned 15-year mission within NASA's Earth Science Program, a multi-mission program to acquire the data necessary for a long-term study and understanding of Earth's global processes and systems. ICESat's contribution to the program is to provide global cryosphere, atmosphere, and land topography altimetry. The ICESat name identifies the three science objectives of the mission. The objectives, in order of priority, are to

1. determine the mass balance of the polar ice sheets and their contributions to global sea level change and to obtain essential data for prediction of future changes in ice volume and sea level,
2. measure clouds and aerosols properties in the atmosphere, and
3. map the topography of land surfaces to measure roughness, reflectivity, vegetation heights, snow cover, and sea-ice surface characteristics.

The ICESat observatory, the first satellite in the planned mission, was composed of a spacecraft bus and a single science instrument, the Geoscience Laser Altimeter System (GLAS). The spacecraft bus, built by Ball Aerospace and Technologies Corporation (BATC), was based on the Ball Commercial Platform 2000 design, similarly to the QuikSCAT spacecraft. The drawing in Figure 2-1 shows the observatory's Nadir and Zenith facing views and major components. In the figure the GLAS coordinate system is labeled X_G, Y_G, Z_G and the spacecraft coordinate system is labeled X_sc, Y_sc, Z_sc.

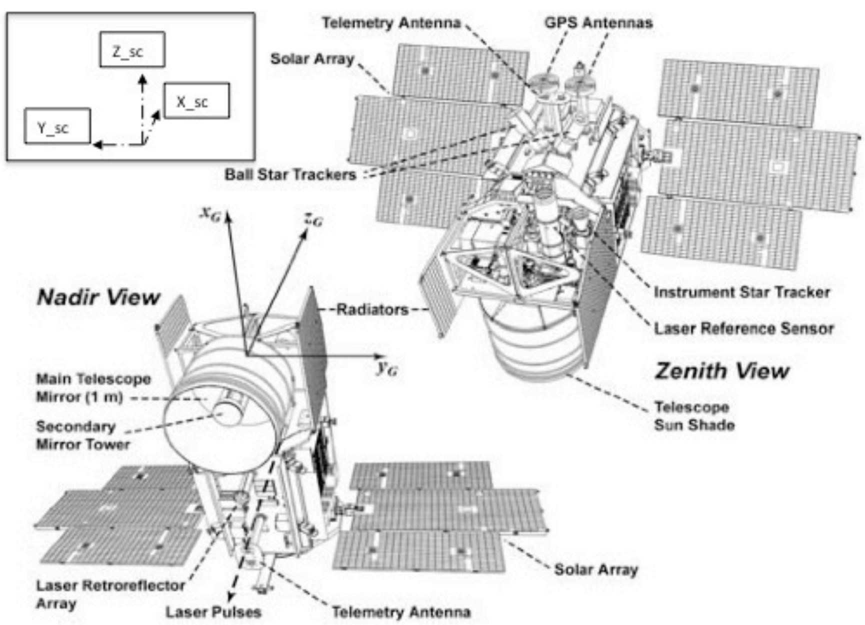


Figure 2-1 ICESat Nadir (Earth-facing) and Zenith Views

The bus provided the GLAS instrument with power, data services, thermal control, spacecraft pointing control, orbit maintenance propulsion, and space-to-ground communications. The spacecraft was three-axis stabilized, with a sophisticated onboard attitude determination and control capability to keep the GLAS instrument precisely pointed. The spacecraft used an S–band uplink for commands and an S-band downlink for housekeeping telemetry, with real-time data on a subcarrier and playback data on the carrier. An X-band telemetry downlink at 40 million bits per second (Mbps) transmitted science data to the ground. The satellite operated in a near-circular 96-minute orbit at an altitude of 600 kilometers and an inclination of 94°. The mission plan included two orbit tracks to be used for the mission. The early orbit and commissioning utilized an 8-day ground repeat track that allowed several ground passes over the same point on Earth during the verification period. After the verification phase, the satellite was transitioned to a 91-day (with a 33-day subcycle) repeat track. Orbit maintenance was required to maintain the ground track repeat to within 1 km at the equator. In the polar regions the spacecraft was pointed at the ground repeat track (also called reference track) to compensate for natural orbit drift and to enable near repeat tracks. The spacecraft flew in one of two orientations (attitudes) to keep the optimal amount of sun on the solar panels. In the sailboat attitude (or mode), the spacecraft y-axis was coincident with the velocity vector; in airplane mode, the x-axis was coincident with the velocity vector.

The ICESat mission began in February 2003 after the successful launch and commissioning of the spacecraft and instrument. Nominal mission duration was three years with a goal of reaching five years. The ICESat science mission ended on October 11, 2009 after the third GLAS laser was depleted and discontinued firing. A series of post-mission tests, described in Section 7, were approved and executed over the next several months. ICESat passivation was completed on August 14, 2010 with the execution of the end of mission command sequence. Prior to passivation the ICESat orbit was lowered until the fuel was depleted. De-orbit of the spacecraft occurred on August 30, 2010 with splashdown of any ICESat remnants into the Barents Sea. The second satellite in the ICESat Mission, ICESat-2, is being developed with a planned launch date in July 2016.

2.2 Instrument Overview

ICESat's instrumentation, the Geoscience Laser Altimeter System (GLAS) and GPS, was designed to make accurate measurements of surface and near surface elevations with a 1064 nm laser channel and clouds and aerosols with both the 1064 nm and a more sensitive 532 nm channel. Return signals were digitized to provide unprecedented details of the height distributions of the surface and near-surface (e.g., trees) and vertical distribution of backscatter from the atmosphere. The instrument measured the round trip transit time-of-flight of a dual frequency laser pulse (1064 nanometers and 532 nanometers wavelength) as it exited the instrument boresight, reflected from the Earth's surface (ice sheets, land, etc.), and was collected by the telescope receiver. The ICESat science team converted the raw laser time-of-flight data into elevation measurements with an accuracy of 10 centimeters. The science analysis required a very accurate knowledge of the observatory's orbit, which was determined using the onboard Global Positioning System (GPS) receiver and the instrument's Stellar Reference System (SRS). The GLAS instrument included a 1.0-meter telescope, three solid-state lasers, redundant 1064nm altimeter detectors, and eight single photon counting modules (SPCMs - to detect 532nm returns). The lasers, firing a 6 nanosecond pulse at 40Hz, were operated singly until degraded performance affected science data. Reference document 1, the GLAS Instrument User's Guide provides details of the GLAS components and their operations. Figure 2-2 shows the GLAS components with Figure 2-3 showing the relationship of the various component axes.

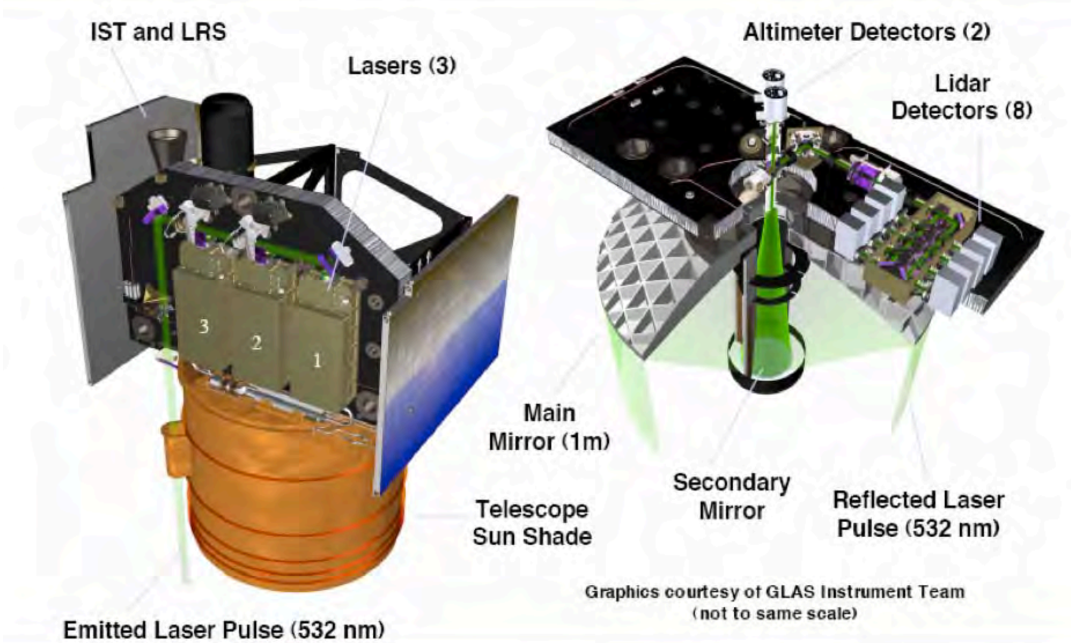


Figure 2-2 GLAS Components

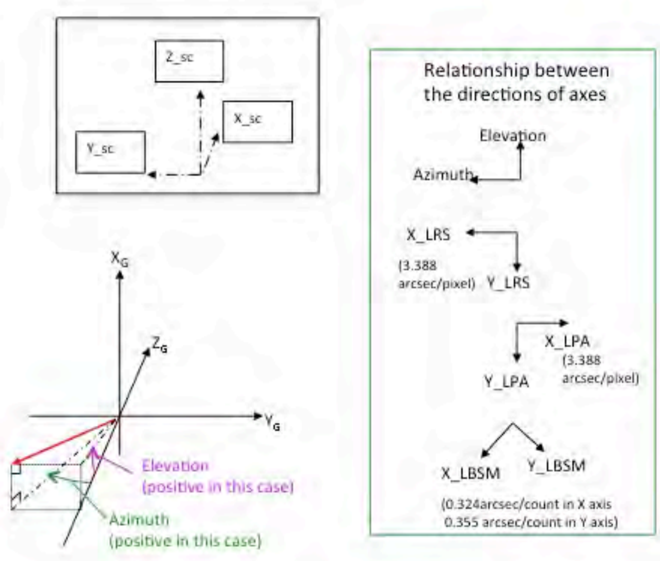


Figure 2-3 Component Axes

2.3 Pre-launch Mission Operations Plan

Mission operations for the ICESat/GLAS were planned to be fairly simple with instrument commanding planned for targeting opportunities, thermal adjustments, and in response to the aging hardware components. The first several weeks of the mission were a planned commissioning period to check out the spacecraft and instrument. Once the science orbit was achieved and commissioning was completed then the science mission would start. There were expected breaks in the science data collection only at the end of each laser's life while operations were switched to the next laser. A brief checkout period was planned for the laser and then science data collection would resume. It was expected that there would be no break in science data collection during the seasonal yaw maneuvers between sailboat and airplane mode.

2.4 Issues Impacting Mission Operations

Prior to launch and within the first several months of post-launch activity there were several events that led to a change in the mission operations plan. This section discusses those events for background. Section 2.5 addresses the post-launch mission operations plan.

2.4.1 Premature Failure of Laser 1 / Rapid Decline of Laser 2 Energy

Each laser was expected to operate for 1.5 years emitting about 1.8 billion shots in orbit. However, after about 37 days and just 126 million shots Laser 1 unexpectedly failed. The ICESat GLAS Anomaly Review Board (IGARB) was convened to investigate the failure. Their findings can be found in the IGARB Report, Reference Document 2. The investigation took several months and led to recommendations for the operations of Lasers 2 and 3. Laser 2 did not begin operating in orbit until September 2003. Laser 2 had a very rapid decay rate, which led the IGARB/GARB to further analyze the laser behavior and to modify the recommended operating plan for Laser 2 and Laser 3; the GARB hypothesis and recommendations are found in Reference Document 3. In summary, we had to tightly maintain the laser thermal environment and minimize extreme and rapid temperature changes. The GARB further recommended to power on the laser as warm as possible to minimize thermal gradients inside the lasers during power on but to operate (fire) the lasers as cold as possible.

2.4.2 Spacecraft Battery

On February 20, 2003, just prior to the start of Laser 1 operations, low battery voltage was detected at End of Discharge (EOD) as the spacecraft exited eclipse. This behavior impacted the operations team throughout the entire mission requiring proactive control of battery charging as well as battery monitoring software by the flight operations team at LASP. Towards the end of mission, flight rules were required for the SPCM operations during laser startup operation for each campaign. The battery health was good, but the battery charge/discharge voltage curve on orbit was significantly lower than test data and design predictions.

2.4.3 Pre-launch SPCM Failures

During ground testing four of the eight flight Single Photon Counting Modules (SPCMs) failed. The investigation of one failed SPCM concluded that outgassing under vacuum while operating the SPCM led to the failure. Prior to launch it was determined to allow the remaining four SPCMs to outgas for a period of time prior to applying power. Therefore the SPCMs were not scheduled to operate for several weeks after the initial Laser 1 power on and start fire. With the premature failure of Laser 1, the engineering team requested the SPCMs be warmed to shorten the outgassing time. See Appendix A for more information of the SPCM failure investigation and outgassing recommendations.

2.4.4 Solar Array Articulation

Prior to the launch of the ICESat Observatory it was planned that, upon request by the science team, the solar array articulation could be disabled to reduce spacecraft jitter. The science team deemed this was important over the Polar Regions, during ocean scans, and over certain targets. However, due to the battery voltage being lower than expected at EOD, several restrictions were placed on the timing of the solar array stop and the arrays were never disabled during science operations beyond the Laser 1 campaign. The estimate of actual jitter caused by the solar array articulation is 2 arcseconds, which was about a magnitude better than predicts (P. Woznick email of 03/04/2003).

2.4.5 LRS Lockups

During the commissioning period and Laser 1 campaign, the Laser Reference System (LRS) went frequently into an "upset" state and reset or became hung requiring a manual power cycle. Prior to entering the "upset" state the LRS experienced a "bright light" condition where excessive light was detected in the tracker for an extended period - in some cases 5 minutes or more. To mitigate the "bright light" condition during Laser 1 operations, the LRS was not operated while it was in the light. Special commands were built based on predicted orbit data and were loaded to the spacecraft that suspended LRS operations during the light portions of the orbit and restarted during the dark portions. The LRS vendor provided several software updates to resolve the handling of this condition and other bugs that were found during the troubleshooting process. These are described in Table 2-1. Version 2.4, loaded in September 2003, minimized the LRS software "upsets" or lockups, to approximately once per 30 days. During the mission an attempt was made to write the LRS software version 2.4 to the LRS EEPROM. This attempt failed and corrupted the RAM; therefore, the software was reloaded each time the LRS was powered off, adding time and extra planning to recovery from an LRS "upset" or lockup.

Table 2-1 Laser Reference System (LRS) Flight Software History

Version	Date Loaded	Objective	Results
2.2	March 29, 2003	Prevent software lockup when there is too much light	Not tracking stars
2.2	April 16, 2003	Reloaded in case the first load had a problem	Not tracking stars
2.3	May 20, 2003	Fix 2.2 not tracking stars problem	Did not work in the current spacecraft attitude
2.4	September 10, 2003	Fix 2.3 attitude problem	Occasional LRS "upsets" or lockup. Still in use.

2.4.6 CLHP Shutdown

On August 17, 2003 the GLAS Component Loop Heat Pipe (CLHP) unexpectedly stopped operating, causing an increase in the temperature of the CLHP and the GLAS components, particularly the instrument Main Electronics Unit (MEU). During the CLHP recovery attempt, the temperatures continued to rise and the MEU over-temperature protection circuitry automatically turned off the power and shutdown the system. Several days were spent recovering the system; Appendix D contains the detailed summary of these events. Eventually, the CLHP was returned to nominal operations and Campaign L2a was started. As a result of this and later CLHP events and the modified mission plan to operate in short seasonal campaigns (see Section 2.5), the CLHP operations procedures were modified. The rate of raising the CLHP temperature setpoint was slowed to 1 count per hour with a maximum of 10 counts per day - the original procedures allowed a rate of 2 counts per 5 minutes continuously. After several trials at various temperature change rates, it was determined that the 1 count per minute rate had a higher probability of success of maintaining a stable thermal system and reaching the desired science operating bench temperature (16C) in the minimum amount of time.

2.4.7 Pointing

For all off-nadir pointing greater than 1 degree, the range window was widened by 3 kilometers and the corresponding cloud digitizer and photon counter start delay values were raised by 3 kilometers so the instrument could capture the return signal. The parameters were not updated during the Laser 1 operations; during the L2a operation the range window was widened but the CD and PC windows were not adjusted until October 9. The tables in Appendix E contain a column noting when the window parameters were updated for off-nadir angles greater than 1 degree for all campaigns.

2.4.7.1 Reference Track Pointing

In the polar regions (>59° latitude in the Arctic, <-60° in the Antarctic), ICESat was commanded to always point at the reference track to compensate for natural orbit drift and enable near repeats (±100 m) of the tracks. (Beginning in May, 2005, the lower limit in the Arctic was reduced from 59° to 46° latitude)

2.4.7.2 Pointing Calibration Scans

Special maneuvers were performed to support calibration/validation by rotating the satellite so as to scan a cone of 5° aperture about the nadir vector. These were implemented as ocean scans (2 contiguous cones over the Atlantic or Pacific Ocean) and as Around the World (ATW) scans (multiple contiguous cones for a complete orbit). Ocean scans were conducted twice per day and ATW scans once per eight days. Ocean scans were not executed on-orbit until March 8, 2003, several days after the start of Laser 1 operations. Post-launch a cone of 3° aperture was implemented. At the end of laser life, cones of 1.5° and 1.0° were implemented for campaign L2f to compensate for the lower transmitted energy. All Ocean and ATW scans are documented in Appendix E. Prior to launch, Ocean scans were limited to two per day and ATW scans to one per eight days due to the size of the command storage memory (CSM). Several campaigns into the mission it was determined that the CSM size could support more scans so the limit was raised to 4 Ocean scans per day and 1 ATW scan per four days. As the laser transmit energy degraded and the possible number of future campaigns became limited it was determined to exclude the Arctic and Antarctic areas from the ATW scans. The tables in Appendix E document the types of scans, the aperture size of the cone and whether the Arctic/Antarctic was excluded.

2.4.7.3 Targets Of Opportunity

Prior to launch, the number of targets of opportunity (TOOs) was limited to five per day due to the size of the command storage memory (CSM). Several campaigns into the mission it was determined that the CSM size could support more TOOs so the limit was raised to 12. All TOOs are documented in Appendix E.

2.5 Post-launch Mission Operations Plan

Due to events described in section 2.4, the mission operations plan was reformulated. After the failure of Laser 1 and rapid decline of Laser 2 energy during Campaign L2a, the Project operated in three science campaigns per year (later modified to two per year) to gather seasonal long-term change data. The campaigns encompass the same 33-day repeat tracks of the 91-day repeat orbit. A summary of the operations timeline throughout the mission is shown in Figure 2-4.

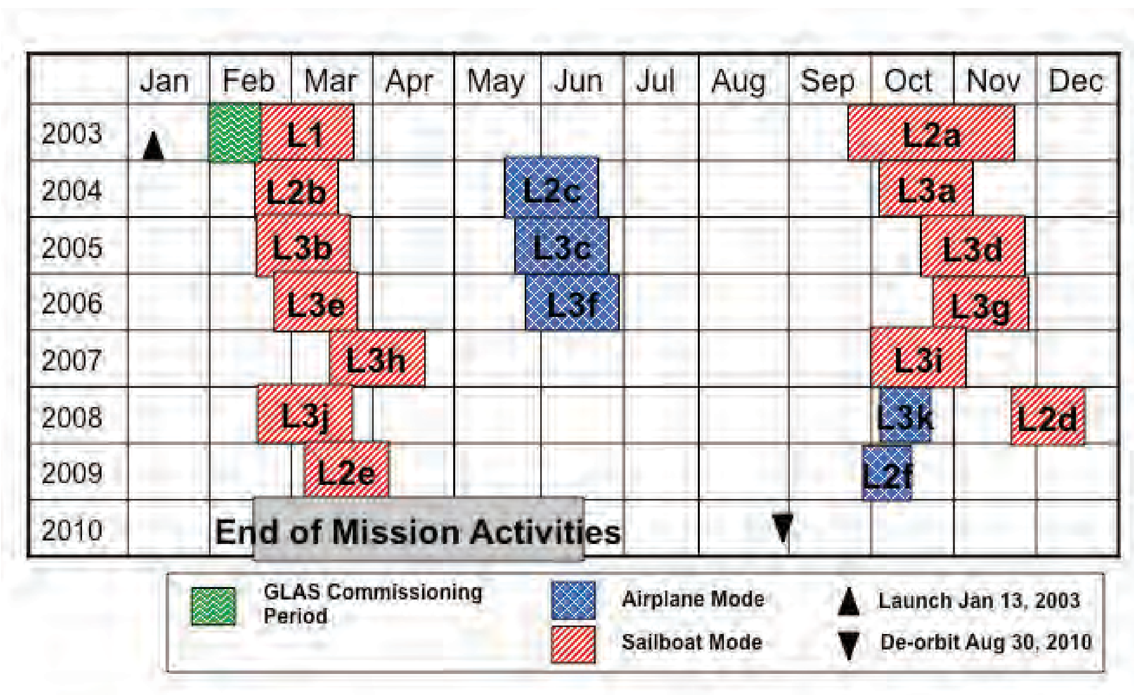


Figure 2-4 Operations Timeline

The unexpected behavior of the lasers led to more rigorous thermal control of the lasers as recommended by the IGARB/GARB2. The thermal engineering team recommended changes in the handling of the CLHP operations due to its unexpected shutdown after the August 2003 yaw maneuver and its subsequent instability. The CLHP temperature raising procedure changed as described in Section 2.4.6 and during the hiatus between the science campaigns the CLHP setpoint was lowered to 0 degrees Celsius (0C). Since the bench was required to be at 16C for science operations a warming cycle occurred prior to the start of each campaign. Also during the hiatus various instrument components were disabled for protection. Therefore, each science campaign was comprised of a mini-commissioning phase to prepare for laser startup, warm the bench, and power up and checkout components; a science phase; and a decommissioning phase to prepare the instrument for the hiatus. Additionally, the instrument behavior led to more frequent parameter changes to optimize the instrument settings at lower transmitted energies.

3.0 INSTRUMENT COMMISSIONING

3.1 Description

After the spacecraft completed its commissioning phase and was attitude and power safe, GLAS instrument commissioning began with the power on of the GLAS Main Electronics Unit (MEU). The GLAS components were warmed to a stable operating temperature and the lasers to a stable non-operating temperature. To warm the GLAS components, the CLHP was activated and its setpoint was raised according to the prelaunch procedure. After the stable operating temperature was reached, the Instrument Star Tracker (IST) and Laser Reference System (LRS) were turned on and their housekeeping data was evaluated. The Laser Loop Heat Pipe (LLHP) was activated and the heater control loop in the MEU used to bring the lasers to their turn-on temperature. Finally the telescope (primary and tower) and etalon heaters were enabled. After the instrument was thermally stable, functional checkout occurred using the Red and Green optical test sources as described in Appendix B. Finally, Laser 1 was powered and firing enabled. After several functional tests with the firing laser and parameter adjustments, commissioning was declared complete.

3.2 Results

All components and the lasers passed the health and performance checks initiated during the commissioning phase.

3.3 Timeline

The instrument commissioning phase spanned February 2 - 21, 2003. The details of the commissioning activities and functional tests are included in Appendix B.

4.0 LASER 1 OPERATIONS

4.1 Overview

The Laser 1 science campaign began on February 20, 2003 with the firing of Laser 1 and ended with the failure of Laser 1 on March 29, 2003. The spacecraft was in the 8-day repeat calibration orbit while the instrument completed commissioning and calibration. While the engineering team performed several functional tests during the initial period, labeled as Phase 2 of the post-launch verifications tests in Appendix B, the data was still used for science analysis. Appendix B provides details regarding these activities. The Laser 1 campaign is divided into two parts (designated L1a and L1b) since the spacecraft performed a yaw from sailboat mode to airplane mode during the campaign. Appendix C documents the start and stop times of the campaigns and the spacecraft flying mode. During the Laser 1 campaign, the reference track pointing was not enabled. Laser 1 operated for 37 days firing an estimated 126,676,800 shots.

Table 4-1 shows the temperature settings, beta angle, and spacecraft orientation during the campaign.

Table 4-1 Laser 1 Operations

Campaign	Date	Laser Temp. (C)	Laser LHP Setpoint (C)	Bench Temp. (C)	Component LHP Setpoint (C)	Beta Angle (degrees)	S/C Orient.
L1a Start	2/20/03	29	19.4	17.8	17.6	-44.96	Sailboat
L1b Start	3/21/03	29	19.4	19.0	17.6	-35.007	Airplane
L1b Laser Temperature Adjust	3/26/03	22	12.35	19.9	17.6	-33.145	Airplane
L1b Stop	3/29/03	22	12.35	19.0	17.6	-32.765	Sailboat

4.2 Laser 1a and Laser 1b Transmitted Energy Behavior

The start and stop laser transmit energy values for the Laser 1 campaigns are shown in Table 4-2. The Laser 1 daily mean total transmit energy behavior is plotted in Figure 4-1.

Table 4-2 Start and Stop Energy

Campaign	Start Transmit Energy (mJ)			Stop Transmit Energy (mJ)		
	1064nm	532nm	Total	1064nm	532nm	Total
L1a	71.3	25.9	99.0	59.1	20.6	81.1
L1b	59.1	20.6	81.1	42.3	15.7	59.1

The Laser 1 daily mean reference temperature is included in Figure 4-1 to show the impact of temperature change on the transmit energy. The low transmit energy on 2003-085 is an artifact of the altimeter detector being powered off when the spacecraft entered "acquire sun" mode on March 26, 2003.

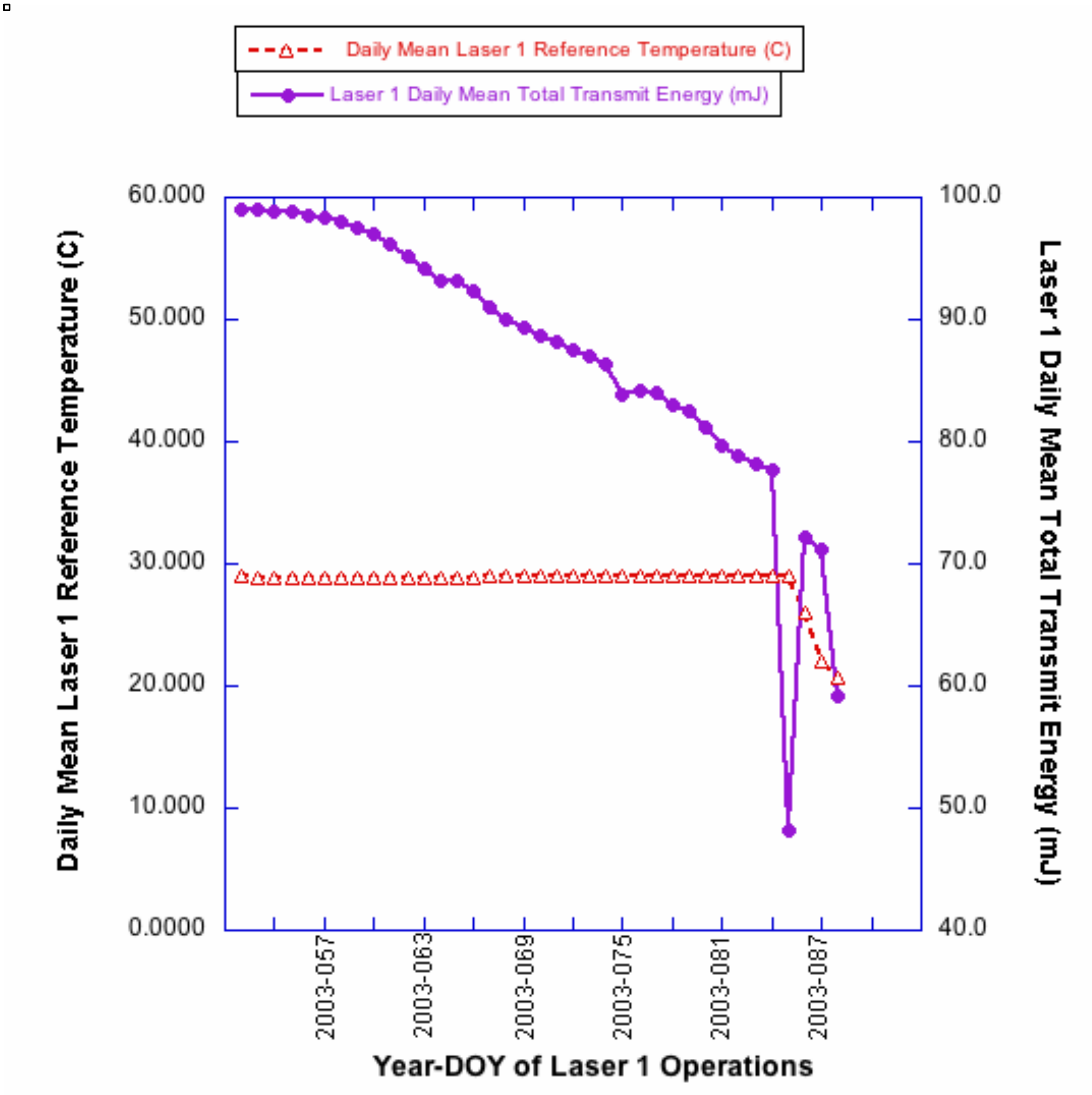


Figure 4-1 Laser 1 Energy Trend

4.3 Laser 1 Configuration

During the laser campaign several parameters were reset from their pre-launch setting. Table 4-3 shows the updated parameters and the SPCM status at the beginning and end of the campaigns.

Table 4-3 Laser 1 Configuration

Campaign	L1a Start	L1a stop / L1b start	L1b stop
Powered SPCMs	none	none	none
Wmin, Range Window Minimum Width (KM)	2	2	2
Background Noise Search Start Offset (ns)	6671	133420	-667000
4nsflag, AGC Parameter (enables/disables use of raw peak filter in AGC)	1	1	1
Vref, AGC Parameter (determines pulse amplitude)	180	150	150
GINIT, AGC Parameter (Initial and reset gain value)	21	21	21
GMIN, AGC Parameter (minimum gain value)	4	13	13
Background Filter Threshold Coefficient, A1 for All Filters	7	7	7
Transmit Pulse Peak Threshold	80	80	80

4.4 Laser 1 Events

The first on-orbit firing of Laser 1 occurred on February 20, 2003 for a planned operating period of at least 1.5 years. While Laser 1 operated during the on-orbit verification and calibration, the spacecraft was in the 8-day repeat orbit. Upon request of the instrument engineering team, the minimum gain parameter used by the Automatic Gain Control algorithm (AGC) within the GLAS flight software was updated to 13 from 4 on March 8, 2003. The parameter change was to prevent the return gain from being set very low (down to 4); therefore, minimizing the impact to the AGC from saturated returns. On March 21, 2003 the spacecraft was yawed from the sailboat attitude mode to the airplane attitude mode. Upon the request of the instrument engineering team, on March 27, 2003 and in two steps, the laser temperature was lowered from 29C to 22C to put the laser in a cooler environment, which was thought to be more stabilizing. Unfortunately, only 48 hours later Laser 1 unexpectedly stopped firing on March 29, 2003. This and other unexpected events during the Laser 1 operations are listed below:

- LRS instability as discussed in Section 2.4.5
- Low battery voltage at EOD impacting Solar Array articulation disable and enable operations as discussed in Section 2.4.4
- Spacecraft entry into Sun Acquire Mode (SAM) due to detected attitude error on March 26, 2003
- Laser 1 unexpected end of life on March 29, 2003

Table 4-4 lists major events that occurred during the Laser 1 campaigns. All commands executed during the campaigns are listed in Appendix F.

Table 4-4 Major Events During Laser 1 Campaigns

Event	Date / Time UTC	Description
Test Ocean Scan	02/25/2003	Time unknown
Solar Array Articulation Flight Rule Implemented	3/4/2003	Established parameters for stopping SA articulation
LRS cold boot / software hang-up	3/5/2003 / 09:40:00	Time approximate
Solar Array Articulation Disabled	3/5/2003 / 09:45:00	Prior to White Sands Overpass
Solar Array Articulation Enabled	3/5/2003 / 10:00:00	After White Sands Overpass
Solar Array Articulation Disabled	3/5/2003 / 12:45:00	Prior to Ocean Scan
Solar Array Articulation Enabled	3/5/2003 / 13:15:00	After Ocean Scan
LRS Power-off	3/5/2003 16:41	Start recovery from LRS cold boot
LRS Recovery	3/6/2003	LRS flight s/w caused software hang-up; cleared by power cycle; time unknown
LRS Power-off	3/6/2003	Start recovery from LRS cold boot; time unknown
LRS Recovery; tracking not enabled	3/7/2003	LRS flight s/w caused software hang-up; cleared by power cycle; time unknown
AGC Minimum Gain Setting Fixed to 13	03/08/2003	Automatic Gain Control minimum gain setting set to 13 to aid determination of saturated returns
LRS Upset	3/19/2003	LRS flight s/w caused software hang-up
LRS Upset/Recovery Complete	3/20/2003 22:16	LRS flight s/w caused software hang-up; cleared by power cycle
LRS Upset	3/21/2003 02:43	LRS flight s/w caused software hang-up
Solar Array Articulation Disabled	3/21/2003 / 09:17:00	Prior to White Sands Overpass
Solar Array Articulation Enabled	3/21/2003 / 09:24:00	After White Sands Overpass
Spacecraft Rotated to Airplane Mode	3/21/03 17:19:59	Required maneuver based on Sun Beta angle
LRS Upset/Recovery	3/22/2003 4:54	LRS flight s/w caused software hang-up; cleared by power cycle
Solar Array Articulation Disabled	3/26/03 11:25	Prior to Ocean Scan
Spacecraft Entered Sun	3/26/03 11:41	Due to detected attitude error during ocean scan.

Event	**Date / Time UTC**	**Description**
Acquire Mode (SAM)		Science data is not useful while in SAM
LRS Power-off	3/26/2003 20:11	LRS off while in SAM
GLAS Altimeter Detector powered-on	3/27/03 00:57	Recovery complete from SAM
Lower Laser Temperature to 15C	3/27/2003 12:05	First step to lower Laser temperature to 12C to put laser in a cooler, more stable environment
Lower Laser Temperature to 12C	3/27/2003 17:04	First step to lower Laser temperature to 12C to put laser in a cooler, more stable environment
Laser 1 Failure	03/29/03 14:57	Unexpected end of Laser 1 operations

5.0 LASER 2 OPERATIONS

5.1 Overview

Laser 2 was operated for six campaigns (L2a, L2b, L2c, L2d, L2e, L2f) with a break of four years between campaigns L2c and L2d. By the end of campaign L2c, Laser 2 total energy output had dropped to about 5 mJ. Since at the laser's current rate of decay it was predicted not to be enough energy to go through another full campaign, the science team made the decision to switch to Laser 3 for subsequent campaigns. At the end of Laser 3's lifetime, operations were switched back to Laser 2 until the end of its lifetime. Laser 2 operated for 189 days firing an estimated 644,316,479 shots.

Table 5-1 shows the temperature settings, beta angle, and spacecraft orientation during the Laser 2 campaigns.

Table 5-1 Laser 2 Operations During Campaigns

Campaign	Date	Laser Reference Temp. (C)	Laser LHP Setpoint (C)	Bench Temp. (C)	Component LHP Setpoint (C)	Beta Angle (degrees)	S/C Orientation
L2a Start	9/25/03	26.5	16	14.2	10.7	50.747	Sailboat
L2a Inadvertent Laser Temperature Adjust*	10/13/03	35	25	14.2	10.7	58.047	Sailboat
L2a Bench Temperature Adjust	10/14/03	26.5	16	15.4	12.7	58.423	Sailboat
L2a Bench Temperature Adjust	10/29/03	26.5	16	17.35	16.6	63.685	Sailboat
L2a Stop	11/18/03	26.8	16	17.6	16.6	68.91	Sailboat
L2b Start	2/17/04	26.7	16	18	16.6	53.775	Sailboat
L2b Stop	3/21/04	27	16	18.8	16.6	40.111	Sailboat
L2c Start	5/18/04	27	16	15.2	6.6	12.945	Airplane
L2c Laser Temperature Adjust	5/21-26/04	16.8	5.75	15.0	6.6	9.0	Airplane
L2c Stop	6/21/04	16.8	5.75	14.7	6.6	-3.696	Airplane
L2d Start	11/25/08	17	6	17	14.09	-45	Sailboat
L2d Laser Temperature Adjust	12/8-9/08	21.88	11	16.9	14.09	-50	Sailboat
L2d Stop	12/17/08	22	11	16.8	14.09	-53	Sailboat

Campaign	**Date**	**Laser Reference Temp. (C)**	**Laser LHP Setpoint (C)**	**Bench Temp. (C)**	**Component LHP Setpoint (C)**	**Beta Angle (degrees)**	**S/C Orientation**
L2e start	2/17/09	21.88	11	16	14.09	-70	Sailboat
L2e Laser Temperature Adjust	4/4-5/ 09	23.97	13	16.2	14.09	-61	Sailboat
L2e Stop	4/11/09	23.97	13	16.2	14.09	-59	Sailboat

* Due to an error in review process Laser LHP commands were executed rather component LHP commands resulting in the laser temperature to jump 8.5C in less than 1 hour. During the real-time pass the Laser LHP temperature was lowered to the desired setpoint.

5.2 Laser 2 Transmitted Energy Behavior

The start and stop laser transmit energy values for the Laser 2 campaigns are shown in Table 5-2. The Laser 2 daily mean total transmit energy behavior is plotted in Figure 5-1. The Laser 2 daily mean reference temperature is included in the plot to show the impact of temperature change on the transmit energy.

Table 5-2 Laser 2 Start and Stop Emery

Campaign	Start Transmit Energy (mJ)			Stop Transmit Energy (mJ)		
	1064nm	532nm	Total	1064nm	532nm	Total
L2a	80.9	20.7	101.6	54.9	13.2	68.0
L2b	57.2	8.7	66.0	31.4	0.0	31.5
L2c	35	0.1	35.1	4.8	0.5	5.2
L2d	8.0	0.9	8.9	4.4	0.5	5.0
L2e	5.9	0.6	6.4	2.0	0.0	2.0
L2f	3.9	0.3	4.2	2.4	0.3	2.7

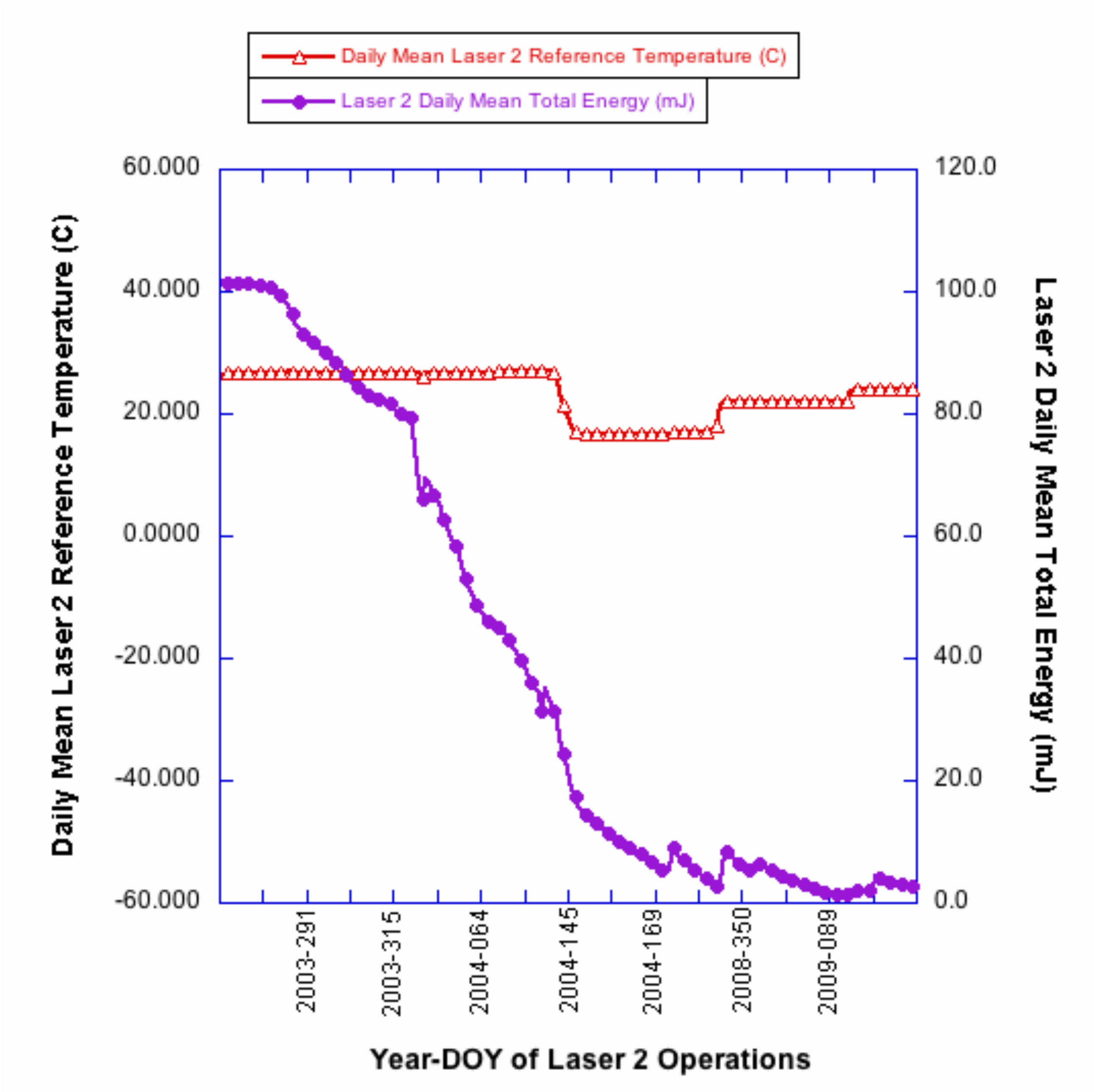


Figure 5-1 Laser 2 Energy Trend

5.3 Laser 2 Configuration

During the laser campaign several parameters were reset from their pre-launch setting. Table 5-3 and Table 5-4 show the updated parameters and the SPCM status at the beginning and end of the Laser 2 campaigns.

Table 5-3 Laser 2a-c Configuration

Campaign	L2a start	L2a stop	L2b start	L2b stop	L2c start	L2c stop
Powered SPCMs	2	2, 5, 6, 8	2, 5, 6, 8	2, 5, 6, 8	2, 5, 6, 8	2, 5, 6, 8
Wmin, Range Window Minimum Width (KM)	1	1	1	1	1	1
Background Noise Search Start Offset (ns)	-667000	-667000	-667000	-667000	-667000	-667000
4nsflag, AGC Parameter (enables/disables use of raw peak filter in AGC)	enabled	enabled	disabled	disabled	disabled	disabled
Vref, AGC Parameter (determines pulse amplitude)	150	150	150	150	150	150
GINIT, AGC Parameter (initial and reset gain value)	80	80	21*	21*	21*	21*
GMIN, AGC Parameter (minimum gain value)	13	13	13	13	13	13
Background Filter Threshold Coefficient, A1 for all Filters	7	7	7	7	7	7
Transmit Pulse Peak Threshold	80	80	80	80	80	80

* The GINIT parameter to initialize the gain was updated to 80 for campaign L2a. With the MEU power-off and recovery after campaign L2a, GINIT was reset to its original value (21) causing data dropout problems when the Laser 2 reached lower transmit energy during campaigns L2b and L2c. GINIT was set back to 80 for the start of the Laser 3 campaigns.

Table 5-4 Laser 2d-f Configuration

Campaign	L2d start	L2d stop	L2e start	L2e stop	L2f start	L2f stop
Powered SPCMs	2, 5, 6, 8	2, 5, 6, 8	2, 5, 6, 8	2, 5, 6, 8	none	2, 5, 6, 8
Wmin, Range Window Minimum Width (KM)	1	1	1	1	1	1
Background Noise Search Start Offset (ns)	-667000	-667000	-667000	-667000	-667000	-667000
4nsflag, AGC Parameter (enables/disables use of raw peak filter in AGC)	disabled	disabled	disabled	disabled	disabled	disabled
Vref, AGC Parameter (determines pulse amplitude)	135	135	135	135	135	135
GINIT, AGC Parameter (Initial and reset gain value)	250	250	250	250	250	250

Campaign	L2d start	L2d stop	L2e start	L2e stop	L2f start	L2f stop
GMIN, AGC Parameter (minimum gain value)	13	13	13	13	13	13
Background Filter Threshold Coefficient, A1 for all Filters	7	4	4	4	4	4
Transmit Pulse Peak Threshold	80	60	60	33	33	33

5.4 Events During Campaigns L2a-L2c

The first on-orbit firing of Laser 2 occurred when the Laser 2a campaign commenced on September 25, 2003 for a planned 33-day campaign. At the start of the campaign the spacecraft was in the 8-day repeat orbit to allow the science team to correlate data to the Laser 1 campaign. On October 4, 2003 the spacecraft was transitioned to the 91-day repeat orbit. The end of the campaign was extended to November 28, 2003 to continue collecting data during the 91-day repeat cycle for a full 33 days with stable operating conditions. During Campaign L2a the following unexpected events occurred:

- A loss of altimetry data was noted during ocean scans; it was discovered that the range window was not being extended for the large off-nadir pointing angle. Upon correcting that error in operations it was then noted that the atmospheric data was also lost during the greater than 1 degree off-nadir pointing events. This was also corrected in the operating procedures by increasing the bias values.
- Due to the CLHP problems in August 2003, the setpoint for the campaign was set conservatively resulting in the bench temperature being less than 16C. The science team found that the laser beam was not centered in the telescope FOV so requested that the bench be warmed to the desired 16C. Unfortunately, an incorrect version of a spacecraft table was used to review the load procedures that implemented the request. This culminated in the Laser LHP setpoint being raised rather than the Component LHP setpoint. The LLHP temperature was raised to its maximum setpoint in one large step causing the LLHP to shutdown and the laser to warm (the Laser 2 BBQ). Fortunately a real time pass was scheduled right after the command execution on the spacecraft and the team was able to restart the LLHP and lower the laser temperature. An unexpected result was that it appeared the laser beam shifted into a better position in the telescope FOV. The CLHP operations were restarted the next day. The warmer bench improved the position of the beam within the FOV.
- On October 28, 2003 a solar storm occurred which caused the GPS receiver to behave in an anomalous manner. The GPS receiver returned to stable operations within a few hours.
- Bringing a sudden end to Campaign L2a, the spacecraft entered ACQSUN after a load of the spacecraft basetime. The basetime value was bad causing the onboard software to fail internal checks.

The Laser 2b campaign commenced on February 17, 2004 and concluded on March 21, 2004 as planned. The following unexpected events occurred:

- During Campaign L2b the spacecraft entered ACQSUN on February 19, 2004 for sun avoidance - the onboard software detected the sun within the avoidance zone during an ATW scan. Fortunately, the acquire sun procedure was changed to only power off the detectors (altimeter and SPCMs) to protect them from possible sun damage.
- At launch, the ACQSUN procedure powered off the entire payload as seen during campaign L2a. As the laser energy degraded, the Etalon temperature-tracking algorithm in the flight software did not behave as expected. The algorithm was intended to keep the etalon temperature at an optimum setting allowing the maximum 532nm signal to pass-through the filter for transmission. During the L2b and subsequent campaigns the etalon temperature monitoring was done manually and adjustment was by ground command.

Campaign L2c started on May 18, 2004 and ended on June 21, 2004 as planned. There were no unexpected events during Campaign L2c, however after the spacecraft yaw maneuver to airplane mode and prior to the start of the campaign the CLHP exhibited anomalous behavior in the form of spikes in its Evaporator temperature reading (see Appendix D for discussion of the CLHP behavior). To maintain the CLHP in a steady state the campaign was operated with the bench temperature at 15C rather than at the minimum 16C desired by the science team for centering the laser return spot in the field of view of the telescope.

Table 5-5 lists major events that occurred during campaigns L2a - L2c. All commands executed during the campaigns are listed in Appendix G.

Table 5-5 Major Events During L2a-L2c Campaigns

Event	Date / Time UTC	Description
L2a Campaign Start	2003-09-25 / 17:19:26	Time of Laser 2 startfire command
Power and Enable SPCMs 5, 6, 8	2003-09-26 / 19:02:44	Only SPCM 2 was powered and enabled for campaign start
Range Window Extended During Ocean Scans	2003-09-30 / 12:00:00	Prior to this date, the range window was not extended during the ocean scans causing a loss of data
Transition to 91-day Repeat Orbit	2003-10-04 / 13:38:07	Orbit transition time
Aerosol / Cloud Biases Extended During Ocean Scans	2003-10-07 / 22:27:00	Prior to this date, the PC and CD biases were not set correctly during the ocean scans causing a loss of data
Laser LHP Shutdown and "Warming" of Laser	2003-10-13 / 18:00:00	Bad load to the spacecraft causing the laser to warm up very quickly; 48 hours later an apparent improvement of the laser beam in the telescope FOV was noticed.

Event	Date / Time UTC	Description
Raise Component LHP to 12.7C	2003-10-14/17:17:04 through 2003-10-15/22:46:04	Component LHP setpoint changes over a period of several hours to raise the bench temperature to improve laser spot location in FOV.
Raise Component LHP to 16.6C	2003-10-28/16:23:02 through 2003-10-29/21:14:37	Component LHP setpoint changes over a period of several hours to raise the bench temperature to improve laser spot location in FOV.
Solar Storm	2003-10-28	GPS receiver anomalous behavior
ACQSUN and L2a Campaign Stop	2003-11-23 / 00:00	Anomalous spacecraft clock basetime loaded to spacecraft causing CPU reset
L2b Campaign Start	2004-02-17 / 21:43:22	Time of Laser 2 startfire command
ACQSUN	2004-02-19 / 16:08:25	Detectors powered off; loss of 9 hours science data during recovery
Power-on Altimeter Detector	2004-02-20 / 02:57:29	Detector powered on; recovery from ACQSUN complete
Stop Etalon Modified Tracking Algorithm	2004-03-09 / 01:00:30	per engineering team request - automated algorithm not working as desired due to low transmitted energy
L2b Campaign Stop	2004-03-21 / 20:38:46	Time of Laser 2 stopfire command
L2c Campaign Start	2004-05-18 / 16:57:03	Time of Laser 2 startfire command
Lower Laser Temperature - Start	2004-05-20 / 19:20:00	Lower Laser Temperature to minimum setpoint per engineering team request - colder environment determined to be more stable
Lower Laser Temperature - Stop	2004-05-26 / 23:16:28	Laser temperature change completed; temperature =16.C
Set Transmit Gain = 142	2004-05-28 / 21:57:11	per engineering team request due to low transmit energy at cold temperature
Set Transmit Gain = 250	2004-06-11 / 22:26:53	per engineering team request due to low transmit energy
L2c Campaign Stop	2004-06-21 / 14:38:50	Time of Laser 2 stopfire command

5.5 Events During Campaigns L2d-L2f

Laser 2 was reactivated on November 25, 2008 after the loss of Laser 3 on October 19, 2008. Upon reactivation the Laser 2 transmitted energy was near the same level as at the end of Campaign L2c. Campaigns L2d, L2e, and L2f executed nominally with no unexpected events until the end of Laser 2 life on October 11, 2009. During Campaigns L2d and L2e the laser temperature was raised to increase the energy output. Table 5-6 lists major events that occurred during campaigns L2d - L2f. All commands executed during the campaigns are listed in Appendix I. Engineering tests that were executed during campaigns are noted in the command table; the tests may affect the quality of the science data.

Table 5-6 Major Events During L2d - L2f Campaigns

Event	Date / Time UTC	Description
L2d Campaign Start	2008-11-25 / 17:49:03	Time of Laser 2 startfire command
Raise Laser Temperature from 17 to 22 degrees C	2008-12-08 06:20 through 2008-12-09 19:00	To increase the Laser 2 transmit energy; temperature raised at the rate of 3 degrees C per day.
Engineering Tests	2008-12-17 / 12:36:34	End of Campaign Test, detailed in Appendix I, L2d Command Table
L2d Campaign Stop	2008-12-17 / 16:42:54	Time of Laser 2 stopfire command
L2e Campaign Start	2009-03-09 / 14:06:47	Time of Laser 2 startfire command
No Data from Alaska Ground Stations	2009-3-10	Communications line was cut. Data was redumped and there was no loss of science data.
LRS VT2 Taken Off-line	2009/070-20:52:12	With ICESat in full sun the LRS software could hang due to the stray light in the VT2.
Raise Laser Temperature from 22 to 24 Degrees C	2009-04-04 / 18:00 through 2009-04-05 / 11:00	To increase the Laser 2 transmit energy; temperature raised at the rate of 3 degrees C per day.
Engineering Tests	2009-04-11 / 11:00:57	End of Campaign Test, detailed in Appendix I, L2e Command Table
L2e Campaign Stop	2009-04-11 / 14:30:23	Time of Laser 2 stopfire command
L2f Campaign Start	2009-09-30 / 21:57:00	Time of Laser 2 startfire command
SPCMs Powered on	2009-10-02 / 17:22:57	SPCMs were off for laser startfire due to power constraints
L2f Campaign Stop	2009-10-11 / 13:30:00	Laser end of life

6.0 LASER 3 OPERATIONS

6.1 Overview

Laser 3 was operated for eleven campaigns (L3a-L3k) for a total of 355 days of on-orbit data collection firing an estimated 1,213,073,440 shots. During the early campaigns, an attempt was made to bring up the green energy by warming the laser but this proved to have little impact. The laser was operated at its coldest temperature starting with campaign L3c until its end of life.

Table 6-1 shows the temperature settings, beta angle, and spacecraft orientation during the Laser 3 campaigns.

Table 6-1 Laser 3 Operations

Campaign Event	Date	Laser Reference Temp. (C)	Laser LHP Setpoint (C)	Bench Temp. (C)	Component LHP Setpoint (C)	Beta Angle (degrees)	S/C Orientation
L3a Start	10/3/04	13.8	6	16.58	14.0932	-48.082	Sailboat
L3a Temperature Adjustment	10/19/04	16	8.2	16.58	14.0932	-52.839	Sailboat
L3a Stop	11/8/04	16	8.2	16.32	14.0932	-57.599	Sailboat
L3b Start	2/17/05	16	8.2	16.25	14.0932	-55.599	Sailboat
L3b Stop	3/24/05	16.15	8.2	16.84	14.0932	-44.55	Sailboat
L3c Start	5/20/05	13.8	6	14.44	6.07	-19.978	Airplane
L3c Stop	6/23/05	13.8	6	14.5	6.07	-3.585	Airplane
L3d Start	10/21/05	13.8	6	16	13.07	50.6	Sailboat
L3d Stop	11/24/05	13.8	6	15.5	13.07	62.6	Sailboat
L3e Start	2/22/06	13.8	6	16.45	15.0096	62.153	Sailboat
L3e Stop	3/28/06	13.8	6	16.97	15.0096	47.953	Sailboat
L3f Start	5/24/06	13.8	6	15.75	8	20.214	Airplane
L3f Stop	6/26/06	13.8	6	15.75	8	4.024	Airplane
L3g Start	10/25/06	13.8	6	16.3	13.07	-44.42	Sailboat
L3g Stop	11/27/06	13.8	6	16	13.07	-54.02	Sailboat
L3h Start	3/12/07	13.8	6	16	14.09	-59.4	Sailboat
L3h Stop	4/14/07	13.8	6	16.5	14.09	-46.9	Sailboat
L3i Start	10/2/07	13.8	6	17.5	14.3	32	Sailboat
L3i Stop	11/5/07	13.8	6	17	14.3	45.8	Sailboat
L3j Start	2/17/08	13.8	6	16	15	74	Sailboat
L3j Stop	3/21/08	13.8	6	16.5	15	61.5	Sailboat

Campaign Event	Date	Laser Reference Temp. (C)	Laser LHP Setpoint (C)	Bench Temp. (C)	Component LHP Setpoint (C)	Beta Angle (degrees)	S/C Orientation
L3k Start	10/4/08	13.8	6	16.5	10.07	-27	Airplane
L3k Stop	10/19/08	13.8	6	16.8	10.07	-32	Airplane

6.2 Laser 3 Transmitted Energy Behavior

The start and stop laser transmit energy values for the laser 3 campaigns are shown in Table 6-2. The Laser 3 daily mean total transmit energy behavior is plotted in Figure 6-1 The Laser 3 daily mean reference temperature is included in the plot to show the impact of temperature change on the transmit energy.

Table 6-2 Laser 3 Start and Stop Energy

Campaign	Start Transmit Energy (mJ)			Stop Transmit Energy (mJ)		
	1064nm	532nm	Total	1064nm	532nm	Total
L3a	69.3	5.4	74.7	66.4	5.0	71.5
L3b	67.9	5.0	72.9	53.6	2.9	56.6
L3c	49.6	2.6	52.2	44.4	2.2	46.5
L3d	43.5	2.2	45.6	38.5	2.1	40.6
L3e	39.1	2.1	41.3	30.4	1.4	31.7
L3f	31.3	1.5	32.7	30.0	1.6	31.6
L3g	31.0	1.6	32.6	24.3	1.1	25.3
L3h	24.8	1.1	25.9	21.6	1.1	22.7
L3i	22.5	1.1	23.6	20.0	1.0	20.9
L3j	20.8	1.0	21.8	16.2	0.8	17.0
L3k	17.5	0.8	18.3	12.3	0.5	12.8

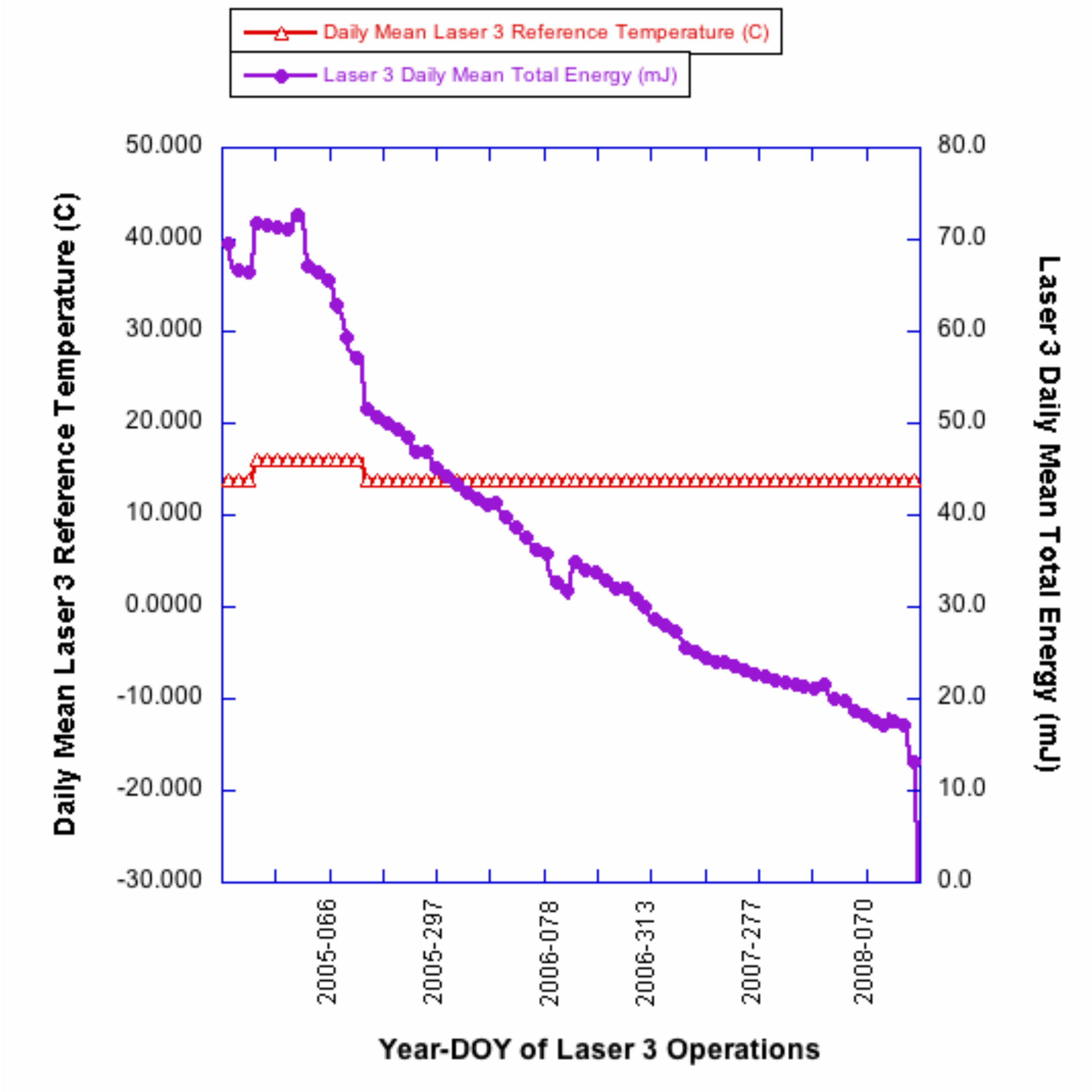


Figure 6-1 Laser 3 Energy Trend

6.3 Laser 3 Configuration

During the laser campaign several parameters were reset from their pre-launch setting. Table 6-3 through Table 6-6 show the updated parameters and the SPCM status at the beginning and end of the Laser 3 campaigns.

Table 6-3 Laser 3a-c Configuration

Campaign	L3a start	L3a stop	L3b start	L3b stop	L3c start	L3c stop
Powered SPCMs	2, 5, 6, 8	2, 5, 6, 8	2, 6, 8	2, 5, 6, 8	2, 6, 8	2, 5, 6, 8
Wmin, Range Window Minimum Width (KM)	1	1	1	1	1	1
Background Noise Search Start Offset (ns)	-667000	-667000	-667000	-667000	-667000	-667000
4nsflag, AGC Parameter (enables/disables use of raw peak filter in AGC)	0	0	0	0	0	0
Vref, AGC Parameter (determines pulse amplitude)	150	150	150	150	150	150
GINIT, AGC Parameter (initial and reset gain value)	80*	80	80	80	80	80
GMIN, AGC Parameter (minimum gain value)	13	13	13	13	13	13
Background Filter Threshold Coefficient, A1 for all Filters	7	7	7	7	7	7
Transmit Pulse Peak Threshold	80	80	80	80	80	80

* The GINIT parameter to initialize the gain was updated to 80 for campaign L2a. With the MEU power-off and recovery after campaign L2a, GINIT was reset to its original value (21) causing data dropout problems when the Laser 2 reached lower transmit energy during campaigns L2b and L2c. GINIT was set back to 80 for the start of the Laser 3 campaigns.

Table 6-4 Laser 3d-f Configuration

Campaign	L3d start	L3d stop	L3e start	L3e stop	L3f start	L3f stop
Powered SPCMs	2, 5, 6, 8	2, 5, 6, 8	2, 5, 6, 8	2, 5, 6, 8	2, 5, 6, 8	2, 5, 6, 8
Wmin, Range Window Minimum Width (KM)	1	1	1	1	1	1
Background Noise Search Start Offset (ns)	-667000	-667000	-667000	-667000	-667000	-667000
4nsflag, AGC Parameter (enables/disables use of raw peak filter in AGC)	0	0	0	0	0	0

Campaign	L3d start	L3d stop	L3e start	L3e stop	L3f start	L3f stop
Vref, AGC Parameter (determines pulse amplitude)	150	150	150	150	150	150
GINIT, AGC Parameter (Initial and reset gain value)	80	80	250	250	250	250
GMIN, AGC Parameter (minimum gain value)	13	13	13	13	13	13
Background Filter Threshold Coefficient, A1 for all Filters	7	7	7	5	7	7
Transmit Pulse Peak Threshold	80	80	80	80	80	80

Table 6-5 Laser 3g-i Configuration

Campaign	L3g start	L3g stop	L3h start	L3h stop	L3i start	L3i stop
Powered SPCMs	2, 5, 6, 8	2, 5, 6, 8	2, 5, 6, 8	2, 5, 6, 8	2, 5, 6, 8	2, 5, 6, 8
Range Window Minimum Width (KM)	1	1	1	1	1	1
Background Noise Search Start Offset (ns)	-667000	-667000	-667000	-667000	-667000	-667000
4nsflag, AGC Parameter (enables/disables use of raw peak filter in AGC)	0	0	0	0	0	0
Vref, AGC Parameter (determines pulse amplitude)	150	150	135	135	135	135
GINIT, AGC Parameter (initial and reset gain value)	250	250	250	250	250	250
GMIN, AGC Parameter (minimum gain value)	13	13	13	13	13	13
Background Filter Threshold Coefficient, A1 for all Filters	7	7	7	7	7	7
Transmit Pulse Peak Threshold	80	80	80	80	80	80

Table 6-6 Laser 3j-k Configuration

Campaign	L3j start	L3j stop	L3k start	L3k stop
Powered SPCMs	2, 5, 6, 8	2, 5, 6, 8	none	2, 5, 6, 8
Wmin, Range Window Minimum Width (KM)	1	1	1	1
Background Noise Search Start Offset (ns)	-667000	-667000	-667000	-667000
4nsflag, AGC Parameter (enables/disables use of raw peak filter in AGC)	0	0	0	0
Vref, AGC Parameter (determines pulse amplitude)	135	135	135	135
GINIT, AGC Parameter (Initial and reset gain value)	250	250	250	250
GMIN, AGC Parameter (minimum gain value)	13	13	13	13
Background Filter Threshold Coefficient, A1 for all Filters	7	7	7	7
Transmit Pulse Peak Threshold	80	80	80	80

6.4 Events

The first on-orbit firing of Laser 3 occurred on October 3, 2004 for the start of the L3a campaign. Unexpectedly, Laser 3's 532nm (green) transmit energy was low compared to the total transmitted energy. In an attempt to increase the green energy, the laser was warmed a few degrees to 16C on October 19, 2004. The laser temperature was kept at 16C during campaign L3b, but for subsequent campaigns the temperature was lowered to its lowest setting (13.8C) per instrument engineering team recommendation. Operations were very stable through all Laser 3 campaigns until its end of life on October 19, 2008. Table 6-7 lists major events that occurred during the Laser 3 campaigns. All commands executed during the campaigns are listed in Appendix H. Engineering tests that were executed during campaigns are noted in the command table; the tests may affect the quality of the science data.

Table 6-7 Laser 3 Events

Event	Date / Time UTC	Description
L3a Campaign Start	2004-10-03 / 21:30:14	Time of Laser 3 startfire command
Raise Laser Temperature from 13.8 to 16 degrees C	2004-10-19 / 00:00 through 2004-10-19 / 17:25	To increase the Laser 3 transmit energy to improve the 532nm output; temperature raised at the rate of 3 degrees C per day.
L3a Campaign Stop	2004-11-04 / 15:09:02	Time of Laser 3 stopfire command
L3b Campaign Start	2005-02-17 / 16:08:13	Time of Laser 3 startfire command
SPCM 5 Powered On	2005-02-18 / 17:53:12	Due to s/c power SPCM 5 power-on delayed until after laser startfire
Drop in Laser 3 Transmit Energy	2005-02-23	Suspected amplifier bar drop which is an expected infrequent laser event
GPS Reset and Configure	2005-03-01/18:05:56	Manual reset due to GPS tracking less than 8 satellites
Drop in Laser 3 Transmit Energy	2005-03-09	Suspected amplifier bar drop which is an expected infrequent laser event
L3b Campaign Stop	2005-03-24 / 16:59:37	Time of Laser 3 stopfire command
Updated DEM Tables loaded to GLAS	2005-04-06 through 2005-04-20	To correct surface type flag errors
L3c Campaign Start	2005-05-20 / 16:35:56	Time of Laser 3 startfire command
SPCM 5 Powered On	2005-05-22 / 16:54	SPCM 5 was powered off for laser start fire due to power constraints
L3c Campaign Stop	2005-06-23 / 05:46:33	Time of Laser 3 stopfire command
L3d Campaign Start	2005-10-21 / 22:56:45	Time of Laser 3 startfire command
Ground Station Problem caused missed X-band Dump	2005-11-03	3 minutes of science data lost
Transmit Gain Set to 71	2005-11-15/17:28:13	Raised from 41 due to lower energy
L3d Campaign Stop	2005-11-23 / 01:08:51	Time of Laser 3 stopfire command
L3e Campaign Start	2006-02-22 / 20:37:10	Time of Laser 3 startfire command
AGC Parameter Update	2006-03-06/17:47:54	zinit update due to lower transit pulse peak
Engineering Test	2006-03-27/21:34:02	End of Campaign Test, detailed in Appendix H, L3e Command Table
L3e Campaign Stop	2006-03-28 / 01:52:39	Time of Laser 3 stopfire command
L3f Campaign Start	2006-05-24 / 17:43:19	Time of Laser 3 startfire command
L3f Campaign Stop	2006-06-26 / 18:17:48	Time of Laser 3 stopfire command
L3g Campaign Start	2006-10-25 / 12:49:38	Time of Laser 3 startfire command

Event	**Date / Time UTC**	**Description**
Engineering Test	2006-11-27/13:27:58	End of Campaign Test, detailed in Appendix H, L3g Command Table
Transmit Gain set to 100	2006-11-27/14:17:44	Raised from 71 due to lower energy and to prepare for next campaign
L3g Campaign Stop	2006-11-27 / 16:38:10	Time of Laser 3 stopfire command
L3h Campaign Start	2007-03-12 / 02:05:22	Time of Laser 3 startfire command
Engineering Test	2007-04-14/10:37:36	End of Campaign Test, detailed in Appendix H, L3h Command Table
L3h Campaign Stop	2007-04-14 / 17:03:31	Time of Laser 3 stopfire command
L3i Campaign Start	2007-10-02 / 21:10:23	Time of Laser 3 startfire command
Engineering Test	2007-11-04/23:12:36	End of Campaign Test, detailed in Appendix H, L3i Command Table
L3i Campaign Stop	2007-11-05 / 02:28:31	Time of Laser 3 stopfire command
L3j Campaign Start	2008-02-17 / 19:52:17	Time of Laser 3 startfire command
Transmit Gain set to 128	2008-03-20/17:02:47	Raised from 100 due to lower energy and to prepare for next campaign
L3j Campaign Stop	2008-03-21 / 23:34:45	Time of Laser 3 stopfire command
L3k Campaign Start	2008-10-04 / 14:13:12	Time of Laser 3 startfire command
SPCM 2, 5, 6, 8 Powered On	2008-10-06 / 17:41:55	Due to s/c power SPCM power-on delayed until after laser startfire
L3k Campaign Stop	2008-10-19 / 1:46:23	Laser end of life

7.0 INSTRUMENT MISSION ACTIVITIES

During routine operations, after launch and commissioning of the spacecraft and GLAS, several activities were performed to calibrate and optimize the instrument's performance and the ground processing of the data. These activities were performed either during each campaign, in between campaigns, or as routine maintenance.

7.1 Oscillator Frequency Calibration and Monitoring

The GLAS oscillator was designed to contribute no more than 2 mm range error to the GLAS altimeter measurement at an average ranging distance of 600km thus requiring the average clock frequency to be known to within 1.0e-9 (1 part per billion or 1PPB) at all times. It was originally planned that the clock frequency would be calculated every 1000 seconds against the time of the GPS ticks. However, the on-orbit data showed the GLAS clock oscillator to be much more stable than expected allowing the clock frequency to be estimated with a lookup table. The stability of the oscillator combined with the actual campaign mode of operating the instrument allowed the team to estimate the clock frequency for an upcoming campaign based on expected temperatures. After a campaign was completed, the team computed the actual oscillator frequency to be used for final science data processing. The clock frequency table lookup table was updated with the clock frequency (either predicted or actual) and the date/time that the data was valid for use. The oscillator frequency over the mission is shown in Figure 7-1. Additionally, the team monitored the aging rate as shown in Figure 7-2.

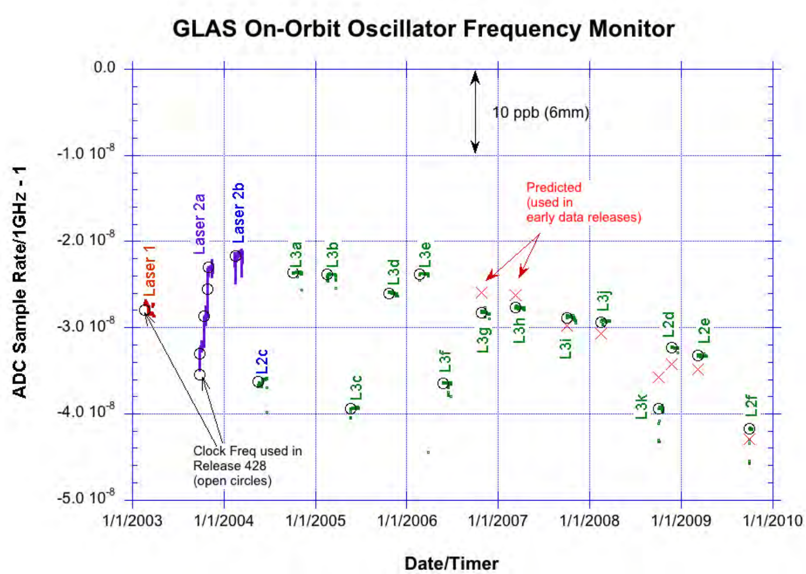


Figure 7-1 GLAS On-Orbit Oscillator Frequency

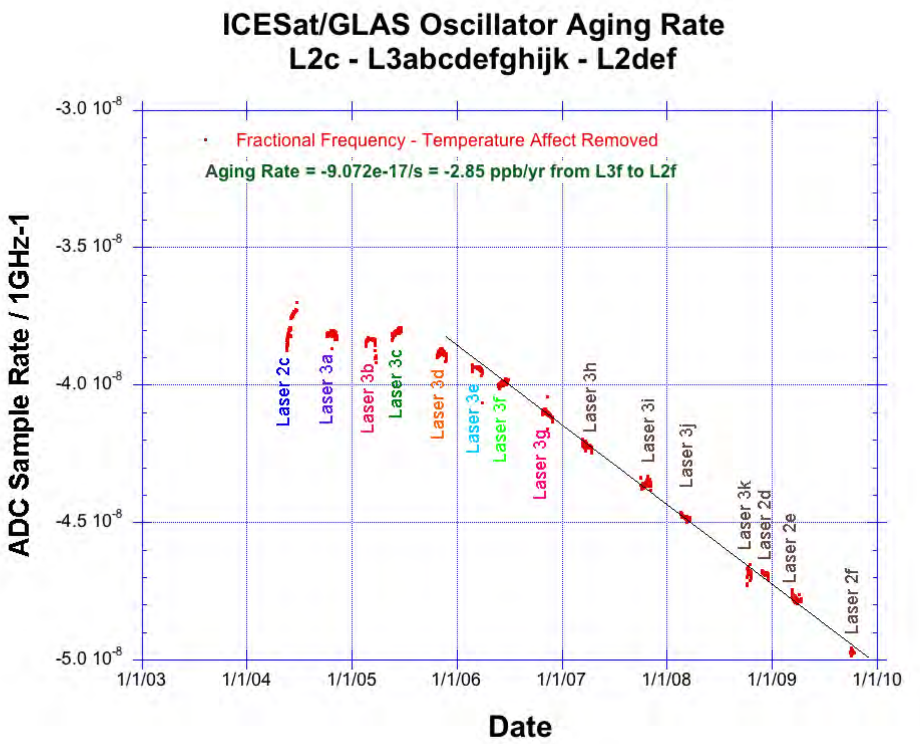


Figure 7-2 GLAS Oscillator Aging Rate

7.2 GLAS Instrument Operations Change Requests

GLAS Instrument Operations Change Requests (CR) were used during the mission to request changes to the instrument operations including updating operating procedures or flight software parameters or uploading new versions of flight software. A CR could be initiated by any member of the GLAS science, operations or sustaining engineering team, was approved by the CR approval board, and implemented by the operations and/or flight software sustaining engineering team. The CR approval board was set up depending on the type of change requested. The approved GLAS CRs are summarized in Table 7-1. The fully documented CRs are in Appendix K.

Table 7-1 GLAS Operations Change Request Summary

CR Number	CR Title	Initiator	Initiation Date	Implement Date
GLAS-CR-001	532nm Boresite Algorithm Modification	Steve Palm	01/07/2003	04/11/2003
GLAS-CR-002	Raise the SPCM Temperatures	Peggy Jester Eleanor Ketchum	04/02/2003	04/03/2003
GLAS-CR-003	Jam GLAS MET to Spacecraft's VTCW	David Hancock	04/10/2003	04/21/2003
GLAS-CR-004	Etalon Closed-loop Algorithm Modifications	Redgie Lancaster	04/03/2003	05/07/2003

CR Number	CR Title	Initiator	Initiation Date	Implement Date
GLAS-CR-005	Implement 40/sec Laser Drive Pulse Width Counter	Peggy Jester	05/10/2003	07/01/2003
GLAS-CR-006	Gain/Cloud Interaction S/W Patch	Jan McGarry	06/21/2003	08/14/2003
GLAS-CR-007	Altimeter Algorithm Parameter Updates	Jan McGarry	08/15/2003	09/01/2003
GLAS-CR-008	Change Npq Compression for Land Surface Type	Jan McGarry	02/11/2004	02/13/2004
GLAS-CR-009	Change Npq Compression for Ice Sheet Surface Type	David Hancock	10/17/2005	10/21/2005
GLAS-CR-010	Update Surface Type in the DEM	David Hancock	01/07/2005	04/20/2005
GLAS-CR-011	Update the Auto-Gain Control (AGC) Parameters	Jan McGarry	02/01/2006	02/21/2006 03/06/2006
GLAS-CR-012	Perform Tests to Optimize Receiver Settings for Low Laser Energy	Peggy Jester	03/15/2006	03/27/2006
GLAS-CR-013	Test AGC parameters, Vref and Filter Weight Limits	Jan McGarry	02/26/2006	03/09/2007 04/14/2007

7.3 Flight Software Optimization

During the mission, the GLAS Flight Software was updated to optimize the on-board algorithms or to fix errors. The GLAS Flight Software Sustaining Engineering Team had their own configuration change request system to track updates to the flight software. Table 7-2 lists the flight software updates and the related GLAS Configuration Change Request. Appendix L contains a table of the GLAS Flight Software CCR descriptions and proposed solutions.

Table 7-2 GLAS Flight Software Versions

FSW CCR No.	GLAS CR No.	Date	Title	Uplink Date/ Time (UTC)	IPS Version
003	n/a	09/20/2002	Modified Etalon Closed-Loop Control Mode	02/11/2003 00:04	4.1
009	001	01/16/2003	Fine Boresite Calibration Number of Positions	04/11/2003 13:14	4.2
011	n/a	03/07/2003	Etalon Parameter Set #3	04/11/2003 13:14	4.2
012	n/a	03/10/2003	Increase Range of AGC GMIN Parameter to 3-250	04/11/2003 13:14	4.2
013	n/a	03/11/2003	Increase Range of Altimeter Detector (AD) Background Noise Offset	04/11/2003 13:14	4.2
014	004	04/02/2003	Modified Etalon Closed-Loop Control Mode #2	05/07/2003 17:40	4.3
015	005	05/06/2003	Pulsewidth Monitor	01/12/2004 19:04	4.4
016	006	06/16/2003	Gain Logic Patch	01/14/2004 20:56	4.5
017	n/a	09/30/2003	Pulse Width Operational Limits	02/17/2004 21:47	4.5
018	n/a	10/07/2003	Etalon Control Parameter Changes	01/06/2004 00:16	4.5
020	010	12/09/2004	Corrections to GPS DEM Tables	04/20/2005 19:59	4.5
021	011	01/25/2006	New Altimeter Detector (AD) Gain Timeout Value	02/21/2006 17:17	4.5
022	011	03/03/2006	Change to AD Gain Parameters	03/06/2006 17:38	4.5
023	012	03/15/2006	Change to AD Gain Weight Limit	03/27/2006 22:48	4.5
024	013	03/30/2007	2nd. Change to AD Gain Weight Limit	04/14/2007 10:37	4.5
025	013	10/24/2007	Test of AD Filter Weight Changes	11/04/2007 19:59	4.5
026		02/20/2008	Modification to AD Gain Logic Patch	03/21/2008 18:48	4.6

7.4 DEM Update

In the course of science data processing it was noticed that the surface type was set incorrectly for some of the on-board DEM 1x1 degree grids. Further analysis showed that many grids at the edges of the ice shelves were not set to the optimal value for collecting data. The science team updated the DEM surface type flags and the flight software team implemented the updates in a series of table loads that are documented in GLAS-CR-010 and FSW CCR-020. The manner of DEM implementation required each of the 360 tables to be updated. The DEM table loads started on 04/06/2005 and were completed and operational on 04/20/2005.

7.5 1064nm Pulse and Return Energy Estimation

The GLAS instrument did not monitor or report the GLAS 1064nm transmitted or received energy. Through ground testing, an algorithm was developed to estimate the energy during post-processing of the science data. It was also determined that the gain setting affected the energy value. Appendix M briefly discusses the gain correction calculation. More detail on the 1064nm energy estimation see the ICESat/GLAS Level 1A ATBD, reference document 6.

7.6 Range Bias Saturation Correction

The GLAS return signal could be saturated due to highly reflective surfaces, the finite response time of the automatic gain control loop, or underestimation of the signal dynamic range. The effect of the return saturation is lower calculated elevation and/or under-estimation of the surface reflection. The engineering team developed and refined a look-up table to correct saturated returns to mitigate these effects. A description of the range bias saturation correction is found in Appendix M.

8.0 END OF MISSION ACTIVITIES

In the Fall of 2009, the ICESat Project and ICESat Project Scientist solicited proposals from the ICESat Science Team and ICESat/GLAS sustaining engineering team for tests to perform once the ICESat primary science data collection was completed. The tests were expected to benefit the planning of future missions such as ICESat-2. When the end of the ICESat primary science mission was declared in February 2010 after all three lasers were depleted and all attempts to restart the lasers failed, the list of proposed Post Laser Campaign Tests was presented to HQ and was approved. The tests and their status are listed in Table 8-1. The test descriptions and results are documented in Appendix J, ICESat Post Campaign Test Report.

Table 8-1 Post Laser Campaign Tests

Test Number	Proposed Test	Status	Report	Test Date
1	Measure the Single Photon Counting Module (SPCM) radiation damage	Completed	Appendix J.1	February – March 2010
2	Point to MESSENGER	Completed	Appendix J.2	2/16/10 - 2/20/10
3	Perform Link test with LRO	Not completed due to LRO schedule constraints; medium confidence that this test would be successful since we demonstrated that ICESat could point toward MESSENGER accurately.	N/A	N/A
4	Point the spacecraft and dwell at the GSFC SLR station	Not completed due to SLR station schedule constraints; medium confidence of that this test would be successful as we had not demonstrated the dwell capability in flight.	N/A	N/A
5	Switch to the GLAS backup Digitizer and Oscillator	Completed	Appendix J.3	3/17/10 - 3/31/10 (GPS1) 5/5/10 (GPS2)
6	Execute SIRU calibration	Completed	Appendix J.4	5/7/2010
7	Switch to the GLAS backup Detector	Completed	Appendix J.3	3/17/10 - 3/31/10 (GPS1) 5/5/2010 (GPS2)
8	Mimic Component Loop Heat Pipe (CLHP) anomaly on the Laser Loop Heat Pipe (LLHP)	Completed	Appendix J.5	April 2010
9	Recreate the CLHP anomaly	Completed	Appendix J.5	April 2010
10	Warm the SPCMs and evaluate affect on radiation damage	Completed	Appendix J.1	4/27/10-6/7/10

Test Number	Proposed Test	Status	Report	Test Date
11	Test the 4th GYRO	Not completed due to resource and schedule constraints; high confidence this test would be successful.	N/A	N/A
12	Power on the redundant GPS Receiver (GPS2)	Completed	Appendix J.6	4/30/2010 through Passivation
13	Use the Instrument Support Facility (ISF) as a backup MOC to command spacecraft	Firewall rules were updated but the command test was not completed due to schedule constraints. The team had high confidence that the test would have succeeded since the ISF housed the same software as the MOC and it only required the commanding option to be enabled and the network interface to be functional.	N/A	N/A
14	Demonstrate ICESat capability to point at the poles	Not completed; this test was subsequently withdrawn after the successful demonstration that ICESat could meet this requirement by pointing to Venus	N/A	N/A
15	Point to Venus	Completed	Appendix J.7	6/7/10 - 6/15/10
16	Repeat pointing to MESSENGER correcting for errors and GLAS detector anomaly during the first attempt	Not completed due to MESSENGER schedule constraints; high confidence this test would be successful.	N/A	N/A

Acknowledgements

Since this report has been a long time coming and the result of contributions from many people, and at the risk of leaving someone out, I have a long list of acknowledgements:

Shelley Thessen and Jim Golder for their operations support during ground testing and on-orbit mission operations and for compiling information for and reviewing this report, Suneel Bhardwaj and the ICESat SIPS team for keeping the Level 0 data flowing, David Hancock for his review of and his suggestions for additional material to include in this report, Eleanor Silverman and the members of the GLAS instrument team and sustaining engineering team for providing insight into operating the instrument and support during the mission, Xiaoli Sun and Jan McGarry for engineering data analysis during and after the mission, Dr. Bob Schutz, ICESat Science Team Leader, for his dedicated support of pointing calibrations and input to GLAS operations, Dr Steve Palm for his dedicated monitoring and analysis of the 532nm data and input to GLAS operations, Darren Osborne, ICESat Flight Director, and the ICESat Mission Operations Center Flight Operation Team and Paul Woznick, ICESat Spacecraft Engineer, for their support in making ICESat a successful mission and for providing data that is included in this report, and Ed Chang, Mission Operations Manager, for his dedication and support of the ICESat mission and for his facilitation of the events described in this report.

Appendix A: SPCM Feailure and Outgassing Estimate Reference

GLAS SPCM Outgassing Time Estimate, Rev 0
X. Sun, E-mail dated Feb 11, 2003

All:

My follow up analysis and some new old data are as follows:

- I am attaching a copy of the Paschen curve and it was just like what Henning described, the critical pressures at 600 volts for air are 0.07 and 3.0 atm-mil, extending slightly less than 2 order of magnitude. The spacing for the HV pins to ground is about 0.5 mm or 20 mil, corresponding to the critical pressures of 3.5 and 150 mbar, respectively.
- I found in my notes that PerkinElmer once measured the critical pressures for the altimeter detector modules (1" TO-8 can with the same lead spacing) and they were 0.1 and 52 torr (0.13 and 67 mbar), which is in line with the Paschen curve given the nature of this type of measurements.
- The corona appeared to have occurred under the HV hybrid, or inside the bubble according to the photo. Therefore we should consider the inside pressure and its decay of the bubble.
- The air pressure inside the bubble follows an exponential function. At twice the corona onset time period, the inside pressure should have dropped to the square of the onset pressure. For example, if the corona started at 67 mbar at 2 weeks, waiting for another two weeks will result in an insider pressure of 0.067^2=0.0045 bar, which is close to but not too far from the critical pressure. We need to wait for 2.5 times the onset time to get below the 0.0013 mbar critical pressure. This, again, is comparable to what Henning stated.
- If we consider the variation of the thickness of the Nusil wall, 0.09 to 0.11 according to Claude's email, the onset time can be 50% longer.
- We therefore need to wait for 1.5*2.5 times the onset time, or 3.75 times the two weeks room temperature onset time that Mike measured, or 7.5 weeks, plus additional time required to account for the cooler SPCM temperature.
- Since we will reach 2.5 weeks equivalent 25 deg time at the end of Feb and the current SPCM temperature is about 8 deg lower than 25 deg C and require twice as long to reach the critical pressure, we will need to wait for 10 weeks from March 1.
- I believe the air pocket under the HV hybrid by the Nusil "seal" was not intentional and therefore not uniform on all the units.

This just another of my non-proven analysis and please comment and correct.

Xiaoli

XSun email, April 2, 2003 concerning Warming the SPCMs to shorten the outgassing time

Here is my estimate of SPCM outgas time if they were to heat up from the current 20 degree C to 23 degree C.

Based on the assumption that the time to leak to pass the critical pressure is shortened by a factor of two for every 8 degree C of temperature change, the ratio of the leak rates at two different temperatures, T1 and T0, can be approximated as

$L(T1)/L(T0) = 2^{[-(T1-T0)/8]}$

For T1=23 and T0=20 deg C,

$L(T1)/L(T0) = 2^{(-3/8)} = 0.77$.

Therefore, the outgas time should be shortened by 23%.

For example, if we decide to raise the temperature tomorrow (4/3/03), the original minimum outgas time, 10 weeks from 3/1/2003 at 20 deg C, will become (10 weeks required - 5 weeks already passed)*0.77 = 3.85 weeks (27 days) from tomorrow, or May 1, 2003.

Appendix B: Commissioning History

GLAS Commissioning Sequence of Events

Event	Activity
1	CLHP Startup Heater Turn-On
2	Monitor CLHP Startup Condition
3	Post-CLHP Startup Monitoring
4	MEU Power On
5	Configure Operational Heaters Set CLHP Setpoint and Enable CLHP (LHP 2) Jam GLAS MET
6	CLHP Temperature Increase Activate Primary Heater Activate Tower Heater Set CD and PC boards to firecmd
7	CLHP Temperature Increase Begin LLHP Conditioning
8	CLHP Temperature Increase LLHP Conditioning Power on the Instrument Star Tracker (IST)
9	CLHP Temperature Increase LLHP Conditioning Power on Laser Reference System (LRS)
10	CLHP Temperature Increase LLHP Conditioning Switch to Meta Format for SRS Data Verification
11	Monitor CLHP Enable SIRU Resonate Heaters
12	Disable CLHP Startup Heater
13	Enable LLHP Startup Heater
14	LLHP Startup Monitoring
15	LLHP Startup Monitoring Start CBM table for LLHP temperature increase Enable Laser Warm Up Heater
16	Load MEU Software Patch for Etalon Algorithm
17	LLHP Temperature Increase Power on Altimeter Detector

18	LLHP Temperature Increase
19	Activate Etalon Heaters Configure OTS for testing Configure AD Board for testing
20	GLAS Status Monitoring
21	Laser Electronics Power On Preparation Adjust Altimeter Detector Gains Configure LSM for Laser Turn-On
22	Monitor Laser Temperatures Verify Spacecraft Battery status for additional load of laser firing Verify Laser 1 temperature is above 15° Cel Power on Laser 1 electronics
23	Monitor Laser Temperatures Configure OTS for Laser Firing Switch to Meta Format for SRS Data Verification
24	Enable Laser Firing Switch to Meta Format for SRS Data Verification Monitor Laser Temperatures Turn off Laser Warm Up Heater
25	Monitor GLAS Status
26	Disable LLHP Startup Heater
27	Etalon Tuning Operations: Manual, Open Loop, Auto

POST LAUNCH VERIFICATION

ALL Tests assume GLAS MEU is on and GLAS is at its nominal temperature

Phase I

Tests to be done BEFORE Turning LASER ON

Test No.	Activity & Settings	Verification Process/Analysis
1	Verify GPS tick interval and GLAS clock oscillator frequency	The GPS tick time should be current and consistent with s/c MET to within 10 seconds;
		GPS tick time corrections in the GPS packet are < 100us;
		GLAS oscillator frequency averaged over 1000 seconds based on the GPS ticks is stable to +/-1e-8 over at least an orbit and drift by less then 0.01ppm over two orbit after correcting for temperature effect
2	Verify GLAS altimeter digitized waveform fidelity, time of flight measurement accuracy, and receiver sensitivity with fixed OTS	OTS pulse amplitude mean over N (TBD) waveforms within +/-5% of preflight test data
	Altimeter Detector1 ON	OTS pulse width mean over N (TBD) waveforms within +/-5% of preflight test data
	Tx Gain = 128, Rtn Gain=128	Time of flight of the two OTS pulses equal to exactly 4,000,000 +/- <0.330 clock periods plus OFFSET
	Altimeter Digitizer in Science Mode	The first OTS pulse starts at digitizer record address 185,000 +/- 5
	Rmin = 565 km, Rmax = 576 km, LAND same as LFF	
	First OTS pulse should be at 200,000 clock cycles from Fire Cmd	
	Second OTS Pulse should be in the middle of the return window	
	First OTS pulse amplitude set to 120	
	Second OTS Pulse amplitude set to 120	
	Enable OTS	

	Set Cloud Digitizer delay to -66, -71, and -77 km	
	Set Cloud Digitizer to Science	"ground echo" shown at the correct range bin in the cloud digitizer output and follows the OTS pulse delay time
3	Verify GLAS altimeter digitized waveform fidelity, time of flight measurement accuracy, and receiver sensitivity with variable OTS	Average measured pulse amplitude within +/-10% the set value and varies proportionally to the OTS pulse amplitude, <10% deviation from linear
	Altimeter Detector1 ON	Auto gain response, needs fewer than 20 shots to stabilize, no sustained oscillation, >90% pulses not saturated (i.e. >230 counts), pulse peak value between 150 and 230 for max and max/2 input OTS signal levels;
	Tx Gain = 128, Rtn Gain=AUTO	Time of flight of the two OTS pulses equal to exactly 4,000,000 +/- <0.330 clock periods plus OFFSET
	Altimeter Digitizer in Science Mode	Min night background noise level the same as the instrument dark noise floor (mean=TBD+/-TBD, and stdev =<TBD)
	Rmin = 565 km, Rmax = 576 km, LAND same as LFF	Max day time (stdev) within a factor 2 of TBD
	First OTS pulse should be at 200,000 clock cycles from Fire Cmd	Background stdev correlates with the earth brightness, e.g., bright clouds, dark ocean, ice and snow, and night time darkness;
	Second OTS Pulse should be in the middle of the return window	The receiver detection threshold set correctly per background noise mean and stdev;
	Cycle through the following OTS levels (roughly 25 secs at each level): 40, 120, 255, 40	
	Enable OTS	
	Set Cloud Digitizer delay to -66, -71, and -77 km	
	Set Cloud Digitizer to Science	"ground echo" shown at the correct range bin in the cloud digitizer output and follows the OTS pulse delay time
4	Verify GLAS altimeter digitized waveform fidelity, time of flight measurement accuracy, and receiver sensitivity with variable OTS and variable delay	Average measured pulse amplitude within +/-10% the set value and varies proportionally to the OTS pulse amplitude, <10% deviation from linear
	Altimeter Detector1 ON	Auto gain response, needs fewer than 20 shots to stabilize, no sustained oscillation, >90% pulses not saturated (i.e. >230 counts), pulse peak value between 150 and 230 for max and

		max/2 input OTS signal levels;
	Tx Gain = 128, Rtn Gain=128	Time of flight of the two OTS pulses equal to exactly 4,000,000 +/- <0.330 clock periods plus OFFSET
	Altimeter Digitizer in Science Mode	Min night background noise level the same as the instrument dark noise floor (mean=TBD+/-TBD, and stdev =<TBD)
	Rmin = 565 km, Rmax = 576 km, LAND same as LFF	Max day time (stdev) within a factor 2 of TBD
	First OTS pulse should be at 200,000 clock cycles from Fire Cmd	Background stdev correlates with the earth brightness, e.g., bright clouds, dark ocean, ice and snow, and night time darkness;
	Second OTS Pulse delay should change from 570 km to 578 km and back to 563 km with a step of 0.5 km with the smallest possible dwell time at each step (total 46 steps)	The receiver detection threshold set correctly per background noise mean and stdev;
	First OTS pulse amplitude set to 120	
	Second OTS Pulse amplitude set to 120	
	Enable OTS	
	Set Cloud Digitizer delay to -66, -71, and -77 km	
	Set Cloud Digitizer to Science	“ground echo” shown at the correct range bin in the cloud digitizer output and follows the OTS pulse delay time
	Verify algorithm operation with OTS and DEM	Rmin and Rmax setting according to the design per DEM and s/c position
	Altimeter Detector1 ON	Surface type, land or ocean, and data compression (N, P, Q) setting according to the design per DEM and s/c position
	Tx Gain = 128, Rtn Gain=AUTO	Calculated noise mean, stdev, threshold by GLAS are correct
5	Rmin, Rmax, surface type as selected by DEM	
	First OTS pulse should be at 200,000 clock cycles from Fire Cmd	
	Second OTS Pulse should be 4,200,000 clock cycles from Fire Cmd	
	First OTS pulse amplitude set to 120	
	Second OTS Pulse amplitude set to 120	
	Set Cloud Digitizer delay to -66, -71, and -77 km	

	Set Cloud Digitizer to Science	"ground echo" shown at the correct range bin in the cloud digitizer output and follows the OTS pulse delay time
Phase II Tests to be done AFTER Turning LASER ON		
Test No.	Activity & Settings	Verification Process/Analysis
6	Verify laser characteristics	1064nm Laser 1 pulse energy derived from the Tx pulse waveform equals to 68 mJ +/-10%
		Tx pulse appears within 183000 to 188,000 memory location of the digitized waveform record
		Laser pulse width between 6.5 and 7.0 ns
		Laser beam pattern and pulse energy at 532nm on CRS image on LRS camera: TBDurad +/-TBD% in the x axis TBDurad +/-TBD% in y axis, and pulse energy TBD counts +/-%;
		PinA outputs 120+/-30 counts with mode hopping characteristics resemble those during ground testing
		PinB outputs 90+/-30 counts PinA outputs 120+/-30 counts with mode hopping characteristics resemble those during ground testing
		PinE output consistent with SRS-CRS pulse energy during initial transient and then mostly clamped at 175 counts with occasional drop-outs
7	Verify receiver performance using the actual ground and cloud echo pulse	Long wavelength topography variation (shape) of the measured along track earth surface topography matches the DEM. to within 1 deg between their axes
	Altimeter Detector1 ON	Measured small scale topography across areas with abrupt transition, such as a segment of a ground track cross the red sea, matches the area elevation map to 1 km along track and TBD meter cross track
	Tx Gain = 128, Rtn Gain=AUTO	Raw pulse amplitude of >TBD% echo pulses fall between 60-220 counts
	Rmin, Rmax, surface type as selected by DEM	Ground echo appeared at the correct

		location in the cloud digitizer output
		Cloud echoes from the cloud digitizer output matches the near real time cloud coverage weather map in geo location and height
		The noise stdev from the 1km "underground" portion of the waveform matches the cloud coverage weather map at daytime
	Perform Mini-One shot	
8	Verify receiver performance using the delay pulse	

Appendix C: Campaign Start and Stop Times

Campaign	UTC Start Time	UTC Stop Time	Start Date	Stop Date	Number of Days	Mode^
Laser 1	2003_051T22:18:00	2003_088T19:01:20	Feb 20, 2003	Mar 29, 2003	37	S
Laser 2a	2003_268T17:17:45	2003_323T05:15:00	Sep 25, 2003	Nov 19, 2003	55*	S
Laser 2b	2004_048T21:43:22	2004_081T20:38:46	Feb 17, 2004	Mar 21, 2004	33	S
Laser 2c	2004_139T16:57:03	2004_173T14:38:50	May 18, 2004	Jun 21, 2004	34	A
Laser 3a	2004_277T21:30:14	2004_313T15:09:02	Oct 3, 2004	Nov 8, 2004	36	S
Laser 3b	2005_048T16:08:13	2005_083T16:59:37	Feb 17, 2005	Mar 24, 2005	35	S
Laser 3c	2005_140T16:35:56	2005_174T05:46:33	May 20, 2005	Jun 23, 2005	34	A
Laser 3d	2005_294T22:56:45	2005_328T01:08:51	Oct 21, 2005	Nov 23, 2005	34	S
Laser 3e	2006_053T20:37:10	2006_087T01:52:39	Feb 22, 2006	Mar 28, 2006	34	S
Laser 3f	2006_144T17:43:19	2006_177T18:17:48	May 24, 2006	June 26, 2006	33	A
Laser 3g	2006_298T12:49:38	2006_331T16:38:10	Oct 25, 2006	Nov 27, 2006	33	S
Laser 3h	2007_071T02:05:22	2007_104T17:03:31	Mar 12, 2007	Apr 14, 2007	34**	S
Laser 3i	2007_275T21:10:23	2007_309T02:28:31	Oct 2, 2007	Nov 5, 2007	34	S
Laser 3j	2008_048T19:52:17	2008_081T23:34:45	Feb 17, 2008	Mar 21, 2008	33	S
Laser 3k	2008_278T14:13:12	2008_293T1:46:23	Oct 4, 2008	Oct 19, 2008	15	A
Laser 2d	2008_330-17:49:03	2008_352-16:42:54	Nov 25, 2008	Dec 17, 2008	22	S
Laser 2e	2009_068-14:06:47	2009_101-14:30:23	Mar 9, 2009	April 11, 2009	33	S
Laser 2f	2009_273-21:57:00	2009_284-13:30:00	Sept 30, 2009	Oct 11, 2009	12	A

* L2a started in the 8-day repeat orbit and transitioned to the 91-day repeat orbit on Oct 4, 2003. Campaign was extended to November 28, 2003 per science team request but spacecraft entry into Acquire Sun Mode due to SCC reset ended the campaign on November 19. Subsequent campaigns were scheduled to be 33-day campaigns.

** Transitioned from 3 campaigns/year to 2 campaigns/year

^Spacecraft flying orientation, A = Airplane, S = Sailboat

Appendix D: CLHP Anomaly

August 17, 2003

ICESAT/GLAS Component Loop Heat Pipe (CLHP) Anomaly

Summary: Dan Butler/Code 545

August 28, 2003

EVENTS:

1. On August 17, 2003, the GLAS Component Loop Heat Pipe stopped operating, resulting in an increase in the temperature of the Loop and the instrument electronics. The Laser LHP continued to function normally. The mission ops team called Charles Baker, who recommended turning on the starter heater. Although the starter heater (60 W) was activated, the temperatures were already near the upper limit and the over-temperature protection circuitry automatically turned off power and shut down the system. It is not clear whether the Loop would have recovered if the starter heater was turned on sooner.

2. The loop and electronics gradually cooled off over the next day until it self started, at which point it quickly cooled to the Compensation Chamber (CC) survival heater set point (- 7 C). The CC survival heater then activated and automatically shut the loop down.

3. A restart was attempted on August 20. The instrument electronics was activated and the Compensation Chamber (CC) temperature was increased to 18 C (the evaporator temperature was at 15.5 C). After 45 minutes, the starter heater was activated and the loop started immediately (evaporator was at 17 C). The loop ran for approximately 2 hours and again stopped operating, in a pattern similar to the 1st anomaly, i.e. the evaporator temperature increased first, followed by the CC temperature. The loop was shut down and the system again allowed to cool. Another self-start was observed, with the CC survival heaters then being activated by thermostat control.

4. On August 21, a loop restart was performed at the colder survival temperature, but this time only the starter heater was activated. The temperature range is –7 C to –2 C on the CC as controlled by the survival heater thermostat. On August 26, the electronics was activated, and shortly thereafter the CC operational controller was then activated at a –5 C set point. The starter heater was left on, with the loop continuing to run successfully.

TIGER TEAM ESTABLISHED**:**

An initial tiger team has been established consisting of personnel with expertise on Loop Heat Pipes and the GLAS thermal control system. The team includes Wes Ousley, Dan Butler, Eric Grob, Tom McCarthy, Charles Baker, Jentung Ku, and Laura Ottenstein of the Thermal Engineering Branch and Eleanor Ketchum of the ICESAT/GLAS project. External consultants include Michael Nikitkin of Swales, and Walter Ancarrow of WCA Engineering. Additional members will be added as required.

OBSERVATIONS:

1.This anomaly was totally unexpected, and the loop operating parameters are well within its design capabilities and test envelope. Initial ground testing difficulties with the GLAS LHP's were traced to undercharging of the loops and were remedied by a CC redesign and recharge. Once the modifications were completed, the loops performed well and did not exhibit any of the current problems.

2.The loops have performed well in orbit since they were started in February 2003. Some evaporator temperature oscillations and loop "chugging" was noted on the CLHP in the week prior to the anomaly, but was not seen during other portions of the mission.

3.Some possible causes of the anomaly are as follows:

- Loss of fluid inventory – A slow leak is consistent with the behavior noted to date. The loops were leak tested and proof pressure tested prior to launch, and no leaks were found.
- Non-condensable gas (NCG) – NCG has been known to cause problems in other two-phase systems. It can plug the end of the evaporator and cause the system to fail. Although propylene has not been used on past missions, it was not expected to cause problems. Propylene LHP's have been operated successfully on the ground after several years.
- Micro-gravity effect: Possible nuances due to micro-gravity can effect loop operation. For example, vertical stratification of the liquid/vapor interface in the CC results in a different temperature profile than seen on the ground. This can increase loop sensitivity to thruster firings and S/C maneuvers due to the sloshing in the CC and sudden mixing of the cold and warm regions. However, the proper operation of the loop for 6 months demonstrated no marked sensitivity to these effects.

CONCLUSIONS:

1. Examination of the data (including power draw) shows that the CC temperature controller and instrumentation is working as expected. The failures are evidenced by an increase in evaporator temperature, followed by an increase in CC temperature, with the liquid line temperature remaining relatively cold. This rules out issues such as temperature controller failure, or external heating of the liquid line.

2. The loop should run better at colder temperatures if the problem is a low fluid inventory. Also the starter heater should be left on if possible. Both of these measures will decrease the amount of fluid in the radiator and increase the amount available to the evaporator. This may also help alleviate a problem due to NCG, or micro-gravity sensitivity, since there will be more fluid available in the evaporator and CC.

ACTIONS:

The tiger team will research the records on other similar LHP's for life testing that was conducted, and request that these loops be retested if possible (GOES and AURA/TES). The GLAS engineering unit will be examined for any possible degradation to its materials (it is currently discharged). An older GLAS breadboard unit is charged with propylene, and will be restarted to see if there has been any degradation of performance. We will review the pertinent fluid charge and volume data, on orbit data, and other LHP tests that have been conducted to try to characterize the problem and recommend appropriate courses of action to the project. The tiger team will meet regularly, and other activities will be undertaken as deemed

Appendix E: Executed TOOs, Ocean Scans, and Around the World Scans

Table E.1 TOOs, Ocean and ATW Scans executed during Campaign L1a & L1b

Note: Times marked with * are not verified by the stored command log - the data was missing; Set window parameters denoted by y* only had the AD range window extended, not the CD or PC window.

Location	Type	Date	DOY	Time	Rev Number	Set Window Parameters
Test	scan	2003-02-25	56	?	?	n
Pacific	scan	2003-03-08	67	11:40:00	811	y* (2.5Km)
Pacific	scan	2003-03-08	67	23:48:00	819	y* (2.5Km)
Pacific	scan	2003-03-26	85	11:30:00	1080	y* (3Km)

Table E.2 TOOs, Ocean and ATW Scans executed during Campaign L2a

Note: Times marked with * are not verified by the stored command log - the data was missing; Set window parameters denoted by y* only had the AD range window extended, not the CD or PC window.

Location	Type	Date	DOY	Time	Rev Number	Set Window Parameters
Pacific	scan	2003-09-25	268	17:31:43	3809	n
Pacific	scan	2003-09-26	269	5:36:50	3817	n
Pacific	scan	2003-09-26	269	17:41:52	3824	n
Salar_Gualicho	target	2003-09-27	270	0:01*	3828	n
MPL_GSFC_MD	target	2003-09-27	270	1:15:34*	3829	n
Pacific	scan	2003-09-27	270	5:47:04	3832	n
Silver Lake CA	target	2003-09-27	270	16:16:02	3838	n
Pacific	scan	2003-09-27	270	17:52:08	3839	n
Mt Erebus	target	2003-09-27	270	20:02:59	3840	n
Pacific	scan	2003-09-28	271	5:57:15	3847	n
Pacific	scan	2003-09-28	271	18:02:19	3854	n
MPL_Barrow_AK	target	2003-09-28	271	19:03*	3855	n
White_Sands	target	2003-09-29	272	3:15:59*	3860	n
Pacific	scan	2003-09-29	272	6:07:26	3862	n
ARM site OK	target	2003-09-29	272	15:02:22*	3867	n
Pacific	scan	2003-09-29	272	18:12:29	3869	n
Ant Dry Valleys	target	2003-09-29	272	20:28:08	3870	n
Amery Rift	target	2003-09-30	273	2:50:51	3874	n

Pacific	scan	2003-09-30	273	6:17:36	3876	n
Pacific	scan	2003-09-30	273	18:22:39	3884	y*
Lake Vostok	target	2003-09-30	273	23:47:02	3887	n
Bonneville Salt Flats	target	2003-10-01	274	3:38:27	3890	n
Pacific	scan	2003-10-01	274	6:27:47	3892	y*
Amery_Rift	target	2003-10-01	274	14:44*	3897	n
Pacific	scan	2003-10-01	274	18:32:50	3899	y*
Mississippi Delta	target	2003-10-02	275	02:09:38	3904	y*
Silver Lake	target	2003-10-02	275	3:47:10	3905	y*
ATW	Scan	2003-10-02	275	20:32:04	3915	y*
Pacific	scan	2003-10-03	276	5:11:26	3921	y*
Pacific	scan	2003-10-03	276	17:16:29	3928	y*
Pacific	scan	2003-10-04	277	5:21:36	3936	y*
Pacific	scan	2003-10-06	279	17:46:08	3973	y*
MPL Barrow	target	2003-10-06	279	19:16:42	3974	y*
White Sands	target	2003-10-07	280	2:54:44	3979	y*
Pacific	scan	2003-10-07	280	5:51:03	3981	y*
MPL_ARM_OK	target	2003-10-07	280	14:07*	3986	y*
Pacific	scan	2003-10-07	280	17:55:54	3988	y
Antarc_Dry_Valley	target	2003-10-07	280	20:05:00	3989	y
Amery Rift	target	2003-10-08	281	02:33*	3993	n
Pacific	scan	2003-10-08	281	6:00:53	3995	y
Pacific	scan	2003-10-08	281	18:21*	4003	y
MPL Madison	target	2003-10-09	282	01:45*	4008	y
Pacific	scan	2003-10-09	282	6:24*	4011	y
Pacific	scan	2003-10-09	282	18:15:30	4018	y
Mississippi Delta	target	2003-10-10	283	1:52:43	4023	y
W.US_615_07	target	2003-10-10	283	3:29:27	4024	n
Pacific	scan	2003-10-10	283	6:20:25	4026	y
White_Sands	target	2003-10-10	283	15:16:17	4031	y
Pacific	scan	2003-10-10	283	18:25:16	4033	y
Pacific	scan	2003-10-11	284	4:53:33	4040	y
Pacific	scan	2003-10-11	284	16:58:24	4047	y
MPL_ARM_OK	target	2003-10-12	285	2:12:49	4053	y
MPL_Monterey	target	2003-10-12	285	3:49:28	4054	y

MPL_Barrow_AK	target	2003-10-12	285	5:35:30	4055	n
Pacific	scan	2003-10-12	285	8:16:37	4056	y
Pacific	scan	2003-10-12	285	17:08:10	4062	y
MPL GSFC	target	2003-10-13	286	00:46:01	4067	y
Pacific	scan	2003-10-13	286	5:13:05	4070	y
MPL Madison	target	2003-10-13	286	14:06:02	4075	y
Aronet_Amster_Isl	target	2003-10-13	286	14:55:50	4075	y
WUS_616_02	target	2003-10-13	286	15:42:10	4076	n
Pacific	scan	2003-10-13	286	17:17:55	4077	y
Pacific	scan	2003-10-14	287	5:22:51	4085	y
Pacific	scan	2003-10-14	287	17:27:42	4092	y
Pacific	scan	2003-10-15	288	5:32:38	4100	y
Pacific	scan	2003-10-15	288	17:37:28	4107	y
Antarct Dry Valleys	target	2003-10-15	288	19:48:05	4108	y
Amery Rift	target	2003-10-16	289	2:12:25	4112	y
Pacific	scan	2003-10-16	289	5:42:24	4115	y
Pacific	scan	2003-10-16	289	16:26*	4121	y
Aeronet Svalbard	target	2003-10-16	289	17:33*	4122	n
Pacific	scan	2003-10-17	290	06:05*	4130	y
Pacific	scan	2003-10-17	290	17:57:00	4137	y
Pacific	scan	2003-10-18	291	6:01:55	4145	y
White Sands	target	2003-10-18	291	14:57:42	4150	y
Amery Rift	target	2003-10-18	291	15:36:17	4150	y
ATW	Scan	2003-10-18	291	19:56:04	4153	y
Pacific	scan	2003-10-19	292	4:35:01	4160	y
Pacific	scan	2003-10-19	292	16:39:53	4166	y
MPL Barrow	target	2003-10-20	293	5:21:47	4174	y
Pacific	scan	2003-10-20	293	6:21:28	4175	y
Pacific	scan	2003-10-20	293	16:49:40	4181	y
Aeronet, Mongu	target	2003-10-21	294	5:59:59	4189	y
Pacific	scan	2003-10-21	294	6:31:15	4190	y
W.US_0615_10	target	2003-10-21	294	15:26:40	4195	y
Pacific	scan	2003-10-21	294	16:59:27	4196	y
Pacific	scan	2003-10-22	295	5:04:23	4204	y
Aeronet, S.Fr.	target	2003-10-22	295	7:30:27	4205	y

Pacific	scan	2003-10-22	295	17:09:13	4211	y
Aeronet, Mongu	target	2003-10-22	295	18:06:26	4211	y
Pacific	scan	2003-10-23	296	5:14:09	4219	y
Pacific	scan	2003-10-23	296	17:32*	4226	y
MPL Barrow AK	target	2003-10-23	296	18:49*	4227	n
Pacific	scan	2003-10-24	297	05:37*	4234	y
Pacific	scan	2003-10-24	297	17:28:47	4241	y
Pacific	scan	2003-10-25	298	5:33:42	4249	y
MPL GSFC	target	2003-10-25	298	12:51:05	4253	y
Pacific	scan	2003-10-25	298	17:38:32	4256	y
Aeronet, S.Fr.	target	2003-10-25	298	18:51:43	4257	y
Aeronet, Amst.Isl.	target	2003-10-26	299	2:04:54	4261	y
Pacific	scan	2003-10-26	299	5:43:28	4264	y
MPL Svalbard	target	2003-10-26	299	8:00:02	4265	y
Amery_Rift	target	2003-10-26	299	13:59*	4269	n
Aeronet-UAE	target	2003-10-26	299	15:42:56	4270	n
Pacific	scan	2003-10-26	299	17:48:18	4271	y
WUS_618_03	target	2003-10-27	300	3:02:42	4277	
Pacific	scan	2003-10-27	300	5:53:14	4279	y
Gr_030513_01	target	2003-10-27	300	11:25:08	4282	y
Gr_030514_01	target	2003-10-27	300	12:59:29	4283	y
Pacific	scan	2003-10-27	300	16:21:25	4285	y
Pacific	scan	2003-10-28	301	4:26:21	4293	y
Pacific	scan	2003-10-28	301	16:31:15	4300	y
Aeronet, Cape Verde	target	2003-10-28	301	20:50*	4303	n
Gr_030513_03	target	2003-10-28	301	21:06:18	4303	y
"Aeronet, UAE"	target	2003-10-29	302	3:54:12	4307	y
Pacific	scan	2003-10-29	302	4:36:11	4308	y
MPL Syowa	target	2003-10-29	302	17:23:46	4315	y
Pacific	scan	2003-10-29	302	18:17:41	4316	y
Gr_030515_04	target	2003-10-29	302	21:16:47	4318	y
Pacific	scan	2003-10-30	303	4:45:58	4323	y
Aeronet, Cape Verde	target	2003-10-30	303	8:56:01	4325	y
W.US_618_06	target	2003-10-30	303	15:17:35	4329	y
Pacific	scan	2003-10-30	303	16:50:48	4330	y

Mt Erebus	target	2003-10-30	303	19:01:24	4331	y
Pacific	scan	2003-10-31	304	4:55:44	4338	y
Pine Isl.	target	2003-10-31	304	12:44:08	4342	n
Pacific	scan	2003-10-31	304	17:00:34	4345	y
ATW	scan	2003-10-31	304	18:50:08*	4346	y
Gr_030514_02	target	2003-10-31	304	21:35:14	4348	n
White Sands	target	2003-11-01	305	2:14:04	4351	y
Pacific	scan	2003-11-01	305	5:05:30	4353	y
Pacific	scan	2003-11-01	305	17:10:18	4360	y
Ant Dry Val.	target	2003-11-01	305	19:20:58	4361	y
Gr_030511_04	target	2003-11-01	305	21:43:07	4363	n
Ant Penin	target	2003-11-02	306	0:19:18	4364	n
Pacific	scan	2003-11-02	306	5:15:13	4368	y
MPL Svalbard	target	2003-11-02	306	17:06:07	4375	y
ATW	scan	2003-11-02	306	23:59:08*	4379	y
Bonneville UT	target	2003-11-03	307	2:35:46	4381	n
Pacific	scan	2003-11-03	307	5:24:57	4383	y
"Aeronet, Korea"	target	2003-11-03	307	10:37:45	4386	y
Pacific	scan	2003-11-03	307	17:29:53	4390	y
Gr_030515_01	target	2003-11-03	307	22:05:11	4393	n
W.US_615_01	target	2003-11-04	308	2:43:31	4396	n
Pacific	scan	2003-11-04	308	5:34:50	4398	y
Gr_030513_01	target	2003-11-04	308	11:06:43	4401	n
Gr_030514_01	target	2003-11-04	308	12:41:04	4402	n
Pacific	scan	2003-11-04	308	17:39:41	4405	y
MPL Syowa	target	2003-11-05	309	3:51:08	4411	n
Pacific	scan	2003-11-05	309	4:07:57	4412	y
Pacific	scan	2003-11-05	309	16:12:48	4419	y
Gr_030513_03	target	2003-11-05	309	20:47:52	4422	n
MPL ARM OK	target	2003-11-06	310	1:27:12	4425	y
MPL Monterey	target	2003-11-06	310	3:03:51	4426	n
Pacific	scan	2003-11-06	310	4:17:44	4427	y
Pacific	scan	2003-11-06	310	16:22:33	4434	y
Gr_030515_04	target	2003-11-06	310	20:58:21	4437	n
Aeronet Korea	target	2003-11-06	310	22:52:21	4438	y

MPL GSFC	target	2003-11-07	311	0:01:04	4439	n
Pacific	scan	2003-11-07	311	4:27:28	4442	y
MPL Madison	target	2003-11-07	311	13:20:25	4447	y
W.US_618_01	target	2003-11-07	311	14:59:04	4448	y
Pacific	scan	2003-11-07	311	16:32:20	4449	y
Mt Erebus	target	2003-11-07	311	18:42:58	4450	n
Pacific	scan	2003-11-08	312	4:37:16	4457	y
Ant. Pine Isl	target	2003-11-08	312	12:25:43	4461	y
Pacific	scan	2003-11-08	312	15:53:49	4464	y
Gr_030514_02	target	2003-11-08	312	21:16:49	4467	y
White Sands	target	2003-11-09	313	1:55:40	4470	y
Pacific	scan	2003-11-09	313	4:47:02	4472	y
MPL ARM OK	target	2003-11-09	313	13:41:43	4477	y
Pacific	scan	2003-11-09	313	16:51:52	4479	y
Ant. Dry Val	target	2003-11-09	313	19:02:32	4480	n
Ant. Peninsula	target	2003-11-10	314	0:00:51	4483	y
Amery Rift	target	2003-11-10	314	1:26:48	4484	n
Pacific	scan	2003-11-10	314	4:56:47	4487	y
Pacific	scan	2003-11-10	314	15:24:58	4493	y
MPL Svalbard	target	2003-11-10	314	16:47:40	4494	n
MPL Madison	target	2003-11-11	315	0:41:09	4499	n
Pacific	scan	2003-11-11	315	5:06:33	4502	y
Pacific	scan	2003-11-11	315	17:11:23	4509	y
Gr_030515_01	target	2003-11-11	315	21:46:41	4512	y
W.US_615_07	target	2003-11-12	316	2:25:01	4515	y
Pacific	scan	2003-11-12	316	5:16:18	4517	y
MPL Sv-DSC	target	2003-11-12	316	7:32:50	4518	n
Gr_030514_01	target	2003-11-12	316	12:22:35	4521	y
White Sands NM	target	2003-11-12	316	14:12:07	4522	n
Pacific	scan	2003-11-12	316	17:21:12	4524	y
ATW	scan	2003-11-12	316	19:10:06*	4525	y
MPL Syowa	target	2003-11-13	317	3:32:40	4530	y
Pacific	scan	2003-11-13	317	3:49:29	4531	y
Pacific	scan	2003-11-13	317	15:54:15	4538	y
Gr_030513_03	target	2003-11-13	317	20:29:24	4541	y

MPL ARM OK	target	2003-11-14	318	1:08:45	4544	y
MPL Barrow	target	2003-11-14	318	4:31:26	4546	n
Pacific	scan	2003-11-14	318	5:35:49	4547	y
Ant_021212_01	target	2003-11-14	318	13:24:08	4551	y
Pacific	scan	2003-11-14	318	16:04:06	4553	y
Enc_RockSNA	target	2003-11-15	319	1:16:59	4559	n
Pacific	scan	2003-11-15	319	4:09:01	4561	y
MPL Madison	target	2003-11-15	319	13:01:59	4566	n
Aeronet Amst Isl	target	2003-11-15	319	13:51:47	4566	n
W.US_616_02	target	2003-11-15	319	14:41:06	4567	y
Pacific	scan	2003-11-15	319	16:13:52	4568	y
Pacific	scan	2003-11-16	320	4:18:48	4576	y
Aeronet-S.Fr.	target	2003-11-16	320	6:44:52	4577	y
Pacific	scan	2003-11-16	320	16:23:39	4583	y
Aeronet-Mongu	target	2003-11-16	320	17:20:51	4583	y
Pacific	scan	2003-11-17	321	4:28:35	4591	y
Pacific	scan	2003-11-17	321	16:33:17	4598	y
MPL Barrow	target	2003-11-17	321	18:03:48	4599	y
Pacific	scan	2003-11-18	322	4:38:21	4606	y
Pacific	scan	2003-11-18	322	16:43:11	4613	y

Table E.3 TOOs, Ocean and ATW Scans executed during Campaign L2b

Note: Times marked with * are not verified by the stored command log - the data was missing; Set window parameters denoted by * are not verified by the stored command log - the data was missing.

Location	Type	Date	DOY	Time	Rev Number	Set Window Parameters
Pacific	scan	2004-02-18	49	02:08*	5982	y
Manaus_T-A	target	2004-02-18	49	6:58*	5978	y*
Ant_021128_02	target	2004-02-18	49	8:35*	5979	y*
Pacific	scan	2004-02-18	49	14:00:15	5982	y
Aeronet-SFr	target	2004-02-18	49	15:13:24	5983	y
Manaus_T-B	target	2004-02-18	49	19:50:50	5985	y
Pacific	scan	2004-02-19	50	02:05:10	5990	y
Ant_021212_03	target	2004-02-19	50	09:53:31	5994	n
Amery_Rift	target	2004-02-19	50	11:00:57	5995	y

White_Sands	target	2004-02-19	50	11:39:33	5995	y
Pacific	scan	2004-02-19	50	14:10:01	5997	y
ATW	scan	2004-02-20	51	15:59:58	5998	y
MPL_Syowa	target	2004-02-20	51	00:21:31	6003	y
Pacific	scan	2004-02-20	51	02:14:57	6005	y
Andr_Forest_OR	target	2004-02-20	51	23:36:15	6018	y
MPL_Barrow_AK	target	2004-02-21	52	01:20:16	6019	y
Pacific	scan	2004-02-21	52	12:52:55	6026	y
N_San_Andreas	target	2004-02-21	52	23:44:36	6033	y
Pacific	scan	2004-02-22	53	00:57:50	6034	y
Aeronet-Mongu	target	2004-02-22	53	02:03:14	6034	y
WUS_615_10	target	2004-02-22	53	11:29:54	6040	y
MPL_Syowa	target	2004-02-22	53	13:45*	6041	y*
Pacific	scan	2004-02-22	53	14:53*	6042	y
Pacific	scan	2004-02-23	54	01:21*	6049	y
Aeronet_S.Fr.	target	2004-02-23	54	03:34*	6050	y*
Ant_021204_01	target	2004-02-23	54	10:32*	6053	y*
Pacific	scan	2004-02-23	54	13:12:27	6056	y
Aeronet-Mongu	target	2004-02-23	54	14:09:40	6056	y
Pacific	scan	2004-02-24	55	01:17:22	6064	y
Ant_021206_02	target	2004-02-24	55	7:57*	6068	n*
Pacific	scan	2004-02-24	55	13:35*	6071	y
MPL_Barrow_AK	target	2004-02-24	55	14:52:36	6072	y
Ant_021128_03	target	2004-02-24	55	23:42:49	6077	n
Pacific	scan	2004-02-25	56	01:27:09	6079	y
Ant_021204_02	target	2004-02-25	56	09:15:23	6083	y
Pacific	scan	2004-02-25	56	13:31:59	6086	y
Ant_021126_01	target	2004-02-25	56	20:40:05	6090	y
Pacific	scan	2004-02-26	57	01:36:54	6094	y
MPL_GSFC	target	2004-02-26	57	08:54:18	6098	y
Pacific	scan	2004-02-26	57	13:55*	6101	y
Manaus_T-A	target	2004-02-26	57	19:33*	6104	y*
Aeronet-Amst_Isl	target	2004-02-26	57	22:08*	6106	y*
Pacific	scan	2004-02-27	58	02:00*	6109	y
Ant_021212_03	target	2004-02-27	58	9:35*	6113	y*

Amery_Rift	target	2004-02-27	58	11:21*	6114	y*
Aeronet-UAE	target	2004-02-27	58	11:46*	6115	n*
Pacific	scan	2004-02-27	58	13:51:30	6116	y
ATW	scan	2004-02-27	58	15:41*	6117	y
Gr_030515_01	target	2004-02-27	58	18:26:46	6119	y
WUS_618_03	target	2004-02-27	58	23:05:33	6122	n
Pacific	scan	2004-02-28	59	01:56:25	6124	y
Uyuni	target	2004-02-28	59	07:53:03	6127	n
Gr_030514_01	target	2004-02-28	59	09:02:38	6128	y
Pacific	scan	2004-02-28	59	14:01:15	6131	y
Mt_Rainier	target	2004-02-28	59	23:18:27	6137	y
Pacific	scan	2004-02-29	60	02:06:10	6139	y
Ant_021212_02	target	2004-02-29	60	09:54:26	6143	y
Pacific	scan	2004-02-29	60	12:34:22	6145	y
Gr_030513_03	target	2004-02-29	60	17:09:27	6148	y
Aeronet-UAE	target	2004-02-29	60	23:26:07	6152	y
N_San_Andreas	target	2004-02-29	60	23:57:21	6152	y
Pacific	scan	2004-03-01	61	00:39:18	6153	y
Ant_021212_01	target	2004-03-01	61	10:04:11	6158	y
MPL_Syowa	target	2004-03-01	61	13:26:55	6160	y
Pacific	scan	2004-03-01	61	14:20:49	6161	y
Gr_030515_04	target	2004-03-01	61	17:19:56	6163	y
Pacific	scan	2004-03-02	62	00:49:06	6168	y
Aeronet-Cape_Verde	target	2004-03-02	62	04:59:10	6170	y
Ant_021206_03	target	2004-03-02	62	08:37:14	6172	y
WUS_618_06	target	2004-03-02	62	11:20:45	6174	y
Pacific	scan	2004-03-02	62	13:07*	6175	y
Pacific	scan	2004-03-03	63	01:12*	6183	y
Ant_021206_01	target	2004-03-03	63	08:47*	6187	n*
Pacific	scan	2004-03-03	63	13:03:43	6190	y
Gr_030514_02	target	2004-03-03	63	17:38:25	6193	n
White_Sands	target	2004-03-03	63	22:17*	6196	y*
Ant_021128_01	target	2004-03-03	63	23:25*	6196	n*
Pacific	scan	2004-03-04	64	01:22*	6198	y
Tapajos_T_A	target	2004-03-04	64	07:00:36	6201	y

Ant_021204_02	target	2004-03-04	64	08:56:55	6202	n
Alaska_1	target	2004-03-04	64	13:10:10	6205	y
Ant_DV	target	2004-03-04	64	15:24:09	6206	y
Gr_030511_04	target	2004-03-04	64	17:46:18	6208	n
Ant_021126_01	target	2004-03-04	64	20:22:28	6209	n
Amery_Rift	target	2004-03-04	64	21:48:25	6210	y
Pacific	scan	2004-03-05	65	01:18:25	6213	y
Pacific	scan	2004-03-05	65	12:00*	6219	y
Alaska	target	2004-03-05	65	13:20*	6220	n*
Pacific	scan	2004-03-06	66	01:28:12	6228	y
Aeronet-Korea	target	2004-03-06	66	06:40:54	6231	y
Ant_021128_02	target	2004-03-06	66	09:16:35	6232	y
Amery_Rift	target	2004-03-06	66	11:02:42	6233	y
Pacific	scan	2004-03-06	66	13:33:02	6235	y
ATW	scan	2004-03-06	66	15:22:59	6236	y
Mississippi_Delta	target	2004-03-06	66	21:09:44	6240	y
WUS_615_01	target	2004-03-06	66	22:46:39	6241	n
Pacific	scan	2004-03-07	67	01:37:57	6243	y
Gr_030513_01	target	2004-03-07	67	07:09:52	6246	n
Ant_021204_03	target	2004-03-07	67	07:49:25	6246	n
Gr_030514_01	target	2004-03-07	67	08:44:12	6247	n
Pacific	scan	2004-03-07	67	13:42:49	6250	y
MPL_Syowa	target	2004-03-07	67	23:54:17	6256	y
Pacific	scan	2004-03-08	68	01:47:44	6258	y
Ant_021212_02	target	2004-03-08	68	09:35:59	6262	n
Pacific	scan	2004-03-08	68	12:29*	6264	y
Gr_030513_03	target	2004-03-08	68	16:51*	6267	n*
MPL_ARM_OK	target	2004-03-08	68	21:30*	6270	y*
Pacific	scan	2004-03-08	68	00:34*	6272	y
Ant_021212_01	target	2004-03-09	69	09:46*	6277	n*
Pacific	scan	2004-03-09	69	12:25:42	6279	y
Gr_030515_04	target	2004-03-09	69	17:01:29	6282	n
Aeronet-Korea	target	2004-03-09	69	18:55:29	6283	y
Pacific	scan	2004-03-10	70	00:30:38	6287	y
Ant_021206_03	target	2004-03-10	70	08:18:47	6291	y

WUS_618_01	target	2004-03-10	70	11:02:12	6293	y
Pacific	scan	2004-03-10	70	12:35:29	6294	y
Pacific	scan	2004-03-11	71	00:40:24	6302	y
Antarc_Dry_Valley	target	2004-03-11	71	05:22:24	6304	y
Ant_021206_01	target	2004-03-11	71	08:28:52	6306	y
Pacific	scan	2004-03-11	71	12:45:15	6309	y
Gr_030514_02	target	2004-03-11	71	17:19:57	6312	y
Ant_021128_01	target	2004-03-11	71	23:06:10	6315	y
Pacific	scan	2004-03-12	72	00:50:10	6317	y
Tapajos_T-B	target	2004-03-12	72	06:42:10	6320	y
Ant_021206_02	target	2004-03-12	72	08:38:33	6321	y
MPL_ARM_OK	target	2004-03-12	72	09:44:52	6322	y
Pacific	scan	2004-03-12	72	12:55:01	6324	y
Antarc_Dry_Valley	target	2004-03-12	72	15:05:40	6325	n
Gr_030511_04	target	2004-03-12	72	17:27:49	6327	y
Tapajos_T-A	target	2004-03-12	72	18:45:32	6327	y
Ant_021126_01	target	2004-03-12	72	20:03:59	6328	y
Pacific	scan	2004-03-13	73	00:59:56	6332	y
Seattle	target	2004-03-13	73	11:28:21	6338	y
Pacific	scan	2004-03-13	73	13:04:47	6339	y
MPL_Madison	target	2004-03-13	73	20:44:17	6344	n
Pacific	scan	2004-03-14	74	01:09:43	6347	y
Manaus_T-B	target	2004-03-14	74	07:01:36	6350	y
Ant_021128_02	target	2004-03-14	74	08:58:07	6351	n
Pacific	scan	2004-03-14	74	13:14:34	6354	y
ATW	scan	2004-03-14	74	15:04*	6355	y
WUS_615_07	target	2004-03-14	74	22:28:12	6360	y
Pacific	scan	2004-03-15	75	01:19:29	6362	y
Ant_021204_03	target	2004-03-15	75	07:30:57	6365	y
Ant_021128_04	target	2004-03-15	75	08:25:44	6366	y
Gr_030514_01	target	2004-03-15	75	09:07:58	6366	n
White_Sands	target	2004-03-15	75	10:15:16	6367	n
Pacific	scan	2004-03-15	75	13:24:21	6369	y
MPL_Syowa	target	2004-03-15	75	23:36*	6375	y*
Pacific	scan	2004-03-16	76	01:42*	6377	y

Ant_021212_02	target	2004-03-16	76	09:17:32	6381	y
Pacific	scan	2004-03-16	76	13:34:07	6384	y
Gr_030513_03	target	2004-03-16	76	16:32:33	6386	y
Washington	target	2004-03-16	76	22:51:17	6390	n
Pacific	scan	2004-03-17	77	00:02:23	6391	y
Ant_021212_01	target	2004-03-17	77	09:27:17	6396	y
Pacific	scan	2004-03-17	77	12:07:15	6398	y
Uyuni	target	2004-03-17	77	19:29:52	6402	n
Pacific	scan	2004-03-18	78	00:12:10	6406	y
Aeronet-Mongu	target	2004-03-18	78	01:17:33	6406	y
Ant_021206_03	target	2004-03-18	78	08:00:20	6410	y
MPL_Madison	target	2004-03-18	78	09:05:08	6411	y
WUS_616_02	target	2004-03-18	78	10:44:15	6412	y
Pacific	scan	2004-03-18	78	12:17:01	6413	y
Pacific	scan	2004-03-19	79	00:21:57	6421	y
Aeronet-SFr	target	2004-03-19	79	02:48:19	6422	y
Ant_021204_01	target	2004-03-19	79	08:09:54	6425	n
Pacific	scan	2004-03-19	79	12:26:47	6428	y
Antarc_Dry_Valley	target	2004-03-19	79	14:37:26	6429	y
Pacific	scan	2004-03-20	80	00:31:43	6436	y
Ant_021206_02	target	2004-03-20	80	08:20:07	6440	n
Pacific	scan	2004-03-20	80	12:36:34	6443	y
ATW	scan	2004-03-20	80	14:27:30	6445	y
Ant_021128_03	target	2004-03-20	80	22:57:09	6449	n
Pacific	scan	2004-03-21	81	00:41:29	6451	y
Antarc_Labyr	target	2004-03-21	81	05:23:23	6453	y
Oregon	target	2004-03-21	81	11:10:47	6457	y
Pacific	scan	2004-03-21	81	12:46:20	6458	y
MPL_Tsukuba	target	2004-03-21	81	17:39:33	6461	y

Table E.4 TOOs, Ocean and ATW Scans executed during Campaign L2c

Note: Times marked with * are not verified by the stored command log - the data was missing; Set window parameters denoted by * are not verified by the stored command log - the data was missing.

Location	Type	Date	DOY	Time	Rev Number	Set Window Parameters
Pacific	scan	2004-05-18	139	23:15*	7329	y
Brazil T-A	target	2004-05-19	140	04:54*	7332	y*
Ant_021128_02	target	2004-05-19	140	06:50*	7333	y*
Pacific	scan	2004-05-19	140	11:20*	7336	y
Manaus_T_B_Br	target	2004-05-19	140	16:57:09	7339	y
Pacific	scan	2004-05-19	140	23:11:29	7344	y
Ant_021212_03	target	2004-05-20	141	06:59:50	7348	n
White Sands	target	2004-05-20	141	08:07:16	7349	y
Amery	target	2004-05-20	141	08:45:51	7349	y
Pacific	scan	2004-05-20	141	11:16:20	7351	y
ATW	scan	2004-05-20	141	13:06:07	7352	y
Pacific	scan	2004-05-20	141	23:21:16	7359	y
Pacific	scan	2004-05-21	142	09:49:28	7365	y
Andr_Forest_OR	target	2004-05-21	142	20:42:34	7372	y
Pacific	scan	2004-05-21	142	23:31:02	7374	y
Pacific	scan	2004-05-22	143	09:59:11	7380	y
N_San_Andreas	target	2004-05-22	143	20:50:56	7387	y
Pacific	scan	2004-05-22	143	22:04:09	7388	y
Aeronet_mongu	target	2004-05-22	143	23:09:33	7388	y
W.US_615_10	target	2004-05-23	144	08:36:14	7394	y
Pacific	scan	2004-05-23	144	10:08:59	7395	y
Pacific	scan	2004-05-23	144	22:13:56	7403	y
Aeronet_Cape_V	target	2004-05-24	145	02:23:59	7405	y
Ant_021204_01	target	2004-05-24	145	06:01:55	7407	y
Pacific	scan	2004-05-24	145	10:18:46	7410	y
Aeronet_Mongu	target	2004-05-24	145	11:16:04	7410	y
Pacific	scan	2004-05-24	145	22:23:42	7418	y
Ant_021206_02	target	2004-05-25	146	06:12:07	7422	y
Pacific	scan	2004-05-25	146	10:28:32	7425	y
Ant_021128_03	target	2004-05-25	146	20:49:09	7431	n
Pacific	scan	2004-05-25	146	22:33:29	7433	y

Ant_021204_02	target	2004-05-26	147	06:21:43	7437	y
Aeronet_Svalbard	target	2004-05-26	147	10:24:08	7440	y
Pacific	scan	2004-05-26	147	10:38:00	7440	y
Ant_021126_01	target	2004-05-26	147	17:47*	7444	y*
Pacific	scan	2004-05-26	147	22:56*	7448	y
Aeronet_Svalbard	target	2004-05-27	148	01:00*	7449	y*
MPL-Goddard	target	2004-05-27	148	06:01*	7452	y*
Pacific	scan	2004-05-27	148	11:01*	7455	y
Manaus_T-A Br	target	2004-05-27	148	16:38:43	7458	y
Pacific	scan	2004-05-27	148	22:53:01	7463	y
Aeronet_Asc_I	target	2004-05-28	149	01:33:02	7464	y
Ant_021212_03	target	2004-05-28	149	06:41:23	7467	y
Amery_rift	target	2004-05-28	149	08:27:18	7468	n
Pacific	scan	2004-05-28	149	10:57:51	7470	y
ATW	scan	2004-05-28	149	12:47:38	7471	y
W.US_618_03	target	2004-05-28	149	20:11:55	7476	n
Pacific	scan	2004-05-28	149	23:02:47	7478	y
Uyuni_D	target	2004-05-29	150	04:59:25	7481	n
Pacific	scan	2004-05-29	150	11:07:37	7485	y
Mt_Rainier	target	2004-05-29	150	20:24:50	7491	y
Pacific	scan	2004-05-29	150	23:12:32	7493	y
Ant_021212_02	target	2004-05-30	151	07:00:49	7497	y
Pacific	scan	2004-05-30	151	09:40:44	7499	y
Gr_030513_03	target	2004-05-30	151	14:15:50	7502	y
N_San_Andreas	target	2004-05-30	151	20:32:30	7506	y
Pacific	scan	2004-05-30	151	21:45:43	7507	y
Ant_021212_01	target	2004-05-31	152	07:10:34	7512	y
Pacific	scan	2004-05-31	152	09:50:33	7514	y
Pacific	scan	2004-05-31	152	21:55:30	7522	y
Aeronet_cape_v	target	2004-06-01	153	02:05:34	7524	y
Ant_021206_03	target	2004-06-01	153	05:43:38	7526	y
W.US_0618_06	target	2004-06-01	153	08:27:08	7528	y
Pacific	scan	2004-06-01	153	10:00:21	7529	y
Pacific	scan	2004-06-01	153	22:05:16	7537	y
Ant_021206_01	target	2004-06-02	154	05:53:43	7541	n

Pacific	scan	2004-06-02	154	10:10:07	7544	y
Ant_021128_01	target	2004-06-02	154	20:31:03	7550	n
Pacific	scan	2004-06-02	154	22:15:03	7552	y
Tapajos_T_A	target	2004-06-03	155	04:06:59	7555	y
Ant_021204_02	target	2004-06-03	155	06:03:18	7556	n
Pacific	scan	2004-06-03	155	08:43:15	7558	y
Alaska_163	target	2004-06-03	155	10:16:34	7559	n
Ant_021126_01	target	2004-06-03	155	17:28:52	7563	n
Amery_rift	target	2004-06-03	155	18:54:49	7564	y
Pacific	scan	2004-06-03	155	22:24:50	7567	y
Pacific	scan	2004-06-04	156	08:53:01	7573	y
Alaska_178	target	2004-06-04	156	10:26:22	7574	n
Pacific	scan	2004-06-04	156	22:34:37	7582	y
Aeronet_kor	target	2004-06-05	157	03:47:18	7585	y
Ant_021128_02	target	2004-06-05	157	06:22:59	7586	y
Amery_rift	target	2004-06-05	157	08:09:01	7587	y
Pacific	scan	2004-06-05	157	10:39:27	7589	y
ATW	scan	2004-06-05	157	12:30:14	7590	y
MS_Delta	target	2004-06-05	157	18:16:08	7594	y
W.US_615_01	target	2004-06-05	157	19:53:03	7595	n
Pacific	scan	2004-06-05	157	22:44:23	7597	y
Ant_021204_03	target	2004-06-06	158	04:55:50	7600	n
Ant_021128_04	target	2004-06-06	158	06:32:50	7601	y
Pacific	scan	2004-06-06	158	10:49:14	7604	y
Pacific	scan	2004-06-06	158	21:17:30	7611	y
Ant_021212_02	target	2004-06-07	159	06:42:24	7616	n
Pacific	scan	2004-06-07	159	09:22:20	7618	y
Gr_030513_03	target	2004-06-07	159	13:57:24	7621	n
Pacific	scan	2004-06-07	159	21:27:16	7626	y
Ant_021212_01	target	2004-06-08	160	06:52:09	7631	n
Pacific	scan	2004-06-08	160	09:32:06	7633	y
Aeronet_kor	target	2004-06-08	160	16:02:12	7637	y
Pacific	scan	2004-06-08	160	21:37:02	7641	y
Ant_021206_03	target	2004-06-09	161	05:25:12	7645	y
W.US_618_01	target	2004-06-09	161	08:08:37	7647	y

Pacific	scan	2004-06-09	161	09:41:53	7648	y
Pacific	scan	2004-06-09	161	21:46:49	7656	y
Ant_021206_01	target	2004-06-10	162	05:35:16	7660	y
Pacific	scan	2004-06-10	162	09:51:37	7663	y
Ant_021128_01	target	2004-06-10	162	20:12:36	7669	y
Pacific	scan	2004-06-10	162	21:56:35	7671	y
Tapajos_TB_Br	target	2004-06-11	163	03:48:37	7674	y
Ant_021206_02	target	2004-06-11	163	05:44:59	7675	y
Aeronet_Svalbard	target	2004-06-11	163	09:47:17	7678	y
Pacific	scan	2004-06-11	163	10:01:25	7678	y
Tapajos_T_A_Br	target	2004-06-11	163	15:51:59	7681	y
Ant_021126_01	target	2004-06-11	163	17:10:26	7682	y
Pacific	scan	2004-06-11	163	22:06:20	7686	y
Aeronet_Svalbard	target	2004-06-12	164	00:23:08	7687	n
Seattle	target	2004-06-12	164	08:34:48	7692	y
Pacific	scan	2004-06-12	164	10:11:11	7693	y
MPL_Madison	target	2004-06-12	164	17:50:44	7698	n
Pacific	scan	2004-06-12	164	22:16:10	7701	y
Aeronet_kor	target	2004-06-13	165	03:28:53	7704	y
Manaus_T_B_Br	target	2004-06-13	165	04:08:03	7704	y
Ant_021128_02	target	2004-06-13	165	06:04:34	7705	n
Pacific	scan	2004-06-13	165	10:21:01	7708	y
ATW	scan	2004-06-13	165	12:11:49	7709	y
Pacific	scan	2004-06-13	165	22:25:56	7716	y
Ant_021204_03	target	2004-06-14	166	04:37:25	7719	y
Ant_021128_04	target	2004-06-14	166	06:14:26	7720	n
White Sands	target	2004-06-14	166	07:21:43	7721	n
Pacific	scan	2004-06-14	166	10:30:47	7723	y
Pacific	scan	2004-06-14	166	22:35:44	7731	y
Ant_021212_02	target	2004-06-15	167	06:24:00	7735	y
Pacific	scan	2004-06-15	167	10:40:34	7738	y
Gr_030513_03	target	2004-06-15	167	13:39:01	7740	y
St_Forest_WA	target	2004-06-15	167	19:57:45	7744	n
Pacific	scan	2004-06-15	167	21:08:51	7745	y
Ant_021212_01	target	2004-06-16	168	06:33:45	7750	y

Pacific	scan	2004-06-16	168	09:13:42	7752	y
Uyuni_asc	target	2004-06-16	168	16:36:21	7756	n
Pacific	scan	2004-06-16	168	21:18:38	7760	y
Aeronet_mongu	target	2004-06-16	168	22:24:01	7760	y
Ant_021206_03	target	2004-06-17	169	05:06:49	7764	y
MPL_Madison	target	2004-06-17	169	06:11:36	7765	n
BonnevilleSF	target	2004-06-17	169	07:48:58	7766	n
Pacific	scan	2004-06-17	169	09:23:29	7767	y
Pacific	scan	2004-06-17	169	21:28:25	7775	y
Ant_021204_01	target	2004-06-18	170	05:16:23	7779	n
Pacific	scan	2004-06-18	170	09:33:16	7782	y
Aeronet_mongu	target	2004-06-18	170	10:30:32	7782	y
Pacific	scan	2004-06-18	170	21:38:12	7790	y
Ant_021206_02	target	2004-06-19	171	05:26:36	7794	n
Aeronet_svalbard	target	2004-06-19	171	09:28:54	7797	y
Pacific	scan	2004-06-19	171	09:43:03	7797	y
Ant_021128_03	target	2004-06-19	171	20:03:38	7803	n
Pacific	scan	2004-06-19	171	21:47:59	7805	y
Aeronet_svalbard	target	2004-06-20	172	00:04:45	7806	y
Oregon	target	2004-06-20	172	08:17:17	7811	y
Pacific	scan	2004-06-20	172	09:52:49	7812	y
Pacific	scan	2004-06-20	172	21:57:45	7820	y
Ant_021128_02	target	2004-06-21	173	05:46:10	7824	y
Pacific	scan	2004-06-21	173	10:02:36	7827	y
ATW	scan	2004-06-21	173	11:53:24	7828	y

Table E.5 TOOs, Ocean and ATW Scans executed during Campaign L3a

Note: Times marked with * are not verified by the stored command log - the data was missing; Set window parameters denoted by * are not verified by the stored command log - the data was missing.

Location	**Type**	**Date**	**DOY**	**Time**	**Rev Number**	**Set Window Parameters**
W_Mt_Rainier	target	2004-10-04	278	04:56*	9388	y*
Pacific	scan	2004-10-04	278	06:45*	9389	y
MPL_Madison	target	2004-10-04	278	14:11:04	9394	y

Pacific	scan	2004-10-04	278	18:36:29	9397	y
Manaus_T-A Braz	target	2004-10-05	279	00:28:22	9400	y
Ant_021128_02	target	2004-10-05	279	02:24:54	9401	y
Pacific	scan	2004-10-05	279	06:41:20	9404	y
Manaus_T_B_Br	target	2004-10-05	279	12:31:55	9407	y
Pacific	scan	2004-10-05	279	18:46:15	9412	y
Ny_Alesund MPL	target	2004-10-05	279	21:02:48	9413	n
Ant_021212_03	target	2004-10-06	280	02:34:36	9416	n
White Sands	target	2004-10-06	280	03:42:02	9417	y
Pacific	scan	2004-10-06	280	06:51:06	9419	y
ATW	scan	2004-10-06	280	08:40:54	9420	y
Pacific	scan	2004-10-06	280	18:56:01	9427	y
Pacific	scan	2004-10-07	281	05:24:13	9433	y
Mt_St_Helens	target	2004-10-07	281	16:17:51	9440	y
Barrow_MPL	target	2004-10-07	281	18:01:20	9441	y
Pacific	scan	2004-10-07	281	19:05:47	9442	y
Pacific	scan	2004-10-08	282	05:33:59	9448	y
COVE_MPL	target	2004-10-08	282	13:11:50	9453	y
N_San_Andreas	target	2004-10-08	282	16:25:41	9455	y
Pacific	scan	2004-10-08	282	17:38:54	9456	y
Aeronet_mongu	target	2004-10-08	282	18:44:18	9456	y
Tsukuba_HSRL	target	2004-10-08	282	22:51:29	9459	y
W.US_615_10	target	2004-10-09	283	04:10:59	9462	y
Pacific	scan	2004-10-09	283	05:43:45	9463	y
Pacific	scan	2004-10-09	283	17:48:41	9471	y
Aeronet_S_Fr	target	2004-10-09	283	20:14:46	9472	y
Aeronet_Cape_V	target	2004-10-09	283	21:58:44	9473	y
Ant_021204_01	target	2004-10-10	284	01:36:39	9475	y
Pacific	scan	2004-10-10	284	05:53:32	9478	y
Aeronet_Mongu	target	2004-10-10	284	06:50:48	9478	y
Pacific	scan	2004-10-10	284	17:58:27	9486	y
Ant_021206_02	target	2004-10-11	285	01:46:51	9490	y
Pacific	scan	2004-10-11	285	06:03:18	9493	y
Barrow_MPL	target	2004-10-11	285	07:33:41	9494	y
Ant_021128_03	target	2004-10-11	285	16:23:53	9499	n

Pacific	scan	2004-10-11	285	18:08:13	9501	y
Ant_DV39	target	2004-10-11	285	22:50:09	9503	y
Ant_021204_02	target	2004-10-12	286	01:56:27	9505	y
Ny_Alesund_MPL	target	2004-10-12	286	05:59:07	9508	y
Pacific	scan	2004-10-12	286	06:13:01	9508	y
Ant_DV45	target	2004-10-12	286	08:23:36	9509	y
Tsukuba_MPL	target	2004-10-12	286	11:06:19	9511	n
Ant_021126_01	target	2004-10-12	286	13:22:01	9512	y
Pacific	scan	2004-10-12	286	18:17:58	9516	y
GSFC_MPL	target	2004-10-13	287	01:35:23	9520	y
Pacific	scan	2004-10-13	287	06:22:49	9523	y
Aeronet_S_Fr	target	2004-10-13	287	07:36:01	9524	y
Manaus_T_A_Br	target	2004-10-13	287	12:13:28	9526	y
Pacific	scan	2004-10-13	287	18:27:46	9531	y
Aeronet_Asc_I	target	2004-10-13	287	21:07:47	9532	y
Ant_021212_03	target	2004-10-14	288	02:16:08	9535	y
Aeronet_uae	target	2004-10-14	288	04:27:13	9537	y
Pacific	scan	2004-10-14	288	06:32:37	9538	y
ATW	scan	2004-10-14	288	08:22:25	9539	y
W.US_618_03	target	2004-10-14	288	15:46:40	9544	n
Pacific	scan	2004-10-14	288	18:37:33	9546	y
Uyuni_85	target	2004-10-15	289	00:34:10	9549	n
Pacific	scan	2004-10-15	289	06:42:24	9553	y
Mt_St_Helens	target	2004-10-15	289	15:59:24	9559	y
Pacific	scan	2004-10-15	289	18:47:19	9561	y
Ant_021212_02	target	2004-10-16	290	02:35:42	9565	y
Pacific	scan	2004-10-16	290	05:15:32	9567	y
Gr_030513_03	target	2004-10-16	290	09:50:34	9570	y
N_San_Andreas	target	2004-10-16	290	16:07:15	9574	y
Aeronet_uae	target	2004-10-16	290	16:38:29	9574	y
Pacific	scan	2004-10-16	290	17:20:27	9575	y
Tsukuba_HSRL	target	2004-10-16	290	22:33:03	9578	y
Ant_021212_01	target	2004-10-17	291	02:45:18	9580	y
Pacific	scan	2004-10-17	291	05:25:18	9582	y
Pacific	scan	2004-10-17	291	17:30:13	9590	y

Aeronet_naru	target	2004-10-17	291	20:56:23	9592	y
Aeronet_Cape_V	target	2004-10-17	291	21:40:18	9592	y
Ant_021206_03	target	2004-10-18	292	01:18:22	9594	y
Railroad_V	target	2004-10-18	292	04:01:04	9596	y
Pacific	scan	2004-10-18	292	05:35:05	9597	y
Pacific	scan	2004-10-18	292	17:40:00	9605	y
Ant_021206_01	target	2004-10-19	293	01:28:27	9609	n
Pacific	scan	2004-10-19	293	05:44:51	9612	y
Barrow_HSRL	target	2004-10-19	293	07:15:16	9613	y
White_Sands	target	2004-10-19	293	14:58:23	9618	y
Ant_021128_01	target	2004-10-19	293	16:05:46	9618	n
Pacific	scan	2004-10-19	293	17:49:46	9620	y
Rio_Tapajos	target	2004-10-19	293	23:41:42	9623	y
Ant_021204_02	target	2004-10-20	294	01:38:02	9624	n
Pacific	scan	2004-10-20	294	04:17:58	9626	y
Alaska_163	target	2004-10-20	294	05:51:18	9627	y
Dry_V_164	target	2004-10-20	294	08:05:18	9628	y
Ant_021126_01	target	2004-10-20	294	13:03:36	9631	n
Amery_Rift	target	2004-10-20	294	14:29:33	9632	y
Pacific	scan	2004-10-20	294	17:59:33	9635	y
Pacific	scan	2004-10-21	295	04:27:45	9641	y
Alaska_178	target	2004-10-21	295	06:01:06	9642	n
Bonneville	target	2004-10-21	295	15:19:56	9648	n
Pacific	scan	2004-10-21	295	18:09:19	9650	y
Aeronet_kor	target	2004-10-21	295	23:22:02	9653	y
Ant_021128_02	target	2004-10-22	296	01:57:43	9654	y
Amery_Rift	target	2004-10-22	296	03:43:44	9655	y
Pacific	scan	2004-10-22	296	06:14:10	9657	y
ATW	scan	2004-10-22	296	08:03:58	9658	y
MS_Delta	target	2004-10-22	296	13:50:52	9662	y
W_US_615_01	target	2004-10-22	296	15:27:47	9663	n
Pacific	scan	2004-10-22	296	18:19:05	9665	y
Ny_Alesund	target	2004-10-22	296	20:35:37	9666	y
Ant_021204_03	target	2004-10-23	297	00:30:33	9668	n
Ant_021128_04	target	2004-10-23	297	02:07:33	9669	y

Pacific	scan	2004-10-23	297	06:23:56	9672	y
Pacific	scan	2004-10-23	297	16:52:12	9679	y
Ant_021212_02	target	2004-10-24	298	02:17:07	9684	n
Pacific	scan	2004-10-24	298	04:57:03	9686	y
Gr_030513_03	target	2004-10-24	298	09:32:08	9689	n
ARM_MPL	target	2004-10-24	298	14:11:28	9692	y
Barrow_HSRL	target	2004-10-24	298	17:34:10	9694	y
Pacific	scan	2004-10-24	298	18:38:38	9695	y
Ant_021212_01	target	2004-10-25	299	02:26:52	9699	n
Pacific	scan	2004-10-25	299	05:06:50	9701	y
Aeronet_kor	target	2004-10-25	299	11:36:40	9705	y
GSFC_MPL	target	2004-10-25	299	12:45:14	9706	n
Pacific	scan	2004-10-25	299	17:11:45	9709	y
Ant_021206_03	target	2004-10-26	300	00:59:54	9713	y
Railroad_Valley	target	2004-10-26	300	03:42:37	9715	y
Pacific	scan	2004-10-26	300	05:16:36	9716	y
Pacific	scan	2004-10-26	300	17:21:32	9724	y
Ant_021206_01	target	2004-10-27	301	01:09:59	9728	y
Pacific	scan	2004-10-27	301	05:26:22	9731	y
Ant_DV_268	target	2004-10-27	301	07:36:59	9732	y
Ant_021128_01	target	2004-10-27	301	15:47:18	9737	y
Pacific	scan	2004-10-27	301	17:31:18	9739	y
Ant_021206_02	target	2004-10-28	302	01:19:41	9743	y
ARM_MPL	target	2004-10-28	302	02:25:59	9744	y
Pacific	scan	2004-10-28	302	05:36:09	9746	y
Tapajos_T_A	target	2004-10-28	302	11:26:41	9750	y
Ant_021126_01	target	2004-10-28	302	12:45:08	9750	y
Amery_Rift	target	2004-10-28	302	14:10:58	9751	n
Pacific	scan	2004-10-28	302	17:41:04	9754	y
Mt_St_Helens	target	2004-10-29	303	04:09:50	9760	y
Pacific	scan	2004-10-29	303	05:45:55	9761	y
Pacific	scan	2004-10-29	303	17:50:51	9769	y
Manaus_T_B	target	2004-10-29	303	23:42:44	9772	y
Ant_021128_02	target	2004-10-30	304	01:39:15	9773	n
Pacific	scan	2004-10-30	304	05:55:42	9776	y

ATW	scan	2004-10-30	304	07:47:30	9777	y
Railroad_Valley	target	2004-10-30	304	15:10:38	9782	n
Pacific	scan	2004-10-30	304	18:00:38	9784	y
Ny_Alesund_MPL	target	2004-10-30	304	20:17:10	9785	n
Ant_021128_04	target	2004-10-31	305	01:49:06	9788	n
White_Sands	target	2004-10-31	305	02:56:24	9789	n
Pacific	scan	2004-10-31	305	06:05:29	9791	y
Pacific	scan	2004-10-31	305	18:10:25	9799	y
Ant_021212_02	target	2004-11-01	306	01:58:40	9803	y
Pacific	scan	2004-11-01	306	06:15:15	9806	y
Gr_030513_03	target	2004-11-01	306	09:13:42	9808	y
Cap_St_Forest	target	2004-11-01	306	15:32:26	9812	n
Pacific	scan	2004-11-01	306	16:43:32	9813	y
Ant_021212_01	target	2004-11-02	307	02:08:25	9818	y
Pacific	scan	2004-11-02	307	04:48:23	9820	y
Uyuni	target	2004-11-02	307	12:11:01	9825	n
Pacific	scan	2004-11-02	307	16:53:18	9828	y
Aeronet_mongu	target	2004-11-02	307	17:58:37	9828	y
Ant_021206_03	target	2004-11-03	308	00:41:28	9832	y
Bonneville_SF	target	2004-11-03	308	03:23:32	9834	n
Pacific	scan	2004-11-03	308	04:58:10	9835	y
Aeronet_naru	target	2004-11-03	308	08:24:33	9837	y
Pacific	scan	2004-11-03	308	17:03:05	9843	y
Aeronet_s_fr	target	2004-11-03	308	19:29:09	9844	y
Ant_021204_01	target	2004-11-04	309	00:51:03	9847	n
Pacific	scan	2004-11-04	309	05:07:56	9850	y
Aeronet_mongu	target	2004-11-04	309	06:05:12	9850	y
Ant_DV_387	target	2004-11-04	309	07:18:34	9851	y
Pacific	scan	2004-11-04	309	17:12:51	9858	y
Ant_021206_02	target	2004-11-05	310	01:01:15	9862	n
Pacific	scan	2004-11-05	310	05:17:43	9865	y
Barrow_HSRL_fl	target	2004-11-05	310	06:48:05	9866	y
Ant_021128_03	target	2004-11-05	310	15:38:17	9871	n
Pacific	scan	2004-11-05	310	17:22:38	9873	y
Mt_St_Helens	target	2004-11-06	311	03:51:24	9879	y

Pacific	scan	2004-11-06	311	05:27:29	9880	y
Tsukuba_HSRL	target	2004-11-06	311	10:20:42	9883	y
Pacific	scan	2004-11-06	311	17:32:24	9888	y
Ant_021128_02	target	2004-11-07	312	01:20:49	9892	y
Pacific	scan	2004-11-07	312	05:37:15	9895	y
ATW	scan	2004-11-07	312	07:28:03	9896	y
Manaus_T_B	target	2004-11-07	312	11:27:51	9899	y
Pacific	scan	2004-11-07	312	17:54:36	9903	y
Ny_Alesund_MPL	target	2004-11-07	312	19:58:43	9904	n
Ant_021212_03	target	2004-11-08	313	01:30:31	9907	n
Amery_Rift	target	2004-11-08	313	03:16:26	9908	y
Aeronet_uae	target	2004-11-08	313	03:41:36	9909	y
Pacific	scan	2004-11-08	313	05:47:00	9910	y
Aeronet_asc_i	target	2004-11-08	313	08:22:53	9911	y

Table E.6 TOOs, Ocean and ATW Scans executed during Campaign L3b

Location	Type	Date	DOY	Actual Time	Rev	Set Window Parameters
SM_lidar_cal	target	2005-02-17	48	22:49:44	11425	y
Pacific	scan	2005-02-18	49	1:57:59	11427	y
Tapajos_Tower_A	target	2005-02-18	49	7:48:32	11431	y
Pacific	scan	2005-02-18	49	14:02:54	11435	y
MPL_Cove	target	2005-02-18	49	21:20:53	11439	y
Mt_Rainier	target	2005-02-19	50	0:31:28	11441	y
Pacific	scan	2005-02-19	50	2:07:44	11442	y
Kilimanjaro	target	2005-02-19	50	13:38:03	11449	y
Pacific	scan	2005-02-19	50	14:12:39	11450	y
Pacific	scan	2005-02-20	51	2:17:30	11457	y
Aeronet_s_fr	target	2005-02-20	51	3:30:40	11458	y
Pacific	scan	2005-02-20	51	14:22:25	11465	y
Ny_Alesund	target	2005-02-20	51	16:38:58	11466	n
Ant_021212_03	target	2005-02-20	51	22:10:46	11469	n
White_Sands	target	2005-02-20	51	23:18:12	11470	y
Pacific	scan	2005-02-21	52	2:27:15	11472	y
ATW	scan	2005-02-21	52	4:18:03	11473	y

Pacific	scan	2005-02-21	52	14:32:11	11480	y
Pacific	scan	2005-02-22	53	2:37:01	11487	y
Andrews_for	target	2005-02-22	53	11:53:31	11493	y
Pacific	scan	2005-02-22	53	13:05:19	11494	y
Pacific	scan	2005-02-23	54	1:10:11	11501	y
SM_lidar_cal	target	2005-02-23	54	10:22:54	11507	y
N_San_Andreas	target	2005-02-23	54	12:01:53	11508	y
Pacific	scan	2005-02-23	54	13:15:06	11509	y
Aeronet_mongu	target	2005-02-23	54	14:20:26	11509	y
MPL_Tsukuba	target	2005-02-23	54	18:27:42	11512	y
W_US_615_10	target	2005-02-23	54	23:47:11	11515	y
Pacific	scan	2005-02-24	55	1:19:57	11516	y
MPL_Syowa	target	2005-02-24	55	2:02:41	11516	y
Pacific	scan	2005-02-24	55	13:24:53	11524	y
Aeronet_s_fr	target	2005-02-24	55	15:50:58	11525	y
Aeronet_Cape_V	target	2005-02-24	55	17:34:56	11526	y
Ant_021204_01	target	2005-02-24	55	21:12:52	11528	y
Andaman_I_12	target	2005-02-24	55	21:42:53	11529	n
Pacific	scan	2005-02-25	56	1:29:44	11531	y
Aeronet_mongu	target	2005-02-25	56	2:27:01	11531	y
Andaman_I_19	target	2005-02-25	56	9:43:48	11536	n
Pacific	scan	2005-02-25	56	13:34:40	11539	y
Ant_021206_02	target	2005-02-25	56	21:23:05	11543	y
Pacific	scan	2005-02-26	57	1:39:31	11546	y
HSRL_Barrow	target	2005-02-26	57	3:09:54	11547	y
Pacific	scan	2005-02-26	57	13:44:27	11554	y
Pacific	scan	2005-02-27	58	1:49:17	11561	y
MPL_Tsukuba	target	2005-02-27	58	6:42:33	11564	n
Ant_021210_03	target	2005-02-27	58	8:58:18	11565	n
Kilimanjaro	target	2005-02-27	58	13:19:38	11568	y
Pacific	scan	2005-02-27	58	13:54:13	11569	y
MPL_GSFC	target	2005-02-27	58	21:11:37	11573	y
Kilimanjaro	target	2005-02-28	59	1:23:15	11575	y
Pacific	scan	2005-02-28	59	1:59:04	11576	y
Aeronet_s_fr	target	2005-02-28	59	3:12:16	11577	y

Gr_030515_06	target	2005-02-28	59	6:34:36	11579	y
Pacific	scan	2005-02-28	59	14:04:00	11584	y
Aeronet_Asc_I	target	2005-02-28	59	16:44:01	11585	y
Ant_021212_03	target	2005-02-28	59	21:52:22	11588	y
Amery_Rift	target	2005-02-28	59	23:58:27	11589	n
Aeronet_uae	target	2005-03-01	60	0:03:27	11590	y
Pacific	scan	2005-03-01	60	2:08:51	11591	y
ATW	scan	2005-03-01	60	3:58:39	11592	y
Gr_030515_01	target	2005-03-01	60	6:44:07	11594	y
W_US_618_03	target	2005-03-01	60	11:22:55	11597	n
Pacific	scan	2005-03-01	60	14:13:46	11599	y
Uyuni_85	target	2005-03-01	60	20:10:24	11602	n
Gr_030514_01	target	2005-03-01	60	21:19:59	11603	y
Pacific	scan	2005-03-02	61	2:18:37	11606	y
Mt_Rainier	target	2005-03-02	61	11:35:50	11612	y
Pacific	scan	2005-03-02	61	12:46:54	11613	y
Gr_030514_03	target	2005-03-02	61	19:53:39	11617	y
Ant_021212_02	target	2005-03-02	61	22:11:47	11618	y
Pacific	scan	2005-03-03	62	0:51:45	11620	y
Aeronet_Cape_V	target	2005-03-03	62	5:10:54	11623	n
N_San_Andreas	target	2005-03-03	62	11:43:29	11627	y
Aeronet_uae	target	2005-03-03	62	12:14:42	11627	y
Pacific	scan	2005-03-03	62	12:56:41	11628	y
HSRL_Tsukuba	target	2005-03-03	62	18:09:18	11631	y
Ant_021212_01	target	2005-03-03	62	22:21:32	11633	y
Pacific	scan	2005-03-04	63	1:01:31	11635	y
MPL_Syowa	target	2005-03-04	63	1:44:17	11635	y
Pacific	scan	2005-03-04	63	13:06:27	11643	y
Aeronet_naru	target	2005-03-04	63	16:32:38	11645	y
Aeronet_Cape_V	target	2005-03-04	63	17:16:32	11645	y
Ant_021206_03	target	2005-03-04	63	20:54:36	11647	y
Andaman_I	target	2005-03-04	63	21:26:03	11648	n
Railroad_V	target	2005-03-04	63	23:37:17	11649	y
Pacific	scan	2005-03-05	64	1:11:18	11650	y
Pacific	scan	2005-03-05	64	13:16:13	11658	y

Gr_030515_02	target	2005-03-05	64	20:22:46	11662	n
Ant_021206_01	target	2005-03-05	64	21:04:41	11662	n
Pacific	scan	2005-03-06	65	1:21:04	11665	y
MPL_Barrow	target	2005-03-06	65	2:51:29	11666	y
White_Sands	target	2005-03-06	65	10:34:38	11671	y
Ant_021128_01	target	2005-03-06	65	11:41:59	11671	n
Pacific	scan	2005-03-06	65	13:26:00	11673	y
Rio_Tapajos	target	2005-03-06	65	19:17:55	11676	y
MPL_ARM	target	2005-03-06	65	22:20:41	11678	y
Alaska_163	target	2005-03-07	66	1:27:33	11680	y
Pacific	scan	2005-03-07	66	3:07:30	11681	y
Ant_021126_01	target	2005-03-07	66	8:39:50	11684	n
Pacific	scan	2005-03-07	66	13:35:47	11688	y
Pacific	scan	2005-03-08	67	0:03:59	11694	y
Alaska_178	target	2005-03-08	67	1:37:20	11695	n
Gr_030515_06	target	2005-03-08	67	6:16:10	11698	n
Bonneville	target	2005-03-08	67	10:56:10	11701	n
Pacific	scan	2005-03-08	67	13:45:34	11703	y
Aeronet_kor	target	2005-03-08	67	18:58:16	11706	y
Everglades	target	2005-03-08	67	21:06:03	11707	y
Pacific	scan	2005-03-09	68	1:50:24	11710	y
Gr_030515_01	target	2005-03-09	68	6:25:41	11713	n
MS_delta	target	2005-03-09	68	9:27:05	11715	y
W_US_615_01	target	2005-03-09	68	11:04:01	11716	n
Pacific	scan	2005-03-09	68	13:55:20	11718	y
MPL_Ny_Alesund	target	2005-03-09	68	16:11:51	11719	y
Ant_021204_03	target	2005-03-09	68	20:06:47	11721	n
Gr_030514_01	target	2005-03-09	68	21:01:34	11722	n
Pacific	scan	2005-03-10	69	2:00:10	11725	y
ATW	scan	2005-03-10	69	3:49:59	11726	y
MPL_Syowa	target	2005-03-10	69	12:11:38	11731	y
Pacific	scan	2005-03-10	69	14:05:06	11733	y
Gr_030514_03	target	2005-03-10	69	19:35:12	11736	n
Ant_021212_02	target	2005-03-10	69	21:53:21	11737	n
Pacific	scan	2005-03-11	70	0:33:17	11739	y

Gr_030513_03	target	2005-03-11	70	5:08:22	11742	n
MPL_ARM	target	2005-03-11	70	9:47:42	11745	y
Pacific	scan	2005-03-11	70	12:38:13	11747	y
Ant_021212_01	target	2005-03-11	70	22:03:05	11752	n
Pacific	scan	2005-03-12	71	0:43:03	11754	y
Aeronet_kor	target	2005-03-12	71	7:12:53	11758	y
MPL_GSFC	target	2005-03-12	71	8:21:28	11759	n
Pacific	scan	2005-03-12	71	12:47:59	11762	y
Ant_021206_03	target	2005-03-12	71	20:36:08	11766	y
W_US_618_01	target	2005-03-12	71	23:19:33	11768	y
Pacific	scan	2005-03-13	72	0:52:49	11769	y
Pacific	scan	2005-03-13	72	12:57:45	11777	y
Gr_030515_02	target	2005-03-13	72	20:04:17	11781	n
Pacific	scan	2005-03-14	73	0:14:19	11784	y
Everglades	target	2005-03-14	73	8:37:24	11789	y
Andaman_I	target	2005-03-14	73	9:15:11	11789	n
White_Sands	target	2005-03-14	73	10:16:09	11790	y
Ant_021128_01	target	2005-03-14	73	11:23:32	11790	y
Pacific	scan	2005-03-14	73	13:07:31	11792	y
Ant_021206_02	target	2005-03-14	73	20:55:54	11796	y
SM_lidar_cal	target	2005-03-14	73	22:04:05	11797	y
Pacific	scan	2005-03-15	74	1:12:21	11799	y
Amery_Rift	target	2005-03-15	74	9:47:18	11804	n
Pacific	scan	2005-03-15	74	13:17:18	11807	y
Seattle_urban	target	2005-03-15	74	23:45:41	11813	y
Pacific	scan	2005-03-16	75	1:22:08	11814	y
Gr_030515_06	target	2005-03-16	75	5:57:42	11817	y
MPL_Madison	target	2005-03-16	75	9:01:39	11819	n
Pacific	scan	2005-03-16	75	13:27:05	11822	y
Aeronet_kor	target	2005-03-16	75	18:39:49	11825	y
Everglades	target	2005-03-16	75	20:47:34	11826	n
Pacific	scan	2005-03-17	76	1:31:56	11829	y
Gr_030515_01	target	2005-03-17	76	6:07:14	11832	y
Railroad_V	target	2005-03-17	76	10:46:51	11835	n
Pacific	scan	2005-03-17	76	13:36:52	11837	y

Gr_030514_01	target	2005-03-17	76	20:43:06	11841	y
Ant_021212_03	target	2005-03-17	76	21:25:12	11841	y
White_Sands	target	2005-03-17	76	22:32:38	11842	n
Pacific	scan	2005-03-18	77	1:41:43	11844	y
ATW	scan	2005-03-18	77	3:32:31	11845	y
MPL_Syowa	target	2005-03-18	77	11:53:12	11850	y
Pacific	scan	2005-03-18	77	13:46:39	11852	y
Gr_030514_03	target	2005-03-18	77	19:16:45	11855	y
Pacific	scan	2005-03-19	78	0:14:50	11858	y
MPL_ARM	target	2005-03-19	78	9:29:16	11864	y
Capitol_State_For	target	2005-03-19	78	11:08:40	11865	n
Pacific	scan	2005-03-19	78	12:19:46	11866	y
Pacific	scan	2005-03-20	79	0:24:37	11873	y
Uyuni_360	target	2005-03-20	79	7:47:15	11878	n
Pacific	scan	2005-03-20	79	12:29:33	11881	y
Aeronet_mongu	target	2005-03-20	79	13:34:51	11881	y
MPL_Madison	target	2005-03-20	79	21:22:30	11886	y
W_US_616_02	target	2005-03-20	79	23:01:38	11887	y
Pacific	scan	2005-03-21	80	0:34:23	11888	y
Aeronet_naru	target	2005-03-21	80	4:00:51	11890	y
Pacific	scan	2005-03-21	80	12:39:20	11896	y
Aeronet_s_fr	target	2005-03-21	80	15:05:23	11897	y
Ant_021206_03	target	2005-03-21	80	20:27:26	11900	y
Pacific	scan	2005-03-22	81	0:44:10	11903	y
Aeronet_mongu	target	2005-03-22	81	1:41:26	11904	y
Pacific	scan	2005-03-22	81	12:49:06	11911	y
Ant_021206_02	target	2005-03-22	81	20:37:30	11915	n
Pacific	scan	2005-03-23	82	0:53:56	11918	y
MPL_Barrow	target	2005-03-23	82	2:24:19	11919	y
Pacific	scan	2005-03-23	82	12:58:52	11926	y
Andrews_For	target	2005-03-23	82	23:28:11	11932	y
Pacific	scan	2005-03-24	83	1:03:43	11933	y
ATW	scan	2005-03-24	83	2:53:31	11934	y
HSRL_Tsukuba	target	2005-03-24	83	5:56:57	11936	y
Kilimanjaro	target	2005-03-24	83	12:34:03	11940	y

Pacific	scan	2005-03-24	83	13:08:39	11941	y

Table E.7 TOOs, Ocean and ATW Scans executed during Campaign L3c

Note: Times marked with * are not verified by the stored command log - the data was missing; Set window parameters denoted by * are not verified by the stored command log - the data was missing.

Location	Type	Date	DOY	Time	Rev Number	Set Window Parameters
Mt_Rainier	target	2005-05-20	140	21:37:48	12795	y
Pacific	scan	2005-05-20	140	23:17:51	12796	y
Kilimanjaro	target	2005-05-21	141	10:44:23	12803	y
Pacific	scan	2005-05-21	141	11:19:15	12804	y
Pacific	scan	2005-05-21	141	23:27:38	12811	y
Aeronet_s_fr	target	2005-05-22	142	0:37:01	12812	y
Manaus_T_B	target	2005-05-22	142	5:14:27	12814	y
Pacific	scan	2005-05-22	142	11:29:03	12819	y
Ant_021212_03	target	2005-05-22	142	19:17:08	12823	n
White_Sands	target	2005-05-22	142	20:24:34	12824	y
Pacific	scan	2005-05-22	142	23:37:25	12826	y
ATW	scan	2005-05-23	143	1:23:26	12827	y
Pacific	scan	2005-05-23	143	11:38:50	12834	y
Pacific	scan	2005-05-23	143	23:47:12	12841	y
Mt_St_Helens	target	2005-05-24	144	9:00:24	12847	y
Pacific	scan	2005-05-24	144	10:11:57	12848	y
PR_CaribeNF	target	2005-05-24	144	17:34:38	12852	n
Pacific	scan	2005-05-24	144	22:20:19	12855	y
SM_lidar_cal	target	2005-05-25	145	7:29:16	12861	y
N_San_Andreas	target	2005-05-25	145	9:08:14	12862	y
Pacific	scan	2005-05-25	145	10:21:44	12863	y
Aeronet_mongu	target	2005-05-25	145	11:26:47	12863	y
MPL_Tsukuba	target	2005-05-25	145	15:34*	12866	y*
W_US_615_10	target	2005-05-25	145	20:53*	12869	y*
Pacific	scan	2005-05-25	145	22:27*	12870	y
MPL_Syowa	target	2005-05-25	145	23:09*	12870	y*
Pacific	scan	2005-05-26	146	10:28*	12878	y

Aeronet_s_fr	target	2005-05-26	146	12:57:19	12879	y
Aeronet_Cape_V	target	2005-05-26	146	14:41:17	12880	y
Ant_021204_01	target	2005-05-26	146	18:19:13	12882	y
Andaman_I_12	target	2005-05-26	146	18:49:14	12883	n
Pacific	scan	2005-05-26	146	22:39:53	12885	y
Aeronet_mongu	target	2005-05-26	146	23:33:22	12885	y
Andaman_I_19	target	2005-05-27	147	6:50:09	12890	n
Pacific	scan	2005-05-27	147	10:41:17	12893	y
Ant_021206_02	target	2005-05-27	147	18:29:25	12897	y
Pacific	scan	2005-05-27	147	22:49:39	12900	y
Tanguro_Br	target	2005-05-28	148	4:33:44	12903	y
Pacific	scan	2005-05-28	148	10:51:04	12908	y
Pacific	scan	2005-05-28	148	22:59:26	12915	y
MPL_Tsukuba	target	2005-05-29	149	3:48:54	12918	n
Ant_021210_03	target	2005-05-29	149	6:04:38	12919	n
Kilimanjaro_D	target	2005-05-29	149	10:25:59	12922	y
Pacific	scan	2005-05-29	149	11:00:50	12923	y
MPL_GSFC	target	2005-05-29	149	18:17:57	12927	y
Kilimanjaro_A	target	2005-05-29	149	22:29:17	12929	y
Pacific	scan	2005-05-29	149	23:09:12	12930	y
Aeronet_s_fr	target	2005-05-30	150	0:18:36	12931	y
Gr_030515_06	target	2005-05-30	150	3:40:56	12933	y
Manaus_T_A	target	2005-05-30	150	4:56:02	12933	y
Pacific	scan	2005-05-30	150	11:10:36	12938	y
Aeronet_Asc_I	target	2005-05-30	150	13:50:22	12939	y
Ant_021212_03	target	2005-05-30	150	18:58:42	12942	y
Amery_Rift	target	2005-05-30	150	20:44:03	12943	n
Aeronet_uae	target	2005-05-30	150	21:09:47	12944	y
Pacific	scan	2005-05-30	150	23:18:58	12945	y
ATW	scan	2005-05-31	151	1:03:59	12946	y
Gr_030515_01	target	2005-05-31	151	3:50:27	12948	y
Caribe_NF	target	2005-05-31	151	5:11:23	12949	y
W_US_618_03	target	2005-05-31	151	8:29:14	12951	n
Pacific	scan	2005-05-31	151	11:20:23	12953	y
Uyuni_85	target	2005-05-31	151	17:16:43	12956	n

Gr_030514_01	target	2005-05-31	151	18:26:20	12957	y
Pacific	scan	2005-05-31	151	23:28:44	12960	y
Mt_Rainier	target	2005-06-01	152	8:42:09	12966	y
Pacific	scan	2005-06-01	152	9:53:30	12967	y
Gr_030514_03	target	2005-06-01	152	16:59:58	12971	y
Ant_021212_02	target	2005-06-01	152	19:18:06	12972	y
Pacific	scan	2005-06-01	152	22:01:51	12974	y
Gr_030513_03	target	2005-06-02	153	2:33:08	12977	y
N_San_Andreas	target	2005-06-02	153	8:49:48	12981	y
Aeronet_uae	target	2005-06-02	153	9:21:01	12981	y
Pacific	scan	2005-06-02	153	10:03:16	12982	y
HSRL_Tsukuba	target	2005-06-02	153	15:15:36	12985	y
Ant_021212_01	target	2005-06-02	153	19:27:51	12987	y
Pacific	scan	2005-06-02	153	22:11:38	12989	y
MPL_Syowa	target	2005-06-02	153	22:50:35	12989	y
Aeronet_kor	target	2005-06-03	154	4:37:39	12993	y
Pacific	scan	2005-06-03	154	10:13:02	12997	y
Aeronet_naru	target	2005-06-03	154	13:38:56	12999	y
Aeronet_Cape_V	target	2005-06-03	154	14:22:50	12999	y
Ant_021206_03	target	2005-06-03	154	18:00:53	13001	y
Andaman_I	target	2005-06-03	154	18:32:21	13002	n
W_US_618_06	target	2005-06-03	154	20:44:24	13003	y
Pacific	scan	2005-06-03	154	22:21:24	13004	y
Pacific	scan	2005-06-04	155	10:22:48	13012	y
Gr_030515_02	target	2005-06-04	155	17:29:03	13016	n
Ant_021206_01	target	2005-06-04	155	18:10:58	13016	n
Pacific	scan	2005-06-04	155	22:31:09	13019	y
White_Sands	target	2005-06-05	156	7:40:55	13025	y
Ant_021128_01	target	2005-06-05	156	8:48:17	13025	n
Pacific	scan	2005-06-05	156	10:32:34	13027	y
Rio_Tapajos	target	2005-06-05	156	16:24:12	13030	y
MPL_ARM	target	2005-06-05	156	19:26:58	13032	y
Alaska_163	target	2005-06-05	156	22:33:51	13034	y
Pacific	scan	2005-06-06	157	0:17:34	13035	y
Ant_021126_01	target	2005-06-06	157	5:46:07	13038	n

Pacific	scan	2005-06-06	157	10:42:19	13042	y
Pacific	scan	2005-06-06	157	21:14:01	13048	y
Alaska_178	target	2005-06-06	157	22:43:38	13049	n
Gr_030515_06	target	2005-06-07	158	3:19:29	13052	n
Bonneville	target	2005-06-07	158	8:02:29	13055	n
Pacific	scan	2005-06-07	158	10:52:05	13057	y
Aeronet_kor	target	2005-06-07	158	16:04:34	13060	y
Everglades	target	2005-06-07	158	18:12:22	13061	y
Pacific	scan	2005-06-07	158	23:00:26	13064	y
Gr_030515_01	target	2005-06-08	159	3:31:59	13067	n
MS_delta	target	2005-06-08	159	6:33:24	13069	y
W_US_615_01	target	2005-06-08	159	8:10:19	13070	n
Pacific	scan	2005-06-08	159	11:01:50	13072	y
MPL_Ny_Alesund	target	2005-06-08	159	13:18:10	13073	y
Ant_021204_03	target	2005-06-08	159	17:13:05	13075	n
Gr_030514_01	target	2005-06-08	159	18:07:53	13076	n
Pacific	scan	2005-06-08	159	23:10:16	13079	y
ATW	scan	2005-06-09	160	0:55:18	13080	y
Pacific	scan	2005-06-09	160	9:35:02	13086	y
Gr_030514_03	target	2005-06-09	160	16:41:32	13090	n
Ant_021212_02	target	2005-06-09	160	18:59:40	13091	n
Pacific	scan	2005-06-09	160	21:43:24	13093	y
Gr_030513_03	target	2005-06-10	161	2:14:42	13096	n
MPL_ARM	target	2005-06-10	161	6:54:02	13099	y
Pacific	scan	2005-06-10	161	9:44:49	13101	y
PR_Bosque	target	2005-06-10	161	17:07:32	13105	y
Ant_021212_01	target	2005-06-10	161	19:09:25	13106	n
Pacific	scan	2005-06-10	161	21:53:11	13108	y
Aeronet_kor	target	2005-06-11	162	4:19:14	13112	y
MPL_GSFC	target	2005-06-11	162	5:27:48	13113	n
Pacific	scan	2005-06-11	162	9:54:35	13116	y
Ant_021206_03	target	2005-06-11	162	17:42*	13120	n*
W_US_618_01	target	2005-06-11	162	20:26*	13122	y*
Pacific	scan	2005-06-11	162	21:59*	13123	y
Aeronet_naru	target	2005-06-12	163	01:26*	13125	y*

Pacific	scan	2005-06-12	163	10:01*	13131	y
Gr_030515_02	target	2005-06-12	163	17:10:39	13135	n
Pacific	scan	2005-06-12	163	22:12:44	13138	y
Everglades	target	2005-06-13	164	5:43:46	13143	y
Andaman_I	target	2005-06-13	164	6:21:33	13143	n
White_Sands	target	2005-06-13	164	7:22:32	13144	y
Ant_021128_01	target	2005-06-13	164	8:29:54	13144	y
Pacific	scan	2005-06-13	164	10:14:09	13146	y
Aeronet_Midway_I	target	2005-06-13	164	12:11:04	13147	y
Tapajos_Tower_B	target	2005-06-13	164	16:05:54	13149	y
Ant_021206_02	target	2005-06-13	164	18:02:16	13150	y
SM_lidar_cal	target	2005-06-13	164	19:10:28	13151	y
Pacific	scan	2005-06-13	164	22:22:31	13153	y
Tapajos_Tower_A	target	2005-06-14	165	4:09:17	13156	y
Amery_Rift	target	2005-06-14	165	6:53:40	13158	n
Pacific	scan	2005-06-14	165	10:23:56	13161	y
MPL_Cove	target	2005-06-14	165	17:41:37	13165	n
Seattle_urban	target	2005-06-14	165	20:52:03	13167	y
Pacific	scan	2005-06-14	165	22:32:17	13168	y
Gr_030515_06	target	2005-06-15	166	3:04:04	13171	y
MPL_Madison	target	2005-06-15	166	6:08:01	13173	n
Pacific	scan	2005-06-15	166	10:33:43	13176	y
Manaus_Tower_B	target	2005-06-15	166	16:25:19	13179	y
Everglades_309	target	2005-06-15	166	17:53:56	13180	n
Pacific	scan	2005-06-15	166	22:42:04	13183	y
Gr_030515_01	target	2005-06-16	167	3:13:35	13186	y
W_US_615_07	target	2005-06-16	167	7:51:56	13189	y
Pacific	scan	2005-06-16	167	10:43:29	13191	y
MPL_Ny_Alesund	target	2005-06-16	167	12:59:45	13192	n
Gr_030514_01	target	2005-06-16	167	17:49:28	13195	y
Ant_021212_03	target	2005-06-16	167	18:31:33	13195	y
White_Sands	target	2005-06-16	167	19:38:59	13196	n
Pacific	scan	2005-06-16	167	22:51:50	13198	y
ATW	scan	2005-06-17	168	0:36:52	13199	y
PR_Bosque	target	2005-06-17	168	4:44:13	13202	y

Pacific	scan	2005-06-17	168	10:53:16	13206	y
Gr_030514_03	target	2005-06-17	168	16:23:06	13209	y
Pacific	scan	2005-06-17	168	21:24:58	13212	y
MPL_ARM	target	2005-06-18	169	6:35:36	13218	y
Capitol_State_For	target	2005-06-18	169	8:15:00	13219	n
Pacific	scan	2005-06-18	169	9:26:23	13220	y
Pacific	scan	2005-06-18	169	21:34:44	13227	y
Uyuni_360	target	2005-06-19	170	4:53:35	13231	n
Pacific	scan	2005-06-19	170	9:36:09	13235	y
Aeronet_mongu	target	2005-06-19	170	10:41:11	13235	y
MPL_Madison	target	2005-06-19	170	18:28:50	13240	y
Bonneville	target	2005-06-19	170	20:06:05	13241	n
Pacific	scan	2005-06-19	170	21:44:30	13242	y
Aeronet_naru	target	2005-06-20	171	1:07:10	13244	y
Pacific	scan	2005-06-20	171	9:45:55	13250	y
Aeronet_s_fr	target	2005-06-20	171	12:11:43	13251	y
Tanguro_Br	target	2005-06-20	171	15:40:22	13253	y
Ant_021204_01	target	2005-06-20	171	17:33:37	13254	n
Pacific	scan	2005-06-20	171	21:54:17	13257	y
Aeronet_mongu	target	2005-06-20	171	22:47:46	13257	y
Pacific	scan	2005-06-21	172	9:55:41	13265	y
Aeronet_midway	target	2005-06-21	172	11:52:38	13266	y
Ant_021206_02	target	2005-06-21	172	17:43:50	13269	n
Mexico_City	target	2005-06-21	172	18:54:43	13270	n
Pacific	scan	2005-06-21	172	22:04:02	13272	y
MPL_Barrow	target	2005-06-21	172	23:30:39	13273	y
Pacific	scan	2005-06-22	173	10:05:28	13280	y
Mt_St_Helens	target	2005-06-22	173	20:34:00	13286	y
Pacific	scan	2005-06-22	173	22:13:49	13287	y
ATW	scan	2005-06-22	173	23:59:51	13289	y

Table E.8 TOOs, Ocean and ATW Scans executed during Campaign L3d

Location	Type	Date	DOY	Time	Rev Number	Set Window Parameters
Mt_Rainier	target	2005-10-21	294	16:43:51.00	15086	y
Pacific	scan	2005-10-21	294	18:23:55.00	15087	y
Ant_041118_04	target	2005-10-22	295	01:28:55.00	15091	n
Kilimanjaro	target	2005-10-22	295	05:50:32.00	15094	y
Pacific	scan	2005-10-22	295	06:25:20.00	15095	y
Pacific	scan	2005-10-22	295	18:33:41.00	15102	y
Aeronet_s_fr	target	2005-10-22	295	19:43:20.00	15103	y
Manaus_T_B	target	2005-10-23	296	00:20:29.00	15105	y
Pacific	scan	2005-10-23	296	06:35:06.00	15110	y
Ant_021212_03	target	2005-10-23	296	14:23:09.00	15114	n
White_Sands	target	2005-10-23	296	15:30:36.00	15115	y
Pacific	scan	2005-10-23	296	18:43:27.00	15117	y
ATW	scan	2005-10-23	296	20:31:29.00	15118	y
Pacific	scan	2005-10-24	297	06:44:52.00	15125	y
Pakis_A	target	2005-10-24	297	15:09:54.00	15130	n
Pacific	scan	2005-10-24	297	18:53:13.00	15132	y
Mt_St_Helens	target	2005-10-25	298	04:06:25.00	15138	y
Pacific	scan	2005-10-25	298	05:17:58.00	15139	y
Nanjenshan	target	2005-10-25	298	12:03:12.00	15143	y
PR_Luquillo	target	2005-10-25	298	12:40:39.00	15143	y
Pacific	scan	2005-10-25	298	17:26:21.00	15146	y
MPL_Cove	target	2005-10-26	299	01:00:25.00	15151	y
SM_lidar_cal	target	2005-10-26	299	02:35:17.00	15152	y
N_San_Andreas	target	2005-10-26	299	04:14:15.00	15153	y
Pacific	scan	2005-10-26	299	05:27:46.00	15154	y
Aeronet_mongu	target	2005-10-26	299	06:32:49.00	15154	y
Sumatra	target	2005-10-26	299	13:44:35.00	15159	n
W_US_615_10	target	2005-10-26	299	15:59:34.00	15160	y
Pacific	scan	2005-10-26	299	17:36:08.00	15161	y
Pacific	scan	2005-10-27	300	05:37:33.00	15169	y
Aeronet_s_fr	target	2005-10-27	300	08:03:21.00	15170	y
Aeronet_Cape_V	target	2005-10-27	300	09:47:19.00	15171	y

Ant_021204_01	target	2005-10-27	300	13:25:14.00	15173	y
Andaman_I_12	target	2005-10-27	300	13:55:15.00	15174	n
Pacific	scan	2005-10-27	300	17:45:55.00	15176	y
Andaman_I_19	target	2005-10-28	301	01:56:10.00	15181	n
Pacific	scan	2005-10-28	301	05:47:20.00	15184	y
Ant_021206_02	target	2005-10-28	301	13:35:27.00	15188	y
Pacific	scan	2005-10-28	301	17:55:41.00	15191	y
Tanguro_Br	target	2005-10-28	301	23:39:46.00	15194	y
BCI	target	2005-10-29	302	01:22:18.00	15196	y
Pacific	scan	2005-10-29	302	05:57:07.00	15199	y
Pacific	scan	2005-10-29	302	18:05:28.00	15206	y
Ant_021210_03	target	2005-10-30	303	01:10:40.00	15210	n
Kilimanjaro_D	target	2005-10-30	303	05:32:01.00	15213	y
Pacific	scan	2005-10-30	303	06:06:53.00	15214	y
ZF3Fazenda	target	2005-10-30	303	11:58:19.00	15217	n
MPL_GSFC	target	2005-10-30	303	13:23:59.00	15218	y
Kilimanjaro_A	target	2005-10-30	303	17:35:19.00	15220	y
Pacific	scan	2005-10-30	303	18:15:14.00	15221	y
Gr_030515_06	target	2005-10-30	303	22:46:58.00	15224	y
ZF3BDFF	target	2005-10-31	304	00:02:08.00	15224	y
Pacific	scan	2005-10-31	304	06:16:39.00	15229	y
Aeronet_Asc_I	target	2005-10-31	304	08:56:24.00	15230	y
Ant_021212_03	target	2005-10-31	304	14:04:44.00	15233	y
Amery_Rift	target	2005-10-31	304	15:50:39.00	15234	n
Pacific	scan	2005-10-31	304	18:25:01.00	15236	y
ATW	scan	2005-10-31	304	20:09:03.00	15237	y
Gr_030515_01	target	2005-10-31	304	22:56:29.00	15239	y
Luquillo	target	2005-11-01	305	00:17:26.00	15240	y
Santa_Ana_ES	target	2005-11-01	305	01:52:54.00	15241	y
W_US_618_03	target	2005-11-01	305	03:35:16.00	15242	n
Pacific	scan	2005-11-01	305	06:26:26.00	15244	y
Korup	target	2005-11-01	305	07:26:03.00	15244	y
Uyuni_85	target	2005-11-01	305	12:22:46.00	15247	n
Gr_030514_01	target	2005-11-01	305	13:32:22.00	15248	y
Pakistan	target	2005-11-01	305	14:51:13.00	15249	n

Pacific	scan	2005-11-01	305	18:34:47.00	15251	y
Pacific	scan	2005-11-02	306	04:59:33.00	15258	y
Nyiragonga	target	2005-11-02	306	06:00:54.00	15258	y
Palanan	target	2005-11-02	306	11:43:25.00	15262	y
Santa_Ana_ES	target	2005-11-02	306	14:00:03.00	15263	y
Ant_021212_02	target	2005-11-02	306	14:24:09.00	15263	y
Pacific	scan	2005-11-02	306	17:07:55.00	15265	y
Gr_030513_03	target	2005-11-02	306	21:39:10.00	15268	y
Mudumalai	target	2005-11-03	307	02:53:52.00	15271	y
N_San_Andreas	target	2005-11-03	307	03:55:50.00	15272	y
Aeronet_uae	target	2005-11-03	307	04:27:04.00	15272	y
Pacific	scan	2005-11-03	307	05:09:20.00	15273	y
Sumatra	target	2005-11-03	307	13:25:40.00	15278	n
Ant_021212_01	target	2005-11-03	307	14:33:54.00	15278	y
Pacific	scan	2005-11-03	307	17:17:41.00	15280	y
Aeronet_kor	target	2005-11-03	307	23:43:42.00	15284	y
Doi_Intanon	target	2005-11-04	308	01:25:09.00	15285	y
Mexico_City	target	2005-11-04	308	02:23:43.00	15286	y
Pacific	scan	2005-11-04	308	05:19:06.00	15288	y
Aeronet_Cape_V	target	2005-11-04	308	09:28:54.00	15290	y
Ant_041118_08	target	2005-11-04	308	11:29:28.00	15291	y
Ant_021206_03	target	2005-11-04	308	13:06:57.00	15292	y
Andaman_I	target	2005-11-04	308	13:38:25.00	15293	n
Railroad_Valley	target	2005-11-04	308	15:49:39.00	15294	y
Pacific	scan	2005-11-04	308	17:27:28.00	15295	y
Nanjenshan	target	2005-11-04	308	23:57:18.00	15299	y
Aguascalientes	target	2005-11-05	309	02:34:08.00	15301	y
Pacific	scan	2005-11-05	309	05:28:53.00	15303	y
Gr_030515_02	target	2005-11-05	309	12:35:07.00	15307	n
Ant_021206_01	target	2005-11-05	309	13:17:02.00	15307	n
Pacific	scan	2005-11-05	309	17:37:14.00	15310	y
Ant_041118_06	target	2005-11-06	310	00:42:34.00	15314	n
White_Sands	target	2005-11-06	310	02:46:59.00	15316	y
Ant_021128_01	target	2005-11-06	310	03:54:22.00	15316	n
Pacific	scan	2005-11-06	310	05:38:39.00	15318	y

Rio_Tapajos	target	2005-11-06	310	11:30:16.00	15321	y
Alaska_163	target	2005-11-06	310	17:39:55.00	15325	y
Pacific	scan	2005-11-06	310	19:23:39.00	15326	y
Ant_021126_01	target	2005-11-07	311	00:52:11.00	15329	n
Amery_Rift	target	2005-11-07	311	02:18:01.00	15330	y
Pacific	scan	2005-11-07	311	06:08:25.00	15333	y
Colima	target	2005-11-07	311	14:47:24.00	15338	n
Pacific	scan	2005-11-07	311	16:20:07.00	15339	y
Alaska_178	target	2005-11-07	311	17:49:41.00	15340	n
Gr_030515_06	target	2005-11-07	311	22:28:31.00	15343	n
ZF3Fazenda	target	2005-11-07	311	23:43:45.00	15343	n
Ant_041118_03	target	2005-11-08	312	01:01:48.00	15344	n
Bonneville	target	2005-11-08	312	03:08:31.00	15346	n
Pacific	scan	2005-11-08	312	05:58:11.00	15348	y
Everglades	target	2005-11-08	312	13:18:24.00	15352	y
Pacific	scan	2005-11-08	312	18:06:33.00	15355	y
Gr_030515_01	target	2005-11-08	312	22:38:02.00	15358	n
Milmadiera	target	2005-11-08	312	23:47:16.00	15358	n
MS_delta	target	2005-11-09	313	01:39:26.00	15360	y
W_US_615_01	target	2005-11-09	313	03:16:22.00	15361	n
Pacific	scan	2005-11-09	313	06:07:57.00	15363	y
MPL_Ny_Alesund	target	2005-11-09	313	08:24:12.00	15364	y
Ant_021204_03	target	2005-11-09	313	12:19:08.00	15366	n
Gr_030514_01	target	2005-11-09	313	13:13:55.00	15367	n
Pacific	scan	2005-11-09	313	18:16:19.00	15370	y
ATW	scan	2005-11-09	313	20:04:21.00	15371	y
Pacific	scan	2005-11-10	314	04:41:05.00	15377	y
Gr_030514_03	target	2005-11-10	314	11:47:33.00	15381	n
Doi_Inthanon	target	2005-11-10	314	13:02:00.00	15382	y
Ant_021212_02	target	2005-11-10	314	14:05:42.00	15382	n
Reunion_I	target	2005-11-10	314	16:04:40.00	15383	y
Pacific	scan	2005-11-10	314	16:49:26.00	15384	y
Ituri_Edoro_1	target	2005-11-10	314	17:47:25.00	15385	n
Gr_030513_03	target	2005-11-10	314	21:20:43.00	15387	n
Pacific	scan	2005-11-11	315	04:50:51.00	15392	y

Scheveluch	target	2005-11-11	315	08:32:03.00	15394	y
Santa_Maria	target	2005-11-11	315	13:51:06.00	15397	y
Ant_021212_01	target	2005-11-11	315	14:15:26.00	15397	n
Pacific scan	scan	2005-11-11	315	16:59:13.00	15399	y
Aeronet_kor	target	2005-11-11	315	23:25:15.00	15403	y
Lascar	target	2005-11-12	316	00:17:03.00	15403	n
MPL_GSFC	target	2005-11-12	316	00:33:49.00	15404	n
Sumatra	target	2005-11-12	316	01:10:15.00	15404	n
Pacific	scan	2005-11-12	316	05:00:37.00	15407	y
Avachinsky	target	2005-11-12	316	08:40:55.00	15409	y
Ant_041118_08	target	2005-11-12	316	11:10:59.99	15410	y
Hektoria	target	2005-11-12	316	11:21:10.00	15410	y
Ant_021206_03	target	2005-11-12	316	12:48:29.00	15411	y
Pacific	scan	2005-11-12	316	17:08:59.00	15414	y
Aeronet_naru	target	2005-11-12	316	20:31:33.00	15416	y
Fushan	target	2005-11-12	316	23:38:07.00	15418	n
Pacific	scan	2005-11-13	317	05:10:23.00	15422	y
Ant_041118_07	target	2005-11-13	317	11:20:48.00	15425	y
Gr_030515_02	target	2005-11-13	317	12:16:39.00	15426	n
Pacific	scan	2005-11-13	317	17:18:45.00	15429	y
Everglades	target	2005-11-14	318	00:49:46.00	15434	y
Andaman_I	target	2005-11-14	318	01:27:34.00	15434	n
White_Sands	target	2005-11-14	318	02:28:31.00	15435	y
Ant_021128_01	target	2005-11-14	318	03:35:54.00	15435	y
Pacific	scan	2005-11-14	318	05:20:10.00	15437	y
La_Planada	target	2005-11-14	318	12:47:25.00	15441	y
Ant_021206_02	target	2005-11-14	318	13:08:16.00	15441	y
SM_lidar_cal	target	2005-11-14	318	14:16:28.00	15442	y
Pacific	scan	2005-11-14	318	17:28:32.00	15444	y
Ant_041118_01	target	2005-11-15	319	00:34:24.00	15448	y
Amery_Rift	target	2005-11-15	319	01:59:41.00	15449	n
Pacific	scan	2005-11-15	319	05:29:57.00	15452	y
MPL_Cove	target	2005-11-15	319	12:47:38.00	15456	n
BCI	target	2005-11-15	319	12:55:03.00	15456	y
Aguascalientes	target	2005-11-15	319	14:28:18.00	15457	y

Seattle_urban	target	2005-11-15	319	15:58:04.00	15458	y
Pacific	scan	2005-11-15	319	17:38:19.00	15459	y
Gr_030515_06	target	2005-11-15	319	22:10:04.00	15462	y
Ant_041118_04	target	2005-11-16	320	00:43:18.00	15463	y
North_Rim	target	2005-11-16	320	02:48:50.00	15465	y
Pacific	scan	2005-11-16	320	05:39:44.00	15467	y
ZF2KM34	target	2005-11-16	320	11:31:18.00	15470	y
Everglades_309	target	2005-11-16	320	12:59:56.00	15471	n
Pacific	scan	2005-11-16	320	17:48:06.00	15474	y
Gr_030515_01	target	2005-11-16	320	22:19:36.00	15477	y
W_US_615_07	target	2005-11-17	321	02:57:56.00	15480	y
Pacific	scan	2005-11-17	321	05:49:30.00	15482	y
MPL_Ny_Alesund	target	2005-11-17	321	08:05:45.00	15483	n
Gr_030514_01	target	2005-11-17	321	12:55:28.00	15486	y
Ant_021212_03	target	2005-11-17	321	13:37:34.00	15486	y
White_Sands	target	2005-11-17	321	14:45:00.00	15487	n
Pacific	scan	2005-11-17	321	17:57:52.00	15489	y
ATW	scan	2005-11-17	321	19:41:54.00	15490	y
Bukit_Timah	target	2005-11-18	322	00:33:17.00	15493	n
Pacific	scan	2005-11-18	322	05:59:17.00	15497	y
Gr_030514_03	target	2005-11-18	322	11:29:07.00	15500	y
Pakistan	target	2005-11-18	322	14:24:00.00	15502	n
Pacific	scan	2005-11-18	322	16:30:59.00	15503	y
Capitol_State_For	target	2005-11-19	323	03:21:01.00	15510	n
Pacific	scan	2005-11-19	323	04:32:24.00	15511	y
Ituri_Edoro_2	target	2005-11-19	323	05:32:55.00	15511	y
Sinharaja	target	2005-11-19	323	11:13:26.00	15515	n
Luquillo	target	2005-11-19	323	11:55:03.00	15515	y
North_Rim	target	2005-11-19	323	15:03:33.00	15517	y
Pacific	scan	2005-11-19	323	16:40:46.00	15518	y
Uyuni_360	target	2005-11-19	323	23:59:36.00	15522	n
Sumatra	target	2005-11-20	324	00:52:02.00	15523	n
Pacific	scan	2005-11-20	324	04:42:11.00	15526	y
Aeronet_mongu	target	2005-11-20	324	05:47:12.00	15526	y
Sumatra	target	2005-11-20	324	12:58:51.00	15531	n

Bonneville	target	2005-11-20	324	15:12:07.00	15532	n
Pacific	scan	2005-11-20	324	16:50:32.00	15533	y
Aeronet_naru	target	2005-11-20	324	20:13:12.00	15535	y
Sumatra	target	2005-11-21	325	01:01:31.00	15538	n
Pacific	scan	2005-11-21	325	04:51:58.00	15541	y
Aeronet_s_fr	target	2005-11-21	325	07:17:44.00	15542	y
Tanguro_Br	target	2005-11-21	325	10:46:23.00	15544	y
Ant_041118_07	target	2005-11-21	325	11:02:22.00	15544	n
Ant_021204_01	target	2005-11-21	325	12:39:38.00	15545	n
Pacific	scan	2005-11-21	325	17:00:19.00	15548	y
Yasuni2	target	2005-11-22	326	00:24:19.00	15552	y
Pacific	scan	2005-11-22	326	05:01:44.00	15556	y
Lambir	target	2005-11-22	326	11:42:09.00	15560	n
Ant_021206_02	target	2005-11-22	326	12:46:51.00	15560	n
Mexico_City	target	2005-11-22	326	14:00:44.00	15561	n
Pacific	scan	2005-11-22	326	17:10:05.00	15563	y
Sherman	target	2005-11-23	327	00:36:43.00	15568	y
Pacific	scan	2005-11-23	327	05:11:30.00	15571	y
Cocoli	target	2005-11-23	327	12:36:40.00	15575	y
Mt_St_Helens	target	2005-11-23	327	15:39:59.99	15577	y
Pacific	scan	2005-11-23	327	17:19:52.00	15578	y
ATW	scan	2005-11-23	327	19:07:54.00	15579	y
Ant_041118_04	target	2005-11-24	328	00:24:52.00	15582	n

Table E.9 TOOs, Ocean and ATW Scans executed during Campaign L3e

Location	Type	Date	DOY	Time	Rev Number	Set Window Parameters
Pacific	scan	2006-02-23	54	02:28:24.00	16940	y
Pacific	scan	2006-02-23	54	14:36:45.00	16947	y
Pacific	scan	2006-02-24	55	02:38:10.00	16955	y
Ant_021212_03	target	2006-02-24	55	10:26:14.00	16959	n
White_Sands	target	2006-02-24	55	11:33:40.00	16960	y
Pacific	scan	2006-02-24	55	14:46:32.00	16962	y
ATW	scan	2006-02-24	55	16:32:34.00	16963	y
Syowa	target	2006-02-25	56	00:54:13.00	16968	y

Pacific	scan	2006-02-25	56	02:47:57.00	16970	y
Pacific	scan	2006-02-25	56	14:56:18.00	16977	y
Pacific	scan	2006-02-26	57	01:21:04.00	16984	y
HSRL_Eureka	target	2006-02-26	57	11:40:15.00	16990	y
Pacific	scan	2006-02-26	57	13:29:25.00	16991	y
MPL_Cove	target	2006-02-26	57	21:03:29.00	16996	y
SM_lidar_cal	target	2006-02-26	57	22:38:21.00	16997	y
N_San_Andreas	target	2006-02-27	58	00:17:20.00	16998	y
Pacific	scan	2006-02-27	58	01:30:50.00	16999	y
Sumatra	target	2006-02-27	58	09:47:39.00	17004	n
W_US_615_10	target	2006-02-27	58	12:02:38.00	17005	y
Pacific	scan	2006-02-27	58	13:39:12.00	17006	y
MPL_Syowa	target	2006-02-27	58	14:18:08.00	17006	y
Pacific	scan	2006-02-28	59	01:40:37.00	17014	y
Aeronet_Cape_V	target	2006-02-28	59	05:50:23.00	17016	y
Ant_021204_01	target	2006-02-28	59	09:28:18.00	17018	y
Andaman_I_12	target	2006-02-28	59	09:55:19.00	17019	n
Pacific	scan	2006-02-28	59	13:48:59.00	17021	y
Andaman_I_19	target	2006-02-28	59	21:59:14.00	17026	n
Pacific	scan	2006-03-01	60	01:50:23.00	17029	y
Ant_021206_02	target	2006-03-01	60	09:38:31.00	17033	y
Pacific	scan	2006-03-01	60	13:58:45.00	17036	y
Tanguro_Br	target	2006-03-01	60	19:42:47.00	17039	y
Tanguragua_Ec	target	2006-03-01	60	21:23:18.00	17041	y
Pacific	scan	2006-03-02	61	02:00:10.00	17044	y
Pacific	scan	2006-03-02	61	14:08:31.00	17051	y
HSRL_Eureka	target	2006-03-02	61	20:17:41.00	17055	y
Ant_041118_05	target	2006-03-02	61	21:13:49.00	17055	n
Barringer_Crater	target	2006-03-02	61	23:18:44.00	17057	y
Kilimanjaro	target	2006-03-03	62	01:35:04.00	17058	y
Pacific	scan	2006-03-03	62	02:09:56.00	17059	y
MPL_GSFC	target	2006-03-03	62	09:27:02.00	17063	y
Kilimanjaro	target	2006-03-03	62	13:38:22.00	17065	y
Pacific	scan	2006-03-03	62	14:18:17.00	17066	y
Gr_030515_06	target	2006-03-03	62	18:50:01.00	17069	y

Manaus_Tower_sec	target	2006-03-03	62	20:05:11.00	17069	y
Starr_Noxubee_MS	target	2006-03-03	62	21:51:21.00	17071	y
Pacific	scan	2006-03-04	63	02:19:42.00	17074	y
Aeronet_Asc_I	target	2006-03-04	63	04:59:27.00	17075	y
Rondonia_1	target	2006-03-04	63	08:13:13.00	17077	y
Ant_021212_03	target	2006-03-04	63	10:07:47.00	17078	y
Haughton_NWT	target	2006-03-04	63	11:03:35.00	17079	n
Amery_Rift	target	2006-03-04	63	11:53:42.00	17079	n
Pacific	scan	2006-03-04	63	14:28:04.00	17081	y
ATW	scan	2006-03-04	63	16:15:06.00	17082	y
Gr_030515_01	target	2006-03-04	63	18:59:32.00	17084	y
Santa_Ana_ES	target	2006-03-04	63	21:55:57.00	17086	y
W_US_618_03	target	2006-03-04	63	23:38:19.00	17087	n
Pacific	scan	2006-03-05	64	02:29:29.00	17089	y
Popigai_Crater	target	2006-03-05	64	07:51:24.00	17092	y
Uyuni_85	target	2006-03-05	64	08:25:49.00	17092	n
Gr_030514_01	target	2006-03-05	64	09:35:25.00	17093	y
Pakistan	target	2006-03-05	64	10:54:16.00	17094	n
Pacific	scan	2006-03-05	64	13:01:11.00	17095	y
Karymsky	target	2006-03-05	64	17:45:47.00	17098	n
Mt_St_Helens	target	2006-03-05	64	23:51:03.00	17102	y
Pacific	scan	2006-03-06	65	01:02:36.00	17103	y
Nyiragongo	target	2006-03-06	65	02:03:56.00	17103	y
Gr_030514_03	target	2006-03-06	65	08:09:03.00	17107	y
Santa_Ana	target	2006-03-06	65	10:03:06.00	17108	y
Ant_021212_02	target	2006-03-06	65	10:27:12.00	17108	y
Barringer_Crater	target	2006-03-06	65	11:34:05.00	17109	y
Pacific	scan	2006-03-06	65	13:10:57.00	17110	y
Gr_030513_03	target	2006-03-06	65	17:42:13.00	17113	y
Haughton_NWT	target	2006-03-06	65	20:55:26.00	17115	n
N_San_Andreas	target	2006-03-07	66	23:58:53.00	17117	y
Pacific	scan	2006-03-07	66	01:12:22.00	17118	y
Bzymianny	target	2006-03-07	66	04:53:24.00	17120	n
Sumatra	target	2006-03-07	66	09:28:42.00	17123	n
Ant_021212_01	target	2006-03-07	66	10:36:57.00	17123	y

Pacific	scan	2006-03-07	66	13:20:44.00	17125	y
Belem_1	target	2006-03-07	66	19:07:56.00	17128	y
Mexico_City	target	2006-03-07	66	22:26:45.00	17131	y
Pacific	scan	2006-03-08	67	01:22:09.00	17133	y
Aeronet_Cape_V	target	2006-03-08	67	05:31:56.00	17135	y
Ant_041118_08	target	2006-03-08	67	07:32:30.00	17136	y
Ant_021206_03	target	2006-03-08	67	09:09:59.00	17137	y
Andaman_I	target	2006-03-08	67	09:41:27.00	17138	n
Railroad_Valley	target	2006-03-08	67	11:52:41.00	17139	y
Pacific	scan	2006-03-08	67	13:30:30.00	17140	y
Aguascalientes	target	2006-03-08	67	22:37:11.00	17146	y
Pacific	scan	2006-03-09	68	01:31:55.00	17148	y
Gr_030515_02	target	2006-03-09	68	08:38:09.00	17152	n
Ant_021206_01	target	2006-03-09	68	09:20:04.00	17152	n
Pacific	scan	2006-03-09	68	13:40:16.00	17155	y
Ant_041118_06	target	2006-03-09	68	20:45:36.00	17159	n
White_Sands	target	2006-03-09	68	22:50:01.00	17161	y
Ant_021128_01	target	2006-03-09	68	23:57:24.00	17161	n
Pacific	scan	2006-03-10	69	01:41:41.00	17163	y
Rio_Tapajos	target	2006-03-10	69	07:33:18.00	17166	y
Enc_RockSNA	target	2006-03-10	69	10:37:43.00	17167	y
Alaska_163	target	2006-03-10	69	13:42:56.00	17170	y
Pacific	scan	2006-03-10	69	15:26:41.00	17171	y
Ant_041118_02	target	2006-03-10	69	20:55:36.00	17174	n
Martell_Forest	target	2006-03-10	69	21:25:03.00	17175	y
Pacific	scan	2006-03-11	70	01:51:27.00	17178	y
Colima_Mex	target	2006-03-11	70	10:50:26.00	17183	n
Pacific	scan	2006-03-11	70	12:23:09.00	17184	y
Alaska_178	target	2006-03-11	70	13:52:43.00	17185	n
Gr_030515_06	target	2006-03-11	70	18:31:33.00	17188	n
HSRL_Eureka	target	2006-03-11	70	20:08:56.00	17189	y
Ant_041118_03	target	2006-03-11	70	21:04:49.00	17189	n
Starr_Nox_MS	target	2006-03-11	70	21:32:54.00	17190	y
Bonneville	target	2006-03-11	70	23:11:33.00	17191	n
Pacific	scan	2006-03-12	71	02:01:13.00	17193	y

Aeronet_kor	target	2006-03-12	71	07:13:36.00	17196	y
Everglades	target	2006-03-12	71	09:21:26.00	17197	y
Haughton_NWT	target	2006-03-12	71	10:45:07.00	17198	y
Pacific	scan	2006-03-12	71	14:09:35.00	17200	y
Gr_030515_01	target	2006-03-12	71	18:41:04.00	17203	n
MS_delta	target	2006-03-12	71	21:42:28.00	17205	y
W_US_615_01	target	2006-03-12	71	23:19:24.00	17206	n
Pacific	scan	2006-03-13	72	02:10:59.00	17208	y
Popigai_Crater	target	2006-03-13	72	07:32:57.00	17211	n
Ant_021204_03	target	2006-03-13	72	08:22:10.00	17211	n
Gr_030514_01	target	2006-03-13	72	09:16:57.00	17212	n
Pacific	scan	2006-03-13	72	14:19:20.00	17215	y
ATW	scan	2006-03-13	72	16:05:23.00	17216	y
Santa_Maria_Guat	target	2006-03-13	72	21:47:29.00	17220	y
Pacific	scan	2006-03-14	73	00:44:06.00	17222	y
Gr_030514_03	target	2006-03-14	73	07:50:36.00	17226	n
Ant_021212_02	target	2006-03-14	73	10:08:45.00	17227	n
HSRL_Eureka	target	2006-03-14	73	11:03:20.00	17228	y
Reunion_I	target	2006-03-14	73	12:07:43.00	17228	y
Pacific	scan	2006-03-14	73	12:52:27.00	17229	y
Nyamuragira	target	2006-03-14	73	13:49:40.00	17229	y
Augustine_AK	target	2006-03-14	73	14:22:22.00	17230	y
Gr_030513_03	target	2006-03-14	73	17:23:46.00	17232	n
Haughton_NWT	target	2006-03-14	73	20:37:00.00	17234	y
Pacific	scan	2006-03-15	74	00:53:53.00	17237	y
Scheveluch_Kamchat	target	2006-03-15	74	04:35:07.00	17239	y
Santa_Maria_Guat	target	2006-03-15	74	09:54:10.00	17242	y
Ant_021212_01	target	2006-03-15	74	10:18:30.00	17242	n
North_Rim	target	2006-03-15	74	11:25:02.00	17243	y
Pacific	scan	2006-03-15	74	13:02:17.00	17244	y
Aeronet_kor	target	2006-03-15	74	19:28:19.00	17248	y
Lascar	target	2006-03-15	74	20:20:07.00	17248	n
MPL_GSFC	target	2006-03-15	74	20:36:53.00	17249	n
Sumatra	target	2006-03-15	74	21:13:19.00	17249	n
Aeronet_maldives	target	2006-03-15	74	22:50:12.00	17250	y

Pacific	scan	2006-03-16	75	01:03:42.00	17252	y
Avachinsky	target	2006-03-16	75	04:43:59.00	17254	y
Ant_041118_08	target	2006-03-16	75	07:14:04.00	17255	n
Hektoria	target	2006-03-16	75	07:24:15.00	17255	y
Ant_021206_03	target	2006-03-16	75	08:51:34.00	17256	y
Pacific	scan	2006-03-16	75	13:12:03.00	17259	y
Popigai_Crater	target	2006-03-16	75	21:05:10.00	17264	n
Pacific	scan	2006-03-17	76	01:13:29.00	17267	y
Ant_041118_07	target	2006-03-17	76	07:23:53.00	17270	y
Gr_030515_02	target	2006-03-17	76	08:19:44.00	17271	n
Pacific	scan	2006-03-17	76	13:21:50.00	17274	y
Chukchi_AK	target	2006-03-17	76	14:48:27.00	17275	y
Everglades	target	2006-03-17	76	20:52:50.00	17279	y
Andaman_I	target	2006-03-17	76	21:30:38.00	17279	n
Colima_MX	target	2006-03-17	76	22:27:53.00	17280	y
Ant_021128_01	target	2006-03-17	76	23:38:59.00	17280	y
Pacific	scan	2006-03-18	77	01:23:16.00	17282	y
Santarem_km83	target	2006-03-18	77	07:14:59.00	17285	y
Tunguragua_Ec	target	2006-03-18	77	08:50:26.00	17286	y
Ant_021206_02	target	2006-03-18	77	09:11:21.00	17286	y
SM_lidar_cal	target	2006-03-18	77	10:19:33.00	17287	y
Pacific	scan	2006-03-18	77	13:31:37.00	17289	y
Santarem_km83	target	2006-03-18	77	19:18:19.00	17292	y
Ant_041118_01	target	2006-03-18	77	20:37:29.00	17293	y
Upheaval_UT	target	2006-03-18	77	22:42:44.00	17295	y
Pacific	scan	2006-03-19	78	01:33:02.00	17297	y
MPL_Cove	target	2006-03-19	78	08:50:42.00	17301	n
Mt_St_Helens	target	2006-03-19	78	12:01:30.00	17303	n
Pacific	scan	2006-03-19	78	13:41:24.00	17304	y
Gr_030515_06	target	2006-03-19	78	18:13:09.00	17307	y
HSRL_Eureka	target	2006-03-19	78	19:50:32.00	17308	n
Ant_041118_04	target	2006-03-19	78	20:46:23.00	17308	y
North_Rim	target	2006-03-19	78	22:51:55.00	17310	y
Pacific	scan	2006-03-20	79	01:42:49.00	17312	y
Aeronet_kor	target	2006-03-20	79	06:55:13.00	17315	y

Manaus_Tower_Primary	target	2006-03-20	79	07:34:24.00	17315	y
Everglades_309	target	2006-03-20	79	09:03:01.00	17316	n
Pacific	scan	2006-03-20	79	13:51:11.00	17319	y
Mississippi_R	target	2006-03-20	79	21:24:05.00	17324	y
W_US_615_07	target	2006-03-20	79	23:01:01.00	17325	y
Pacific	scan	2006-03-21	80	01:52:35.00	17327	y
Gr_030514_01	target	2006-03-21	80	08:58:33.00	17331	y
Ant_021212_03	target	2006-03-21	80	09:40:39.00	17331	y
White_Sands	target	2006-03-21	80	10:48:05.00	17332	n
Pacific	scan	2006-03-21	80	14:00:57.00	17334	y
ATW	scan	2006-03-21	80	15:46:59.00	17335	y
Rondonia_2	target	2006-03-21	80	19:45:52.00	17337	y
MPL_Syowa	target	2006-03-22	81	00:08:38.00	17340	y
Pacific	scan	2006-03-22	81	02:02:22.00	17342	y
Gr_030514_03	target	2006-03-22	81	07:32:12.00	17345	y
HSRL_Eureka	target	2006-03-22	81	10:44:56.00	17347	y
Pacific	scan	2006-03-22	81	12:34:05.00	17348	y
Nyiragongo	target	2006-03-22	81	13:31:14.00	17348	y
Capitol_St_Forest	target	2006-03-22	81	23:24:06.00	17355	n
Pacific	scan	2006-03-23	82	00:35:30.00	17356	y
Scheveluch	target	2006-03-23	82	04:16:43.00	17358	y
Martell_Forest	target	2006-03-23	82	09:28:52.00	17361	y
North_Rim	target	2006-03-23	82	11:06:39.00	17362	y
Pacific	scan	2006-03-23	82	12:43:51.00	17363	y
Uyuni_360	target	2006-03-23	82	20:02:41.00	17367	n
MPL_Cove	target	2006-03-23	82	20:17:54.00	17368	n
Sumatra	target	2006-03-23	82	20:55:07.00	17368	n
Enc_RockSNA	target	2006-03-23	82	21:52:50.00	17369	n
Pacific	scan	2006-03-24	83	00:45:16.00	17371	y
Karymsky	target	2006-03-24	83	04:25:47.00	17373	n
Belem_2	target	2006-03-24	83	06:36:30.00	17374	n
Sumatra	target	2006-03-24	83	09:01:56.00	17376	n
Beaverhead_MT	target	2006-03-24	83	11:14:10.00	17377	y
Pacific	scan	2006-03-24	83	12:53:38.00	17378	y

Popigai_Crater	target	2006-03-24	83	20:46:45.00	17383	n
Sumatra	target	2006-03-24	83	21:04:36.00	17383	y
Pacific	scan	2006-03-25	84	00:55:04.00	17386	y
Tanguro_Br	target	2006-03-25	84	06:49:26.00	17389	y
Ant_041118_07	target	2006-03-25	84	07:05:28.00	17389	n
Ant_021204_01	target	2006-03-25	84	08:42:44.00	17390	n
Pacific	scan	2006-03-25	84	13:03:25.00	17393	y
Pacific	scan	2006-03-26	85	01:04:49.00	17401	y
Galeras_Colum	target	2006-03-26	85	08:32:03.00	17405	n
Ant_021206_02	target	2006-03-26	85	08:52:56.00	17405	n
Mexico_City	target	2006-03-26	85	10:03:50.00	17406	n
Pacific	scan	2006-03-26	85	13:13:11.00	17408	y
Araguainha_Br	target	2006-03-26	85	18:56:13.00	17411	y
Pacific	scan	2006-03-27	86	01:14:36.00	17416	y
Mt_St_Helens	target	2006-03-27	86	11:43:05.00	17422	y
Pacific	scan	2006-03-27	86	13:22:57.00	17423	y
ATW	scan	2006-03-27	86	15:08:59.00	17424	y
HSRL_Eureka	target	2006-03-27	86	19:32:07.00	17427	n
Ant_041118_04	target	2006-03-27	86	20:27:58.00	17427	n
Beaverhead_MT	target	2006-03-27	86	22:35:43.00	17429	n
Kilimanjaro	target	2006-03-28	87	00:49:29.00	17430	y
Pacific	scan	2006-03-28	87	01:24:22.00	17431	y

Table E.10 TOOs, Ocean and ATW Scans executed during Campaign L3f

* Possible pointing error of up to 350 meters due to bad FDS planning files

Location	Type	Date	DOY	Time	Rev Number	Set window Parameters
Beaverhead_MT	target	2006-05-24	144	20:46:03.00	18292	y
Kilimanjaro	target	2006-05-24	144	22:59:48.00	18293	y
Pacific	scan	2006-05-24	144	23:34:41.00	18294	y
Pacific	scan	2006-05-25	145	11:43:02.00	18301	y
Reunion_Isl	target	2006-05-25	145	21:37:49.00	18307	n
Pacific	scan	2006-05-25	145	23:44:29.00	18309	y
Rondonia_1	target	2006-05-26	146	05:37:58.00	18312	y
Ant_021212_03	target	2006-05-26	146	07:32:33.00	18313	n
White_Sands	target	2006-05-26	146	08:39:59.00	18314	y
Pacific	scan	2006-05-26	146	11:52:51.00	18316	y
ATW	scan	2006-05-26	146	13:39:53.00	18317	y
Bartlett	target	2006-05-26	146	17:52:11.00	18320	y
Santa_Ana_El_Sal	target	2006-05-26	146	19:20:42.00	18321	y
San_Bernardino	target	2006-05-26	146	21:02:49.00	18322	n
Pacific	scan	2006-05-26	146	23:54:17.00	18324	y
Rio_Blanco_1	target	2006-05-27	147	05:47:48.00	18327	y
Tennessee_1	target	2006-05-27	147	07:12:16.00	18328	y
Pacific	scan	2006-05-27	147	10:25:59.00	18330	y
Avachinsky	target	2006-05-27	147	15:10:47.00	18333	y
Sorin_1	target	2006-05-27	147	19:34:59.99	18336	n
Mt_St_Helens	target	2006-05-27	147	21:15:49.00	18337	y
Pacific	scan	2006-05-27	147	22:27:23.00	18338	y
HSRL_Eureka	target	2006-05-28	148	08:46:34.00	18344	y
Pacific	scan	2006-05-28	148	10:35:45.00	18345	y
Rio_Blanco_2	target	2006-05-28	148	17:57:06.00	18349	y
Haughton_NWT	target	2006-05-28	148	18:20:13.00	18350	y
SM_lidar_cal	target	2006-05-28	148	19:44:41.00	18351	y
N_San_Andreas	target	2006-05-28	148	21:23:39.00	18352	y
Pacific	scan	2006-05-28	148	22:37:10.00	18353	y
Augustine_AK	target	2006-05-28	148	23:05:49.00	18353	y
Naessat_2	target	2006-05-29	149	00:58:29.00	18354	y

Sumatra	target	2006-05-29	149	06:53:59.00	18358	n
W_US_615_10	target	2006-05-29	149	09:08:58.00	18359	y
Pacific	scan	2006-05-29	149	10:45:32.00	18360	y
MPL_Syowa	target	2006-05-29	149	11:24:28.00	18360	y
Naessat_1	target	2006-05-29	149	11:59:25.00	18360	y
Popigai_Crater	target	2006-05-29	149	18:38:40.00	18365	y
Pacific	scan	2006-05-29	149	22:46:57.00	18368	y
Aeronet_Cape_V	target	2006-05-30	150	02:56:43.00	18370	y
Ant_021204_01	target	2006-05-30	150	06:34:38.00	18372	y
Andaman_I_12	target	2006-05-30	150	07:04:39.00	18373	n
San_Bernardino	target	2006-05-30	150	09:18:39.00	18374	y
Pacific	scan	2006-05-30	150	10:55:19.00	18375	y
Andaman_I_19	target	2006-05-30	150	19:05:34.00	18380	n
Pacific	scan	2006-05-30	150	22:56:44.00	18383	y
Ant_021206_02	target	2006-05-31	151	06:44:51.00	18387	y
Marcel	target	2006-05-31	151	07:48:31.00	18388	y
Tahoe	target	2006-05-31	151	09:26:58.00	18389	y
Pacific	scan	2006-05-31	151	11:05:05.00	18390	y
Tanguro_Br	target	2006-05-31	151	16:49:07.00	18393	y
Tenn_2	target	2006-05-31	151	18:38:47.00	18395	n
Pacific	scan	2006-05-31	151	23:06:30.00	18398	y
Mission_Cr	target	2006-06-01	152	09:34:38.00	18404	y
Pacific	scan	2006-06-01	152	11:14:52.00	18405	y
HSRL_Eureka	target	2006-06-01	152	17:24:02.00	18409	y
Ant_041118_05	target	2006-06-01	152	18:20:09.00	18409	n
Martell	target	2006-06-01	152	18:49:51.00	18410	y
Barringer_Crater	target	2006-06-01	152	20:25:04.00	18411	y
Kilimanjaro	target	2006-06-01	152	22:41:24.00	18412	y
Pacific	scan	2006-06-01	152	23:16:17.00	18413	y
MPL_GSFC	target	2006-06-02	153	06:33:23.00	18417	y
Kilimanjaro	target	2006-06-02	153	10:44:43.00	18419	y
Pacific	scan	2006-06-02	153	11:24:38.00	18420	y
Gr_030515_06	target	2006-06-02	153	15:56:22.00	18423	y
Manaus_Tower_sec	target	2006-06-02	153	17:11:32.00	18423	y
Starr_Noxubee_MS	target	2006-06-02	153	18:57:42.00	18425	y

Pacific	scan	2006-06-02	153	23:26:03.00	18428	y
Aeronet_Asc_I	target	2006-06-03	154	02:05:47.00	18429	y
Rondonia_1	target	2006-06-03	154	05:19:33.00	18431	y
Ant_021212_03	target	2006-06-03	154	07:14:08.00	18432	y
Haughton_NWT	target	2006-06-03	154	08:09:56.00	18433	n
Amery_Rift	target	2006-06-03	154	09:00:03.00	18433	n
Pacific	scan	2006-06-03	154	11:34:24.00	18435	y
ATW	scan	2006-06-03	154	13:21:26.00	18436	y
Santa_Ana_ES	target	2006-06-03	154	19:02:18.00	18440	y
W_US_618_03	target	2006-06-03	154	20:44:40.00	18441	n
Pacific	scan	2006-06-03	154	23:35:50.00	18443	y
Popigai_Crater	target	2006-06-04	155	04:57:45.00	18446	y
Uyuni_85	target	2006-06-04	155	05:32:09.00	18446	n
Gr_030514_01	target	2006-06-04	155	06:41:45.00	18447	y
Tennessee_1A	target	2006-06-04	155	06:53:52.00	18447	y
Pakistan	target	2006-06-04	155	08:00:37.00	18448	n
Pacific	scan	2006-06-04	155	10:07:32.00	18449	y
Bonanza	target	2006-06-04	155	11:35:55.00	18450	n
Karymsky	target	2006-06-04	155	14:52:08.00	18452	n
Mt_St_Helens	target	2006-06-04	155	20:57:24.00	18456	y
Pacific	scan	2006-06-04	155	22:08:57.00	18457	y
Nyamuragira	target	2006-06-04	155	23:10:16.00	18457	n
Gr_030514_03	target	2006-06-05	156	05:15:24.00	18461	y
Rio_Blanco_2	target	2006-06-05	156	05:39:19.00	18461	y
Santa_Ana	target	2006-06-05	156	07:09:26.00	18462	y
Ant_021212_02	target	2006-06-05	156	07:33:33.00	18462	y
Upheaval_UT	target	2006-06-05	156	08:39:30.00	18463	y
Pacific	scan	2006-06-05	156	10:17:18.00	18464	y
Augustine_AK	target	2006-06-05	156	11:47:10.00	18465	n
Gr_030513_03	target	2006-06-05	156	14:48:34.00	18467	y
Haughton_NWT	target	2006-06-05	156	18:01:47.00	18469	n
N_San_Andreas	target	2006-06-05	156	21:05:14.00	18471	y
Pacific	scan	2006-06-05	156	22:18:43.00	18472	y
Bzymianny	target	2006-06-06	157	01:59:45.00	18474	n
Sumatra	target	2006-06-06	157	06:35:03.00	18476	n

Ant_021212_01	target	2006-06-06	157	07:43:17.00	18476	n
Pacific	scan	2006-06-06	157	08:50:25.00	18478	y
Belem_1	target	2006-06-06	157	16:14:17.00	18482	y
Aeronet_kor	target	2006-06-06	157	16:53:05.00	18483	y
Lef_site1	target	2006-06-06	157	18:04:14.00	18484	y
Mexico_City	target	2006-06-06	157	19:33:06.00	18485	y
Pacific	scan	2006-06-06	157	22:28:29.00	18487	y
Aeronet_Cape_V	target	2006-06-07	158	02:38:17.00	18489	y
Ant_041118_08	target	2006-06-07	158	04:38:51.00	18490	y
Ant_021206_03	target	2006-06-07	158	06:16:20.00	18491	y
Andaman_I	target	2006-06-07	158	06:47:48.00	18492	n
Railroad_Valley	target	2006-06-07	158	08:59:02.00	18493	y
Pacific	scan	2006-06-07	158	10:36:50.00	18494	y
GLEES	target	2006-06-07	158	19:48:44.00	18500	y
Pacific	scan	2006-06-07	158	22:38:15.00	18502	y
Gr_030515_02	target	2006-06-08	159	05:44:30.00	18506	n
Ant_021206_01	target	2006-06-08	159	06:26:26.00	18506	n
Pacific	scan	2006-06-08	159	10:46:36.00	18509	y
Ant_041118_06	target	2006-06-08	159	17:51:58.00	18513	n
White_Sands	target	2006-06-08	159	19:56:23.00	18515	y
Ant_021128_01	target	2006-06-08	159	21:03:46.00	18515	n
Pacific	scan	2006-06-08	159	22:48:01.00	18517	y
Rio_Tapajos	target	2006-06-09	160	04:39:40.00	18520	y
Enc_RockSNA	target	2006-06-09	160	07:44:06.00	18522	y
Mission_Creek	target	2006-06-09	160	09:16:12.00	18523	y
Alaska_163	target	2006-06-09	160	10:49:19.00	18524	y
Pacific	scan	2006-06-09	160	12:33:01.00	18525	y
Ant_041118_02	target	2006-06-09	160	18:01:59.00	18528	n
Martell_Forest	target	2006-06-09	160	18:31:25.00	18529	y
Pacific	scan	2006-06-09	160	22:57:47.00	18532	y
Colima_Mex	target	2006-06-10	161	07:56:49.00	18537	n
Pacific	scan	2006-06-10	161	09:29:29.00	18538	y
Alaska_178	target	2006-06-10	161	10:59:06.00	18539	n
Gr_030515_06	target	2006-06-10	161	15:37:56.00	18542	n
HSRL_Eureka	target	2006-06-10	161	17:15:19.00	18543	y

Ant_041118_03	target	2006-06-10	161	18:11:13.00	18543	n
Starr_Nox_MS	target	2006-06-10	161	18:39:17.00	18544	y
Bonneville	target	2006-06-10	161	20:17:56.00	18545	n
Pacific	scan	2006-06-10	161	23:07:37.00	18547	y
Aeronet_kor	target	2006-06-11	162	04:19:59.00	18550	y
Everglades	target	2006-06-11	162	06:27:50.00	18551	y
Haughton_NWT	target	2006-06-11	162	07:51:30.00	18552	y
Lefsky_site2	target	2006-06-11	162	09:35:06.00	18553	n
Pacific	scan	2006-06-11	162	11:15:59.00	18554	y
Gr_030515_01	target	2006-06-11	162	15:47:28.00	18557	n
MS_delta	target	2006-06-11	162	18:48:52.00	18559	y
W_US_615_01	target	2006-06-11	162	20:25:47.00	18560	n
Bonanza	target	2006-06-11	162	22:10:52.00	18561	y
Pacific	scan	2006-06-11	162	23:17:24.00	18562	y
Popigai_Crater	target	2006-06-12	163	04:39:20.00	18565	n
Ant_021204_03	target	2006-06-12	163	05:28:34.00	18565	n
Gr_030514_01	target	2006-06-12	163	06:23:20.00	18566	n
Pacific	scan	2006-06-12	163	11:25:45.00	18569	y
ATW	scan	2006-06-12	163	13:12:47.00	18570	y
Santa_Maria_Guat	target	2006-06-12	163	18:53:52.00	18574	y
Tahoe	target	2006-06-12	163	20:37:10.00	18575	y
MPL_Syowa	target	2006-06-12	163	21:33:26.00	18575	y
Pacific	scan	2006-06-12	163	21:50:31.00	18576	y
Gr_030514_03	target	2006-06-13	164	04:56:59.99	18580	n
Ant_021212_02	target	2006-06-13	164	07:15:08.00	18581	n
HSRL_Eureka	target	2006-06-13	164	08:09:44.00	18582	y
Reunion_I	target	2006-06-13	164	09:14:06.00	18582	y
Pacific	scan	2006-06-13	164	09:58:53.00	18583	y
Kebira_Crater	target	2006-06-13	164	11:03:03.00	18584	y
Gr_030513_03	target	2006-06-13	164	14:30:09.00	18586	n
Rio_Blanco_1	target	2006-06-13	164	17:20:26.00	18587	y
Haughton_NWT	target	2006-06-13	164	17:43:23.00	18588	y
Garcia	target	2006-06-13	164	20:46:46.00	18590	y
Pacific	scan	2006-06-13	164	22:00:18.00	18591	y
Scheveluch	target	2006-06-14	165	01:41:30.00	18593	y

Starr_Nox	target	2006-06-14	165	06:55:36.00	18596	n
Ant_021212_01	target	2006-06-14	165	07:24:54.00	18596	n
Aeronet_maldives	target	2006-06-14	165	07:54:02.00	18597	n
Pacific	scan	2006-06-14	165	10:08:40.00	18598	y
Aeronet_kor	target	2006-06-14	165	16:34:42.00	18602	y
Lascar	target	2006-06-14	165	17:26:31.00	18602	n
MPL_GSFC	target	2006-06-14	165	17:43:16.00	18603	n
Sumatra	target	2006-06-14	165	18:19:43.00	18603	n
Aeronet_maldives	target	2006-06-14	165	19:56:36.00	18604	y
Pacific	scan	2006-06-14	165	22:10:05.00	18606	y
Avachinsky	target	2006-06-15	166	01:50:23.00	18608	y
Hektoria	target	2006-06-15	166	04:30:38.00	18609	y
Ant_021206_03	target	2006-06-15	166	05:57:57.00	18610	n
Pacific	scan	2006-06-15	166	10:18:26.00	18613	y
Naessat_1	target	2006-06-15	166	11:32:18.00	18614	y
Pacific	scan	2006-06-15	166	22:19:52.00	18621	y
Pacific	scan	2006-06-16	167	10:28:13.00	18628	y
Everglades	target	2006-06-16	167	17:59:14.00	18633	y
Andaman_I	target	2006-06-16	167	18:37:01.00	18633	n
Colima_MX	target	2006-06-16	167	19:34:16.00	18634	y
Ant_021128_01	target	2006-06-16	167	20:45:22.00	18634	y
Pacific	scan	2006-06-16	167	22:29:38.00	18636	y
Santarem_km83	target	2006-06-17	168	05:45:23.00	18639	y
Bartlett	target	2006-06-17	168	05:56:49.00	18640	y
Ant_021206_02	target	2006-06-17	168	06:17:45.00	18640	y
SM_lidar_cal	target	2006-06-17	168	07:25:56.00	18641	y
Pacific	scan	2006-06-17	168	10:38:00.00	18643	y
Santarem_km83	target	2006-06-17	168	16:24:42.00	18646	y
Pacific	scan	2006-06-17	168	22:39:25.00	18651	y
BCI	target	2006-06-18	169	06:04:31.00	18655	y
Mt_St_Helens	target	2006-06-18	169	09:07:53.00	18657	y
Pacific	scan	2006-06-18	169	10:47:46.00	18658	y
Gr_030515_06*	target	2006-06-18	169	15:19:31.00	18661	y
HSRL_Eureka*	target	2006-06-18	169	16:56:54.00	18662	n
Ant_041118_04*	target	2006-06-18	169	17:52:45.00	18662	y

Pacific*	scan	2006-06-18	169	22:49:11.00	18666	y
Aeronet_kor*	target	2006-06-19	170	04:01:34.00	18669	y
Manaus*	target	2006-06-19	170	04:40:41.00	18669	y
Everglades_309*	target	2006-06-19	170	06:09:23.00	18670	n
Pacific*	scan	2006-06-19	170	10:57:33.00	18673	y
Mississippi_R	target	2006-06-19	170	18:30:28.00	18678	y
W_US_615_07	target	2006-06-19	170	20:07:24.00	18679	y
Pacific	scan	2006-06-19	170	22:58:58.00	18681	y
Gr_030514_01	target	2006-06-20	171	06:04:56.00	18685	y
Ant_021212_03	target	2006-06-20	171	06:47:01.00	18685	y
White_Sands	target	2006-06-20	171	07:54:27.00	18686	n
Pacific	scan	2006-06-20	171	11:07:20.00	18688	y
ATW	scan	2006-06-20	171	12:54:21.00	18689	y
Rondonia_1	target	2006-06-20	171	16:52:15.00	18691	y
Bartlett	target	2006-06-20	171	17:06:39.00	18692	n
Mission_Creek	target	2006-06-20	171	20:20:52.00	18694	y
MPL_Syowa	target	2006-06-20	171	21:15:01.00	18694	y
Pacific	scan	2006-06-20	171	23:08:45.00	18696	y
Gr_030514_03	target	2006-06-21	172	04:38:35.00	18699	y
Rio_Blanco_1	target	2006-06-21	172	05:02:16.00	18699	y
HSRL_Eureka	target	2006-06-21	172	07:51:19.00	18701	y
Pacific	scan	2006-06-21	172	09:40:27.00	18702	y
Nyiragongo	target	2006-06-21	172	10:37:37.00	18702	y
Capitol_St_Forest	target	2006-06-21	172	20:30:29.00	18709	n
Pacific	scan	2006-06-21	172	21:41:52.00	18710	y
Ituri_Lenda_1	target	2006-06-21	172	22:42:27.00	18710	y
Scheveluch	target	2006-06-22	173	01:23:05.00	18712	y
Luquillo	target	2006-06-22	173	05:04:30.00	18714	y
Martell_Forest	target	2006-06-22	173	06:35:15.00	18715	y
HSRL_Eureka	target	2006-06-22	173	08:01:02.00	18716	y
Pacific	scan	2006-06-22	173	09:50:14.00	18717	y
Uyuni_360	target	2006-06-22	173	17:09:04.00	18721	n
Sumatra	target	2006-06-22	173	18:01:30.00	18722	n
Pacific	scan	2006-06-22	173	21:51:39.00	18725	y
Karymsky	target	2006-06-23	174	01:32:09.00	18727	n

Belem_1	target	2006-06-23	174	03:42:52.00	18728	n
Sumatra	target	2006-06-23	174	06:08:19.00	18730	n
Bonneville	target	2006-06-23	174	08:21:34.00	18731	n
Pacific	scan	2006-06-23	174	10:00:00.00	18732	y
Naessat_1	target	2006-06-23	174	11:13:52.00	18733	n
Popigai_Crater	target	2006-06-23	174	17:53:08.00	18737	y
Sumatra	target	2006-06-23	174	18:10:59.00	18737	n
Pacific	scan	2006-06-23	174	22:01:26.00	18740	y
Tanguro_Br	target	2006-06-24	175	03:55:48.00	18743	y
Ant_041118_07	target	2006-06-24	175	04:11:50.00	18743	n
Ant_021204_01	target	2006-06-24	175	05:49:06.00	18744	n
Pacific	scan	2006-06-24	175	10:09:47.00	18747	y
Pacific	scan	2006-06-24	175	22:11:12.00	18755	y
Galeras_Colum	target	2006-06-25	176	05:38:25.00	18759	n
Ant_021206_02	target	2006-06-25	176	05:59:19.00	18759	n
Mexico_City	target	2006-06-25	176	07:10:12.00	18760	n
Pacific	scan	2006-06-25	176	10:19:33.00	18762	y
Pacific	scan	2006-06-25	176	22:20:58.00	18770	y
Pacific	scan	2006-06-26	177	10:29:20.00	18777	y
ATW	scan	2006-06-26	177	12:16:21.00	18778	y
HSRL_Eureka	target	2006-06-26	177	16:38:29.00	18781	y
Ant_041118_04	target	2006-06-26	177	17:34:20.00	18781	y

Table E.11 TOOs, Ocean and ATW Scans executed during Campaign L3g

Location	Type	Date	DOY	Time	Rev number	Set Window Parameters
Kilimanjaro	target	2006-10-25	298	18:05:52.00	20584	y
Pacific	scan	2006-10-25	298	18:40:46.00	20585	y
Manaus_5	target	2006-10-26	299	00:32:23.00	20588	y
Pacific	scan	2006-10-26	299	06:49:08.00	20592	y
Lefs_3	target	2006-10-26	299	12:49:25.00	20596	y
Reunion_Isl	target	2006-10-26	299	16:43:53.00	20598	y
Ft_Greely	target	2006-10-26	299	17:43:46.00	20599	y
Pacific	scan	2006-10-26	299	18:50:32.00	20600	y
Ant_021212_03	target	2006-10-27	300	02:38:37.00	20604	n
White_Sands	target	2006-10-27	300	03:46:03.00	20605	y
Pacific	scan	2006-10-27	300	06:58:54.00	20607	y
ATW	scan	2006-10-27	300	08:45:55.00	20608	y
Bern_1	target	2006-10-27	300	16:08:52.00	20613	n
Pacific	scan	2006-10-27	300	19:00:19.00	20615	y
Pasoh	target	2006-10-28	301	01:40:25.00	20619	y
Kamb_Ant	target	2006-10-28	301	02:50:15.00	20619	n
Pakis_1322	target	2006-10-28	301	03:25:21.00	20620	n
Pacific	scan	2006-10-28	301	05:32:01.00	20621	y
Avachinsky	target	2006-10-28	301	10:16:50.00	20624	y
Sori_1	target	2006-10-28	301	14:41:04.00	20627	n
Mt_St_Helens	target	2006-10-28	301	16:21:52.00	20628	y
Ituri_Lenda_2	target	2006-10-28	301	18:34:03.00	20629	n
Pacific	scan	2006-10-28	301	19:10:06.00	20630	y
Nanj_1	target	2006-10-29	302	00:18:39.00	20633	y
Luquillo_PR	target	2006-10-29	302	00:56:06.00	20633	y
Pacific	scan	2006-10-29	302	05:41:49.00	20636	y
Haughton_NWT	target	2006-10-29	302	13:26:17.00	20641	y
SM_lidar_cal	target	2006-10-29	302	14:50:44.00	20642	y
N_San_Andreas	target	2006-10-29	302	16:29:43.00	20643	y
Pacific	scan	2006-10-29	302	17:43:13.00	20644	y
Naes_3	target	2006-10-29	302	20:04:32.00	20645	y
Sumatra	target	2006-10-30	303	02:00:02.00	20649	n

W_US_615_10	target	2006-10-30	303	04:15:01.00	20650	y
Pacific	scan	2006-10-30	303	05:51:35.00	20651	y
Naes_1	target	2006-10-30	303	07:05:28.00	20652	y
Popigai_Crater	target	2006-10-30	303	13:44:43.00	20656	y
Pacific	scan	2006-10-30	303	17:53:00.00	20659	y
Andaman_I_12	target	2006-10-31	304	02:10:42.00	20664	n
Bern_1	target	2006-10-31	304	04:24:42.00	20665	y
Pacific	scan	2006-10-31	304	06:01:22.00	20666	y
Andaman_I_19	target	2006-10-31	304	14:11:37.00	20671	n
Niwo_rev	target	2006-10-31	304	15:12:54.00	20672	y
Pacific	scan	2006-10-31	304	18:02:46.00	20674	y
Ibiza	target	2006-10-31	304	20:29:57.00	20675	n
Ant_021206_02	target	2006-11-01	305	01:50:54.00	20678	y
Marc_1	target	2006-11-01	305	02:54:15.00	20679	y
Pacific	scan	2006-11-01	305	06:11:08.00	20681	y
Tang_1	target	2006-11-01	305	11:55:10.00	20684	y
Lamb_1	target	2006-11-01	305	12:45:47.00	20685	y
Tunguragua_Ecuador	target	2006-11-01	305	13:35:41.00	20686	y
Pacific	scan	2006-11-01	305	18:12:33.00	20689	y
Miss_1	target	2006-11-02	306	04:40:41.00	20695	y
Pacific	scan	2006-11-02	306	06:20:55.00	20696	y
HSRL_Eureka	target	2006-11-02	306	12:30:05.00	20700	y
Ant_041118_05	target	2006-11-02	306	13:26:12.00	20700	n
Martell	target	2006-11-02	306	13:55:53.00	20701	y
Barringer_Crater	target	2006-11-02	306	15:31:07.00	20702	y
Kilimanjaro	target	2006-11-02	306	17:47:27.00	20703	y
Pacific	scan	2006-11-02	306	18:22:19.00	20704	y
MPL_GSFC	target	2006-11-03	307	01:39:26.00	20708	y
Kilimanjaro	target	2006-11-03	307	05:50:46.00	20710	y
Pacific	scan	2006-11-03	307	06:30:41.00	20711	y
Lefs_3	target	2006-11-03	307	12:30:59.99	20715	y
Starr_Noxubee_MS	target	2006-11-03	307	14:03:45.00	20716	y
Aeronet_Crozet	target	2006-11-03	307	16:32:14.00	20717	y
Ft_Greely	target	2006-11-03	307	17:25:20.00	20718	y
Pacific	scan	2006-11-03	307	18:32:06.00	20719	y

Ant_021212_03	target	2006-11-04	308	02:20:11.00	20723	y
Haughton_NWT	target	2006-11-04	308	03:15:59.00	20724	n
Amery_Rift	target	2006-11-04	308	04:06:06.00	20724	n
Pacific	scan	2006-11-04	308	06:40:27.00	20726	y
Estartit	target	2006-11-04	308	07:49:17.00	20727	n
ATW	scan	2006-11-04	308	08:27:28.00	20728	y
Puerto_Rico	target	2006-11-04	308	12:32:52.00	20730	y
Santa_Ana_ES	target	2006-11-04	308	14:08:20.00	20731	y
W_US_618_03	target	2006-11-04	308	15:50:43.00	20732	n
Pacific	scan	2006-11-04	308	18:41:52.00	20734	y
Popigai_Crater	target	2006-11-05	309	00:03:48.00	20737	y
Uyuni_85	target	2006-11-05	309	00:38:12.00	20737	n
Tennessee_1	target	2006-11-05	309	01:59:54.00	20738	y
Pakis	target	2006-11-05	309	03:06:39.00	20739	n
Glee_1	target	2006-11-05	309	03:34:59.00	20739	y
Pacific	scan	2006-11-05	309	06:50:14.00	20741	y
Karymsky	target	2006-11-05	309	09:58:11.00	20743	n
Aeronet_Santa_Cruz	target	2006-11-05	309	12:32:58.00	20744	y
Pasoh	target	2006-11-05	309	13:25:11.00	20745	n
Tahoe_rev1	target	2006-11-05	309	16:01:40.00	20747	y
Pacific	scan	2006-11-05	309	17:14:59.00	20748	y
Nyamuragira	target	2006-11-05	309	18:16:19.00	20748	n
Santa_Ana	target	2006-11-06	310	02:15:29.00	20753	y
Ant_021212_02	target	2006-11-06	310	02:39:35.00	20753	y
Upheaval_UT	target	2006-11-06	310	03:45:33.00	20754	y
Pacific	scan	2006-11-06	310	05:23:21.00	20755	y
Augustine_AK	target	2006-11-06	310	06:53:13.00	20756	n
Gr_030513_03	target	2006-11-06	310	09:54:36.00	20758	y
TWP_Manus	target	2006-11-06	310	10:22:59.00	20758	y
Haughton_NWT	target	2006-11-06	310	13:07:50.00	20760	n
Mudu_1	target	2006-11-06	310	15:09:18.00	20761	y
Lefs_2	target	2006-11-06	310	16:14:11.00	20762	n
Pacific	scan	2006-11-06	310	17:24:46.00	20763	y
Bzymianny	target	2006-11-06	310	21:05:47.00	20765	n
Sumatra	target	2006-11-07	311	01:41:06.00	20768	n

Ant_021212_01	target	2006-11-07	311	02:49:20.00	20768	y
Pacific	scan	2006-11-07	311	05:33:08.00	20770	y
Belem_1	target	2006-11-07	311	11:20:19.00	20774	y
Aeronet_kor	target	2006-11-07	311	11:59:08.00	20774	y
Lefs_1	target	2006-11-07	311	13:10:17.00	20775	y
Doi_Inthanon	target	2006-11-07	311	13:40:35.00	20775	y
Mexico_City	target	2006-11-07	311	14:39:09.00	20776	y
Pacific	scan	2006-11-07	311	17:34:32.00	20778	y
Ant_041118_08	target	2006-11-07	311	23:44:54.00	20781	y
Ant_021206_03	target	2006-11-08	312	01:22:23.00	20782	y
Andaman_I	target	2006-11-08	312	01:53:51.00	20783	n
Railroad_Valley	target	2006-11-08	312	04:05:05.00	20784	y
Pacific	scan	2006-11-08	312	05:42:54.00	20785	y
Nanj_1	target	2006-11-08	312	12:12:44.00	20789	y
Popigai_Crater	target	2006-11-08	312	13:35:59.00	20790	y
Niwo_rev	target	2006-11-08	312	14:54:27.00	20791	y
Pacific	scan	2006-11-08	312	17:44:18.00	20793	y
Estartit	target	2006-11-08	312	20:10:38.00	20794	y
Gr_030515_02	target	2006-11-09	313	00:50:33.00	20797	n
Yasu_1	target	2006-11-09	313	01:12:03.00	20797	n
Ant_021206_01	target	2006-11-09	313	01:32:28.00	20797	n
Pacific	scan	2006-11-09	313	05:52:40.00	20800	y
Barrow	target	2006-11-09	313	07:19:16.00	20801	n
Ant_041118_06	target	2006-11-09	313	12:57:59.00	20804	n
White_Sands	target	2006-11-09	313	15:02:24.00	20806	y
Ant_021128_01	target	2006-11-09	313	16:09:47.00	20806	n
Pacific	scan	2006-11-09	313	17:54:05.00	20808	y
Rio_Tapajos	target	2006-11-09	313	23:45:42.00	20811	y
SGP_Central	target	2006-11-10	314	02:48:28.00	20813	y
Miss_1	target	2006-11-10	314	04:22:14.00	20814	y
Alaska_163	target	2006-11-10	314	05:55:20.00	20815	y
Pacific	scan	2006-11-10	314	07:39:05.00	20816	y
HSRL_Eureka	target	2006-11-10	314	12:11:37.00	20819	y
Ant_041118_02	target	2006-11-10	314	13:07:59.99	20819	n
Martell_Forest	target	2006-11-10	314	13:37:26.00	20820	y

Pacific	scan	2006-11-10	314	18:03:51.00	20823	y
Ply_rev	target	2006-11-11	315	01:21:49.00	20827	n
Colima_Mex	target	2006-11-11	315	03:02:50.00	20828	n
Pacific	scan	2006-11-11	315	04:35:33.00	20829	y
Alaska_178	target	2006-11-11	315	06:05:07.00	20830	n
Gr_030515_06	target	2006-11-11	315	10:43:57.00	20833	n
TWP_Darwin	target	2006-11-11	315	11:14:38.00	20833	y
Aeronet_guadaloupe	target	2006-11-11	315	12:04:05.00	20834	y
Ant_041118_03	target	2006-11-11	315	13:17:13.00	20834	n
Starr_Nox_MS	target	2006-11-11	315	13:45:18.00	20835	y
Bonneville	target	2006-11-11	315	15:23:57.00	20836	n
Pacific	scan	2006-11-11	315	18:13:37.00	20838	y
Aeronet_santa_cruz	target	2006-11-12	316	00:09:17.00	20841	n
Everglades	target	2006-11-12	316	01:33:50.00	20842	y
Haughton_NWT	target	2006-11-12	316	02:57:31.00	20843	y
Lefs_2	target	2006-11-12	316	04:41:06.00	20844	n
Pacific	scan	2006-11-12	316	06:21:58.00	20845	y
Aeronet_midway	target	2006-11-12	316	08:00:13.00	20846	y
Milmadiera	target	2006-11-12	316	12:02:41.00	20848	n
MS_delta	target	2006-11-12	316	13:54:52.00	20850	y
W_US_615_01	target	2006-11-12	316	15:31:47.00	20851	n
Pacific	scan	2006-11-12	316	18:23:23.00	20853	y
Popigai_Crater	target	2006-11-12	316	23:45:20.00	20856	n
Aeronet_guadaloupe	target	2006-11-13	317	00:09:55.00	20856	n
Ant_021204_03	target	2006-11-13	317	00:34:33.00	20856	n
Bukit_rev	target	2006-11-13	317	01:03:04.00	20857	y
Gr_030514_01	target	2006-11-13	317	01:29:20.00	20857	n
Glee_1	target	2006-11-13	317	03:16:31.00	20858	y
Pacific	scan	2006-11-13	317	06:31:45.00	20860	y
Ibiza	target	2006-11-13	317	07:39:43.00	20861	y
ATW	scan	2006-11-13	317	08:19:46.00	20862	y
Santa_Maria_Guat	target	2006-11-13	317	13:59:51.00	20865	y
Pacific	scan	2006-11-13	317	16:56:30.00	20867	y
Fushan	target	2006-11-13	317	23:42:27.00	20871	y
Gr_030514_03	target	2006-11-14	318	00:02:58.00	20871	y

HKK	target	2006-11-14	318	01:16:38.00	20872	y
Ant_021212_02	target	2006-11-14	318	02:21:07.00	20872	n
HSRL_Eureka	target	2006-11-14	318	03:15:43.00	20873	n
Reunion_I	target	2006-11-14	318	04:20:05.00	20873	y
Pacific	scan	2006-11-14	318	05:04:52.00	20874	y
Ituri_Edoro_2	target	2006-11-14	318	06:02:50.00	20875	n
Gr_030513_03	target	2006-11-14	318	09:36:08.00	20877	n
Haughton_NWT	target	2006-11-14	318	12:49:22.00	20879	y
SGP_Central	target	2006-11-14	318	14:15:28.00	20880	y
Pacific	scan	2006-11-14	318	17:06:17.00	20882	y
Scheveluch	target	2006-11-14	318	20:47:28.00	20884	y
Aeronet_Guam	target	2006-11-14	318	22:12:31.00	20885	n
Starr_Nox	target	2006-11-15	319	02:01:34.00	20887	n
Ant_021212_01	target	2006-11-15	319	02:30:51.00	20887	n
Grand_1	target	2006-11-15	319	03:37:24.00	20888	y
Pacific	scan	2006-11-15	319	05:14:38.00	20889	y
Aeronet_kor	target	2006-11-15	319	11:40:40.00	20893	y
Lascar	target	2006-11-15	319	12:32:28.00	20893	n
MPL_GSFC	target	2006-11-15	319	12:49:14.00	20894	n
Sumatra	target	2006-11-15	319	13:25:41.00	20894	n
Pacific	scan	2006-11-15	319	17:16:02.00	20897	y
Avachinsky	target	2006-11-15	319	20:56:20.00	20899	y
Ant_021206_03	target	2006-11-16	320	01:03:54.00	20901	y
Pacific	scan	2006-11-16	320	05:24:24.00	20904	y
Naes_1	target	2006-11-16	320	06:38:15.00	20905	y
Fushan	target	2006-11-16	320	11:53:32.00	20908	n
Popigai_Crater	target	2006-11-16	320	13:17:30.00	20909	n
Pacific	scan	2006-11-16	320	17:25:49.00	20912	y
Kebira_Crater	target	2006-11-16	320	18:20:09.00	20912	y
lEstartit	target	2006-11-16	320	19:52:09.00	20913	y
Ant_041118_07	target	2006-11-16	320	23:36:12.00	20915	y
Lefs_3	target	2006-11-17	321	00:40:35.00	20916	y
Ant_021206_01	target	2006-11-17	321	01:13:59.00	20916	y
Sori_1	target	2006-11-17	321	02:21:48.00	20917	y
Aeronet_crozet_isl	target	2006-11-17	321	04:42:36.00	20918	y

Pacific	scan	2006-11-17	321	05:34:10.00	20919	y
Barrow	target	2006-11-17	321	07:00:47.00	20920	y
Everglades	target	2006-11-17	321	13:05:10.00	20924	y
Andaman_I	target	2006-11-17	321	13:42:58.00	20924	n
Colima_MX	target	2006-11-17	321	14:40:12.00	20925	y
Ant_021128_01	target	2006-11-17	321	15:51:18.00	20925	y
Pacific	scan	2006-11-17	321	17:35:35.00	20927	y
Bart_nh_rev	target	2006-11-18	322	00:51:19.00	20931	y
Ant_021206_02	target	2006-11-18	322	01:23:40.00	20931	y
SM_lidar_cal	target	2006-11-18	322	02:31:52.00	20932	y
Taho_rev2	target	2006-11-18	322	04:05:49.00	20933	n
Pacific	scan	2006-11-18	322	05:43:56.00	20934	y
Araguainha_Br	target	2006-11-18	322	11:26:57.00	20937	y
Pacific	scan	2006-11-18	322	17:45:21.00	20942	y
BCI_1	target	2006-11-19	323	01:10:27.00	20946	y
Mt_St_Helens	target	2006-11-19	323	04:13:50.00	20948	y
Pacific	scan	2006-11-19	323	05:53:42.00	20949	y
HSRL_Eureka	target	2006-11-19	323	12:02:51.00	20953	n
Ant_041118_04	target	2006-11-19	323	12:58:42.00	20953	y
Grand_1	target	2006-11-19	323	15:04:14.00	20955	y
Pacific	scan	2006-11-19	323	17:55:08.00	20957	y
Aeronet_kor	target	2006-11-19	323	23:07:32.00	20960	y
Mana_5	target	2006-11-19	323	23:46:43.00	20960	y
Everglades_309	target	2006-11-20	324	01:15:20.00	20961	n
Pacific	scan	2006-11-20	324	06:03:30.00	20964	y
South_Snake3	target	2006-11-20	324	15:16:44.00	20970	y
Ft_Greely	target	2006-11-20	324	16:58:07.00	20971	y
Pacific	scan	2006-11-20	324	18:04:54.00	20972	y
TWP_Darwin	target	2006-11-20	324	23:04:14.00	20974	n
Lefs_1	target	2006-11-21	325	01:19:28.00	20976	n
Ant_021212_03	target	2006-11-21	325	01:52:57.00	20976	y
White_Sands	target	2006-11-21	325	03:00:23.00	20977	n
Pacific	scan	2006-11-21	325	06:13:16.00	20979	n
ATW	scan	2006-11-21	325	07:59:17.00	20980	y
Bart_nh_rev	target	2006-11-21	325	12:12:35.00	20983	n

Bukit_rev	target	2006-11-21	325	12:48:39.00	20983	n
Sinharaga	target	2006-11-21	325	14:23:57.00	20984	y
Miss_1	target	2006-11-21	325	15:26:48.00	20985	y
MPL_Syowa	target	2006-11-21	325	16:20:57.00	20985	y
Pacific	scan	2006-11-21	325	18:14:41.00	20987	y
Gr_030514_03	target	2006-11-21	325	23:44:31.00	20990	y
Mudu_1	target	2006-11-22	326	02:33:44.00	20992	y
Pacific	scan	2006-11-22	326	04:46:23.00	20993	y
Nyiragongo	target	2006-11-22	326	05:43:33.00	20993	y
Oregon	target	2006-11-22	326	15:35:34.00	21000	n
Pacific	scan	2006-11-22	326	16:47:48.00	21001	y
Ituri_Lenda_2	target	2006-11-22	326	17:48:23.00	21001	y
Scheveluch	target	2006-11-22	326	20:29:01.00	21003	y
TWP_Manus	target	2006-11-22	326	21:49:56.00	21003	y
Luquillo	target	2006-11-23	327	00:10:26.00	21005	y
Martell_Forest	target	2006-11-23	327	01:41:11.00	21006	y
Grand_1	target	2006-11-23	327	03:18:57.00	21007	y
Pacific	scan	2006-11-23	327	04:56:10.00	21008	y
Odra_river	target	2006-11-23	327	06:07:23.00	21009	y
Uyuni_360	target	2006-11-23	327	12:14:59.99	21012	n
Sumatra_361	target	2006-11-23	327	13:07:26.00	21013	n
Pacific	scan	2006-11-23	327	16:57:35.00	21016	y
Naes_3	target	2006-11-23	327	19:18:53.00	21017	y
Karymsky	target	2006-11-23	327	20:38:05.00	21018	n
Belem_3	target	2006-11-23	327	22:48:49.00	21019	n
Sumatra_369	target	2006-11-24	328	01:14:15.00	21021	n
Bonneville	target	2006-11-24	328	03:27:31.00	21022	n
Pacific	scan	2006-11-24	328	05:05:56.00	21023	y
Naes_1	target	2006-11-24	328	06:19:48.00	21024	n
Sumatra_376	target	2006-11-24	328	13:16:55.00	21028	n
Pacific	scan	2006-11-24	328	17:07:21.00	21031	y
Araguainha_Brazil	target	2006-11-24	328	23:02:45.00	21034	y
Ant_021204_01	target	2006-11-25	329	00:55:02.00	21035	n
Pacific	scan	2006-11-25	329	05:15:43.00	21038	y
Glee_1	target	2006-11-25	329	14:27:36.00	21044	y

Pacific	scan	2006-11-25	329	17:17:08.00	21046	y
Lamb_1	target	2006-11-25	329	23:57:33.00	21050	n
Galeras_Colum	target	2006-11-26	330	00:44:21.00	21050	n
Ant_021206_02	target	2006-11-26	330	01:05:15.00	21050	n
Mexico_City	target	2006-11-26	330	02:16:08.00	21051	n
Pacific	scan	2006-11-26	330	05:25:29.00	21053	y
Barrow	target	2006-11-26	330	06:52:04.00	21054	y
Tenn_1	target	2006-11-26	330	12:59:10.00	21058	y
Pacific	scan	2006-11-26	330	17:26:54.00	21061	y
Mt_St_Helens	target	2006-11-27	331	03:55:24.00	21067	y
Pacific	scan	2006-11-27	331	05:35:16.00	21068	y
ATW	scan	2006-11-27	331	07:21:17.00	21069	y
HSRL_Eureka	target	2006-11-27	331	11:44:25.00	21072	n
Ant_041118_04	target	2006-11-27	331	12:40:16.00	21072	n
Beaverhead_MT	target	2006-11-27	331	14:48:02.00	21074	n

Table E.12 TOOs, Ocean and ATW Scans executed during Campaign L3h

Location	Type	Date	DOY	Time	Rev Number	Set Window Paramters
Pacific	scan	2007-03-11	70	02:05:46.00	22615	y
Pacific	scan	2007-03-11	70	14:07:11.00	22623	y
Pacific	scan	2007-03-12	71	02:15:33.00	22630	y
Aberfoyle	target	2007-03-12	71	03:28:11.00	22631	y
La_Selva	target	2007-03-12	71	09:42:30.00	22635	y
Beaverhead_MT	target	2007-03-12	71	11:28:18.00	22636	y
Kilimanjaro	target	2007-03-12	71	13:42:04.00	22637	y
Pacific	scan	2007-03-12	71	14:16:58.00	22638	y
Mana_5	target	2007-03-12	71	20:08:34.00	22641	y
Pacific	scan	2007-03-13	72	02:25:19.00	22645	y
Mana_5	target	2007-03-13	72	08:12:07.00	22648	y
Reunion_Isl	target	2007-03-13	72	12:20:04.00	22651	n
Pacific	scan	2007-03-13	72	14:26:44.00	22653	y
Ant_021212_03	target	2007-03-13	72	22:14:48.00	22657	n
Sinharaga	target	2007-03-13	72	22:44:25.00	22658	n
White_Sands	target	2007-03-13	72	23:22:14.00	22658	y

Pacific	scan	2007-03-14	73	02:35:06.00	22660	y
ATW	scan	2007-03-14	73	04:24:07.00	22661	y
Santa_Ana_ES	target	2007-03-14	73	10:02:57.00	22665	y
Sinharaga	target	2007-03-14	73	10:45:48.00	22665	y
Pacific	scan	2007-03-14	73	14:36:31.00	22668	y
Pasoh	target	2007-03-14	73	21:16:37.00	22672	y
Mudu_1	target	2007-03-14	73	22:55:35.00	22673	y
Pacific	scan	2007-03-15	74	01:08:13.00	22674	y
For_Dean	target	2007-03-15	74	03:56:16.00	22676	y
Avachinsky	target	2007-03-15	74	05:53:02.00	22677	y
Mt_St_Helens	target	2007-03-15	74	11:58:04.00	22681	y
Ituri_Lenda_2	target	2007-03-15	74	14:10:14.00	22682	n
Pacific	scan	2007-03-15	74	14:46:17.00	22683	y
Nanj_1	target	2007-03-15	74	19:54:51.00	22686	y
Luquillo_PR	target	2007-03-15	74	20:32:18.00	22686	y
Wassatch_1337	target	2007-03-15	74	23:39:38.00	22688	n
Pacific	scan	2007-03-16	75	01:18:00.00	22689	y
Haughton_NWT	target	2007-03-16	75	09:02:28.00	22694	y
SM_lidar_cal	target	2007-03-16	75	10:26:56.00	22695	y
Pacific	scan	2007-03-16	75	13:19:25.00	22697	y
W_US_615_10	target	2007-03-16	75	23:51:12.00	22703	y
Pacific	scan	2007-03-17	76	01:27:46.00	22704	y
Popigai_Crater	target	2007-03-17	76	09:20:54.00	22709	y
Pacific	scan	2007-03-17	76	13:29:12.00	22712	y
Pacific	scan	2007-03-18	77	01:37:33.00	22719	y
Glees	target	2007-03-18	77	10:49:27.00	22725	y
Pacific	scan	2007-03-18	77	13:38:58.00	22727	y
Ibiza	target	2007-03-18	77	16:06:09.00	22728	n
Pacific	scan	2007-03-19	78	01:47:19.00	22734	y
Tang_1	target	2007-03-19	78	07:31:21.00	22737	y
Lamb_1	target	2007-03-19	78	08:21:58.00	22738	y
Tunguragua_Ec	target	2007-03-19	78	09:11:52.00	22739	y
Pacific	scan	2007-03-19	78	13:48:45.00	22742	y
Pacific	scan	2007-03-20	79	01:57:06.00	22749	y
Martell	target	2007-03-20	79	09:32:05.00	22754	y

Barringer_Crater	target	2007-03-20	79	11:07:18.00	22755	y
Kilimanjaro	target	2007-03-20	79	13:23:39.00	22756	y
Pacific	scan	2007-03-20	79	13:58:31.00	22757	y
For_of_Dean	target	2007-03-20	79	16:22:16.00	22758	y
Kilimanjaro	target	2007-03-21	80	01:26:57.00	22763	y
Pacific	scan	2007-03-21	80	02:06:52.00	22764	y
Starr_Noxubee_MS	target	2007-03-21	80	09:39:56.00	22769	y
Pacific	scan	2007-03-21	80	14:08:17.00	22772	y
La_Selva	target	2007-03-21	80	21:33:03.00	22776	y
Haughton_NWT	target	2007-03-21	80	22:52:10.00	22777	n
Pacific	scan	2007-03-22	81	02:16:39.00	22779	y
l_Estartit	target	2007-03-22	81	03:25:28.00	22780	n
ATW	scan	2007-03-22	81	04:01:40.00	22780	y
Puerto_Rico	target	2007-03-22	81	08:09:04.00	22783	y
Santa_Ana_ES	target	2007-03-22	81	09:44:32.00	22784	y
W_US_618_03	target	2007-03-22	81	11:26:54.00	22785	n
Pacific	scan	2007-03-22	81	14:18:04.00	22787	y
Korup_rev	target	2007-03-22	81	15:17:39.00	22787	n
Popigai_Crater	target	2007-03-22	81	19:40:00.00	22790	y
Uyuni_85	target	2007-03-22	81	20:14:24.00	22790	n
Glees	target	2007-03-22	81	23:11:10.00	22792	y
Pacific	scan	2007-03-23	82	02:26:25.00	22794	y
Kielder	target	2007-03-23	82	03:38:46.00	22795	y
Karymsky	target	2007-03-23	82	05:34:22.00	22796	n
Pasoh	target	2007-03-23	82	09:01:23.00	22798	n
Pacific	scan	2007-03-23	82	12:51:11.00	22801	y
Nyamuragira	target	2007-03-23	82	13:52:30.00	22801	n
Palanan	target	2007-03-23	82	19:35:03.00	22805	y
Lefs_12S	target	2007-03-23	82	20:22:10.00	22805	n
Santa_Ana_ES	target	2007-03-23	82	21:51:41.00	22806	y
Wassatch_edsc	target	2007-03-23	82	23:21:11.00	22807	n
Pacific	scan	2007-03-24	83	00:59:32.00	22808	y
TWP_Manus	target	2007-03-24	83	05:59:10.00	22811	y
Lefs_9S	target	2007-03-24	83	08:21:05.00	22812	y
Haughton_NWT	target	2007-03-24	83	08:44:02.00	22813	n

Mudu_1	target	2007-03-24	83	10:45:30.00	22814	y
Pacific	scan	2007-03-24	83	13:00:58.00	22816	y
Pacific	scan	2007-03-25	84	01:09:19.00	22823	y
Belem_1	target	2007-03-25	84	06:56:32.00	22826	y
Palanan	target	2007-03-25	84	07:40:32.00	22827	y
Doi_Inthanan	target	2007-03-25	84	09:16:47.00	22828	y
Mexico_City	target	2007-03-25	84	10:15:21.00	22829	y
Pacific	scan	2007-03-25	84	13:10:45.00	22831	y
TWP_Naru	target	2007-03-25	84	16:36:37.00	22832	y
W_US_618_06	target	2007-03-25	84	23:42:06.00	22837	y
Pacific	scan	2007-03-26	85	01:19:06.00	22838	y
Nanj_1	target	2007-03-26	85	07:48:57.00	22842	y
Popigai_Crater	target	2007-03-26	85	09:12:12.00	22843	y
Pacific	scan	2007-03-26	85	13:20:32.00	22846	y
l_Estartit	target	2007-03-26	85	15:46:51.00	22847	y
Yasu_1	target	2007-03-26	85	20:48:16.00	22850	n
Pacific	scan	2007-03-27	86	01:28:53.00	22853	y
White_Sands	target	2007-03-27	86	10:38:37.00	22859	y
Pacific	scan	2007-03-27	86	13:30:18.00	22861	y
Rio_Tapajos	target	2007-03-27	86	19:21:55.00	22864	y
SGP_Central	target	2007-03-27	86	22:24:41.00	22866	y
Alaska_163	target	2007-03-28	87	01:31:34.00	22868	y
Pacific	scan	2007-03-28	87	03:15:18.00	22869	y
Martell_Forest	target	2007-03-28	87	09:13:40.00	22873	y
Pacific	scan	2007-03-28	87	13:40:04.00	22876	y
Colima_Mex	target	2007-03-28	87	22:39:03.00	22881	n
Pacific	scan	2007-03-29	88	00:11:47.00	22882	y
Alaska_178	target	2007-03-29	88	01:41:20.00	22883	n
TWP_Darwin	target	2007-03-29	88	06:50:52.00	22886	y
HSRL_Eureka	target	2007-03-29	88	07:57:34.00	22887	y
Starr_Nox_MS	target	2007-03-29	88	09:21:32.00	22888	y
Bonneville	target	2007-03-29	88	11:00:28.00	22889	n
Pacific	scan	2007-03-29	88	13:49:51.00	22891	y
Kielder_Forest	target	2007-03-29	88	16:12:39.00	22892	y
Everglades_190	target	2007-03-29	88	21:10:04.00	22895	y

Haughton	target	2007-03-29	88	22:33:45.00	22896	y
Pacific	scan	2007-03-30	89	01:58:13.00	22898	y
Milmadiera	target	2007-03-30	89	07:38:55.00	22901	n
Mississippi_rev	target	2007-03-30	89	09:31:07.00	22903	y
W.US_615_01	target	2007-03-30	89	11:08:01.00	22904	n
Pacific	scan	2007-03-30	89	13:59:37.00	22906	y
Popigai_Crater	target	2007-03-30	89	19:21:35.00	22909	n
Bukit_rev	target	2007-03-30	89	20:39:18.00	22910	y
Glees	target	2007-03-30	89	22:52:46.00	22911	y
Mozamb_15	target	2007-03-31	90	01:23:49.00	22912	n
Pacific	scan	2007-03-31	90	02:07:59.00	22913	y
Ibiza	target	2007-03-31	90	03:12:58.00	22914	n
ATW	scan	2007-03-31	90	03:56:00.00	22914	y
Red_River_213	target	2007-03-31	90	09:45:11.00	22918	n
Frazier_R_214	target	2007-03-31	90	11:22:14.00	22919	y
Pacific	scan	2007-03-31	90	12:32:45.00	22920	y
Fushan	target	2007-03-31	90	19:18:42.00	22924	y
Lefs_9S	target	2007-03-31	90	20:02:56.00	22924	y
HKK	target	2007-03-31	90	20:52:53.00	22925	y
Belize	target	2007-03-31	90	21:32:16.00	22925	y
HSRL_Eureka	target	2007-03-31	90	22:51:58.00	22926	y
Reunion_I	target	2007-03-31	90	23:56:20.00	22926	y
Pacific	scan	2007-04-01	91	00:41:07.00	22927	y
Ituri_Edoro_2	target	2007-04-01	91	01:39:05.00	22928	n
Haughton_NWT	target	2007-04-01	91	08:25:37.00	22932	y
SGP_Central	target	2007-04-01	91	09:51:43.00	22933	y
Pacific	scan	2007-04-01	91	12:42:32.00	22935	y
Scheveluch	target	2007-04-01	91	16:23:44.00	22937	y
Starr_Nox_MS	target	2007-04-01	91	21:37:50.00	22940	n
Pacific	scan	2007-04-02	92	00:50:54.00	22942	y
Lefs_12S	target	2007-04-02	92	08:11:37.00	22946	n
MPL_GSFC	target	2007-04-02	92	08:25:29.00	22947	n
HKK	target	2007-04-02	92	08:59:07.00	22947	y
Pacific	scan	2007-04-02	92	12:52:18.00	22950	y
Avachinsky	target	2007-04-02	92	16:32:36.00	22952	y

Austral_Inj	target	2007-04-02	92	17:48:07.00	22952	n
Pacific	scan	2007-04-03	93	01:00:40.00	22957	y
Fushan	target	2007-04-03	93	07:29:48.00	22961	n
Popigai_Crater	target	2007-04-03	93	08:53:46.00	22962	n
Pacific	scan	2007-04-03	93	13:02:05.00	22965	y
Kebira_Crater	target	2007-04-03	93	13:56:26.00	22965	y
l_Estartit	target	2007-04-03	93	15:28:25.00	22966	y
Pacific	scan	2007-04-04	94	01:10:26.00	22972	y
Everglades_272	target	2007-04-04	94	08:41:26.00	22977	y
White_Sands	target	2007-04-04	94	10:20:12.00	22978	y
Pacific	scan	2007-04-04	94	13:11:51.00	22980	y
Aberfoyle	target	2007-04-04	94	15:34:22.00	22981	y
Tapa_8	target	2007-04-04	94	19:03:35.00	22983	y
Tunguragua	target	2007-04-04	94	20:39:01.00	22984	y
SM_lidar	target	2007-04-04	94	22:08:02.00	22985	y
Pacific	scan	2007-04-05	95	01:20:13.00	22987	y
Sant_1	target	2007-04-05	95	07:06:54.00	22990	y
Upheaval_UT	target	2007-04-05	95	10:31:19.00	22993	y
Pacific	scan	2007-04-05	95	13:21:38.00	22995	y
BCI_1	target	2007-04-05	95	20:46:44.00	22999	y
Mt_St_Helens	target	2007-04-05	95	23:50:06.00	23001	y
Pacific	scan	2007-04-06	96	01:29:59.00	23002	y
Aberfoyle	target	2007-04-06	96	02:42:36.00	23003	n
La_Selva	target	2007-04-06	96	08:56:55.00	23007	y
Mozamb_15	target	2007-04-06	96	13:00:46.00	23009	n
Pacific	scan	2007-04-06	96	13:31:24.00	23010	y
Kielder_For	target	2007-04-06	96	15:54:12.00	23011	y
Mana_5	target	2007-04-06	96	19:22:59.00	23013	y
Everglades_309	target	2007-04-06	96	20:51:36.00	23014	n
Pacific	scan	2007-04-07	97	01:39:46.00	23017	y
So_Snake_River	target	2007-04-07	97	10:53:00.00	23023	y
Pacific	scan	2007-04-07	97	13:41:10.00	23025	y
TWP_Darwin	target	2007-04-07	97	18:40:30.00	23027	n
White_Sands	target	2007-04-07	97	22:36:39.00	23030	n
Pacific	scan	2007-04-08	98	01:49:31.00	23032	y

ATW	scan	2007-04-08	98	03:37:33.00	23033	y
Bukit_rev	target	2007-04-08	98	08:24:55.00	23036	n
Sinharaga	target	2007-04-08	98	10:00:13.00	23037	y
Pacific	scan	2007-04-08	98	13:50:57.00	23040	y
Mudu_1	target	2007-04-08	98	22:09:59.99	23045	y
Pacific	scan	2007-04-09	99	00:22:39.00	23046	y
Nyiragongo	target	2007-04-09	99	01:19:49.00	23046	y
Pacific	scan	2007-04-09	99	12:24:05.00	23054	y
Ituri_Lenda_2	target	2007-04-09	99	13:24:40.00	23054	y
Scheveluch	target	2007-04-09	99	16:05:18.00	23056	y
TWP_Manus	target	2007-04-09	99	17:26:13.00	23056	y
Luquillo	target	2007-04-09	99	19:46:43.00	23058	y
Martell_Forest	target	2007-04-09	99	21:17:27.00	23059	y
Wassatch_355	target	2007-04-09	99	22:54:05.00	23060	n
Pacific	scan	2007-04-10	100	00:32:26.00	23061	y
Odra_River	target	2007-04-10	100	01:43:40.00	23062	y
Uyuni_360	target	2007-04-10	100	07:51:17.00	23065	y
Haughton_NWT	target	2007-04-10	100	08:16:54.00	23066	y
Pacific	scan	2007-04-10	100	12:33:52.00	23069	y
Karymsky	target	2007-04-10	100	16:14:22.00	23071	n
Belem_3	target	2007-04-10	100	18:25:06.00	23072	n
Bonneville	target	2007-04-10	100	23:03:48.00	23075	n
Pacific	scan	2007-04-11	101	00:42:13.00	23076	y
TWP_Nauru	target	2007-04-11	101	04:04:50.00	23078	y
Popigai_Crater	target	2007-04-11	101	08:35:21.00	23081	y
Pacific	scan	2007-04-11	101	12:43:39.00	23084	y
Araguainha_Brazil	target	2007-04-11	101	18:39:03.00	23087	y
Pacific	scan	2007-04-12	102	00:52:01.00	23091	y
Yasu_1	target	2007-04-12	102	08:15:59.99	23095	y
Glees	target	2007-04-12	102	10:03:54.00	23097	y
Pacific	scan	2007-04-12	102	12:53:25.00	23099	y
Aberfoyle	target	2007-04-12	102	15:15:58.00	23100	y
Lamb_1	target	2007-04-12	102	19:33:51.00	23103	n
Galeras_Columbia	target	2007-04-12	102	20:20:39.00	23103	n
Mexico_City	target	2007-04-12	102	21:52:26.00	23104	n

Pacific	scan	2007-04-13	103	01:01:47.00	23106	y
Lamb_1	target	2007-04-13	103	07:36:25.00	23110	y
Davis_Ind	target	2007-04-13	103	08:36:44.00	23111	y
Pacific	scan	2007-04-13	103	13:03:13.00	23114	y
Mt_St_Helens	target	2007-04-13	103	23:31:42.00	23120	y
Pacific	scan	2007-04-14	104	01:11:34.00	23121	y
Aberfoyle	target	2007-04-14	104	02:24:13.00	23122	y
ATW	scan	2007-04-14	104	02:59:35.00	23122	y

Table E.13 TOOs, Ocean and ATW Scans executed during Campaign L3i

Note: Times marked with * are not verified by the stored command log - the data was missing; Set window parameters denoted by * are not verified by the stored command log - the data was missing.

Location	Type	Date	DOY	Time	Rev Number	Set Window Parameters
La_Selva	target	2007-10-03	276	03:11:26.00	25685	y
Grand_1	target	2007-10-03	276	04:55:01.00	25686	y
Kilimanjaro	target	2007-10-03	276	07:10:59.00	25687	y
Pacific	scan	2007-10-03	276	07:45:53.00	25688	y
Forest_Dean	target	2007-10-03	276	10:09:37.00	25689	y
Mana_5	target	2007-10-03	276	13:37:30.00	25691	y
Pacific	scan	2007-10-03	276	19:54:14.00	25695	y
Mana_5	target	2007-10-04	277	01:41:02.00	25698	y
Reunion_I	target	2007-10-04	277	05:48:59.00	25701	n
Ft_Greely	target	2007-10-04	277	06:48:53.00	25702	y
Pacific	scan	2007-10-04	277	07:55:39.00	25703	y
Lefs_1	target	2007-10-04	277	15:10:13.00	25707	y
Sinharaga	target	2007-10-04	277	16:13:20.00	25708	n
White_Sands	target	2007-10-04	277	16:51:09.00	25708	y
Pacific	scan	2007-10-04	277	20:04:01.00	25710	y
ATW	scan	2007-10-04	277	21:51:03.00	25711	y
Santa_Ana_ES	target	2007-10-05	278	03:31:52.00	25715	y
Sinharaga	target	2007-10-05	278	04:14:43.00	25715	y
Bern_1	target	2007-10-05	278	05:13:59.00	25716	n
Pacific	scan	2007-10-05	278	08:05:26.00	25718	y
Pasoh	target	2007-10-05	278	14:45:32.00	25722	y
Mudu_1	target	2007-10-05	278	16:24:30.00	25723	y
Pacific	scan	2007-10-05	278	18:37:08.00	25724	y
Forest_Dean	target	2007-10-05	278	21:25:11.00	25726	y
Avachinsky	target	2007-10-05	278	23:21:57.00	25727	y
Sori_1	target	2007-10-06	279	03:46:10.00	25730	n
Mt_St_Helens	target	2007-10-06	279	05:26:59.00	25731	y
Lenda_1	target	2007-10-06	279	07:39:09.00	25732	n
Pacific	scan	2007-10-06	279	08:15:12.00	25733	y
Nanj_1	target	2007-10-06	279	13:23:46.00	25736	y

Luquillo_PR	target	2007-10-06	279	14:01:13.00	25736	y
Wassatch_1337	target	2007-10-06	279	17:08:33.00	25738	n
Pacific	scan	2007-10-06	279	18:46:55.00	25739	y
Haughton_NWT	target	2007-10-07	280	02:31:23.00	25744	y
Freeman	target	2007-10-07	280	03:55:51.00	25745	y
Pacific	scan	2007-10-07	280	06:48:20.00	25747	y
Naes_3_Dsc	target	2007-10-07	280	09:09:38.00	25748	y
W_US_615_10	target	2007-10-07	280	17:20:07.00	25753	y
Pacific	scan	2007-10-07	280	18:56:41.00	25754	y
Naes_1_Asc	target	2007-10-07	280	20:10:34.00	25755	y
Popigai_Crater	target	2007-10-08	281	02:49:49.00	25759	y
Pacific	scan	2007-10-08	281	06:58:07.00	25762	y
Bern_1	target	2007-10-08	281	17:29:48.00	25768	y
Pacific	scan	2007-10-08	281	19:06:28.00	25769	y
Niwo_rev_Asc	target	2007-10-09	282	04:17:59.99	25775	y
Pacific	scan	2007-10-09	282	07:07:53.00	25777	y
Ibiza	target	2007-10-09	282	09:35:03.00	25778	n
Pacific	scan	2007-10-09	282	19:16:14.00	25784	y
Tang_1	target	2007-10-10	283	01:00:16.00	25787	y
Lamb_1	target	2007-10-10	283	01:50:53.00	25788	y
Tenn_1	target	2007-10-10	283	02:49:56.00	25789	n
Pacific	scan	2007-10-10	283	07:17:40.00	25792	y
Miss_1	target	2007-10-10	283	17:45:47.00	25798	y
Pacific	scan	2007-10-10	283	19:26:01.00	25799	y
Mart_1	target	2007-10-11	284	03:01:00.00	25804	y
Barringer_Crater	target	2007-10-11	284	04:36:13.00	25805	y
Kilimanjaro	target	2007-10-11	284	06:52:33.00	25806	y
Pacific	scan	2007-10-11	284	07:27:26.00	25807	y
Forest_Dean	target	2007-10-11	284	09:51:11.00	25808	y
Kilimanjaro	target	2007-10-11	284	18:55:52.00	25813	y
Pacific	scan	2007-10-11	284	19:35:47.00	25814	y
Starr_Noxubee_MS	target	2007-10-12	285	03:08:51.00	25819	y
Pacific	scan	2007-10-12	285	07:37:12.00	25822	y
La_Selva	target	2007-10-12	285	15:01:57.00	25826	y
P_Baltoro_B4	target	2007-10-12	285	16:02:45.00	25827	y

Haughton_NWT	target	2007-10-12	285	16:21:05.00	25827	n
Pacific	scan	2007-10-12	285	19:45:33.00	25829	y
l_Estartit	target	2007-10-12	285	20:54:23.00	25830	n
ATW	scan	2007-10-12	285	21:33:36.00	25830	y
Luq_1	target	2007-10-13	286	01:37:58.00	25833	y
Santa_Ana_ES	target	2007-10-13	286	03:13:26.00	25834	y
W_US_618_03	target	2007-10-13	286	04:55:49.00	25835	n
Pacific	scan	2007-10-13	286	07:46:58.00	25837	y
Korup	target	2007-10-13	286	08:46:34.00	25837	y
Popigai_Crater	target	2007-10-13	286	13:08:54.00	25840	y
Uyuni_85	target	2007-10-13	286	13:43:18.00	25840	n
P_Astore_B1	target	2007-10-13	286	16:12:20.00	25842	y
Glee_1	target	2007-10-13	286	16:40:05.00	25842	y
Pacific	scan	2007-10-13	286	19:55:20.00	25844	y
Kielder	target	2007-10-13	286	21:07:40.00	25845	y
Karymsky	target	2007-10-13	286	23:03:17.00	25846	n
Pasoh	target	2007-10-14	287	02:30:17.00	25848	n
Mt_St_Helens	target	2007-10-14	287	05:08:32.00	25850	y
Pacific	scan	2007-10-14	287	06:20:06.00	25851	y
Nyamuragira	target	2007-10-14	287	07:21:25.00	25851	n
Palanan	target	2007-10-14	287	13:03:57.00	25855	y
Davis_IN	target	2007-10-14	287	15:13:30.00	25856	y
Wassatch_e	target	2007-10-14	287	16:50:06.00	25857	n
Pacific	scan	2007-10-14	287	18:28:27.00	25858	y
Augustine_AK	target	2007-10-14	287	19:58:19.00	25859	n
Haughton_NWT	target	2007-10-15	288	02:12:56.00	25863	n
Mudu_1	target	2007-10-15	288	04:14:24.00	25864	y
Lefs_2	target	2007-10-15	288	05:19:17.00	25865	n
Pacific	scan	2007-10-15	288	06:29:52.00	25866	y
Pacific	scan	2007-10-15	288	18:38:14.00	25873	y
Belem_1	target	2007-10-16	289	00:25:25.00	25876	y
Palanan	target	2007-10-16	289	01:09:26.00	25877	y
Lefs_1	target	2007-10-16	289	02:15:23.00	25878	y
Doi_Inthanan	target	2007-10-16	289	02:45:41.00	25878	y
Mexico_City	target	2007-10-16	289	03:44:15.00	25879	y

Pacific	scan	2007-10-16	289	06:39:38.00	25881	y
W_US_618_06	target	2007-10-16	289	17:11:00.00	25887	y
Pacific	scan	2007-10-16	289	18:48:00.00	25888	y
Nanj_1	target	2007-10-17	290	01:17:50.00	25892	y
Niwo_rev_asc	target	2007-10-17	290	03:59:33.00	25893	y
P_Batura_B3	target	2007-10-17	290	04:27:15.00	25894	y
Pacific	scan	2007-10-17	290	06:49:25.00	25896	y
l_Estartit	target	2007-10-17	290	09:15:44.00	25897	y
Yasu_1	target	2007-10-17	290	14:17:09.00	25900	n
Pacific	scan	2007-10-17	290	18:57:46.00	25903	y
White_Sands	target	2007-10-18	291	04:07:31.00	25909	y
Pacific	scan	2007-10-18	291	06:59:11.00	25911	y
Rio_Tapajos	target	2007-10-18	291	12:50:48.00	25914	y
Alaska_163	target	2007-10-18	291	19:00:26.00	25918	y
Pacific	scan	2007-10-18	291	20:44:11.00	25919	y
Mart_1	target	2007-10-19	292	02:42:33.00	25923	y
Pacific	scan	2007-10-19	292	07:08:57.00	25926	y
Ply_rev	target	2007-10-19	292	14:26:55.00	25930	y
Colima_Mex	target	2007-10-19	292	16:07:56.00	25931	n
Pacific	scan	2007-10-19	292	17:40:40.00	25932	y
Alaska_178	target	2007-10-19	292	19:10:13.00	25933	n
Starr_Nox_MS	target	2007-10-20	293	02:50:24.00	25938	y
Bonneville	target	2007-10-20	293	04:29:03.00	25939	n
Pacific	scan	2007-10-20	293	07:18:44.00	25941	y
Kielder_For	target	2007-10-20	293	09:41:31.00	25942	y
Everglades_190	target	2007-10-20	293	14:38:56.00	25945	y
Haughton_NWT	target	2007-10-20	293	16:02:37.00	25946	y
Lefs_2	target	2007-10-20	293	17:46:13.00	25947	n
Pacific	scan	2007-10-20	293	19:27:05.00	25948	y
Milmadiera	target	2007-10-21	294	01:07:47.00	25951	n
Mississippi_rev	target	2007-10-21	294	02:59:59.00	25953	y
W.US_615_01	target	2007-10-21	294	04:36:53.00	25954	n
Pacific	scan	2007-10-21	294	07:28:30.00	25956	y
Popigai_Crater	target	2007-10-21	294	12:50:27.00	25959	n
Bukit_rev	target	2007-10-21	294	14:08:10.00	25960	y

P_Batura_B3	target	2007-10-21	294	15:54:15.00	25961	n
Fras_rev_dsc	target	2007-10-21	294	16:21:59.99	25961	y
Mozamb_15	target	2007-10-21	294	18:52:41.00	25962	n
Pacific	scan	2007-10-21	294	19:36:51.00	25963	y
Ibiza	target	2007-10-21	294	20:44:50.00	25964	n
ATW	scan	2007-10-21	294	21:25:53.00	25964	y
Red_River_213	target	2007-10-22	295	03:14:03.00	25968	n
Frazier_Riv_214	target	2007-10-22	295	04:51:06.00	25969	y
Pacific	scan	2007-10-22	295	06:01:37.00	25970	y
Fushan	target	2007-10-22	295	12:47:33.00	25974	y
HKK	target	2007-10-22	295	14:21:45.00	25975	y
Davis_For	target	2007-10-22	295	14:55:03.00	25975	y
Reunion_I	target	2007-10-22	295	17:25:11.00	25976	y
Pacific	scan	2007-10-22	295	18:09:58.00	25977	y
Lenda2_asc	target	2007-10-22	295	19:07:52.00	25978	y
Haughton_NWT	target	2007-10-23	296	01:54:28.00	25982	y
Pacific	scan	2007-10-23	296	06:11:23.00	25985	y
Scheveluch	target	2007-10-23	296	09:52:35.00	25987	y
Starr_Nox_D_MS	target	2007-10-23	296	15:07*	25990	n*
Grand_1	target	2007-10-23	296	16:43*	25991	y*
Pacific	scan	2007-10-23	296	18:16*	25992	y*
Lascar	target	2007-10-24	297	01:38*	25996	n*
MPL_GSFC	target	2007-10-24	297	01:55*	25997	n*
HKK	target	2007-10-24	297	02:28*	25997	y*
Pacific	scan	2007-10-24	297	06:18*	26000	y*
Avachinsky	target	2007-10-24	297	10:02*	26002	y*
Austral_Inj	target	2007-10-24	297	11:17*	26002	n*
Pacific	scan	2007-10-24	297	18:29:31.00	26007	y
Naes_1	target	2007-10-24	297	19:43:21.00	26008	y
Fushan	target	2007-10-25	298	00:58:39.00	26011	n
Popigai_Crater	target	2007-10-25	298	02:22:37.00	26012	y
P_Mum_B5	target	2007-10-25	298	04:08:53.00	26013	y
Pacific	scan	2007-10-25	298	06:30:56.00	26015	y
Kebira_Crater	target	2007-10-25	298	07:25:16.00	26015	y
l_Estartit	target	2007-10-25	298	08:57:16.00	26016	y

Lefs_3	target	2007-10-25	298	13:45:42.00	26019	y
Sori_1	target	2007-10-25	298	15:26:55.00	26020	y
Pacific	scan	2007-10-25	298	18:39:17.00	26022	y
Everglades_272	target	2007-10-26	299	02:10:17.00	26027	y
White_Sands_D	target	2007-10-26	299	03:48:54.00	26028	y
Pacific	scan	2007-10-26	299	06:40:42.00	26030	y
Tapa_8	target	2007-10-26	299	12:32:25.00	26033	y
Bart_nh_rev	target	2007-10-26	299	13:56:26.00	26034	y
Freeman	target	2007-10-26	299	15:36:53.00	26035	y
Taho_rev2	target	2007-10-26	299	17:10:56.00	26036	n
Pacific	scan	2007-10-26	299	18:49:03.00	26037	y
Sant_1	target	2007-10-27	300	00:35:45.00	26040	y
Upheaval_UT	target	2007-10-27	300	04:00:10.00	26043	y
Hawaii	target	2007-10-27	300	07:08:30.00	26045	n
Pacific	scan	2007-10-27	300	08:27:07.00	26046	y
Sherman_D	target	2007-10-27	300	14:15:32.00	26049	n
Mt_St_Helens	target	2007-10-27	300	17:18:56.00	26051	y
Pacific	scan	2007-10-27	300	18:58:49.00	26052	y
La_Selva	target	2007-10-28	301	02:25:45.00	26057	y
Grand_1	target	2007-10-28	301	04:09:20.00	26058	y
Mozamb_15	target	2007-10-28	301	06:29:36.00	26059	n
Pacific	scan	2007-10-28	301	07:00:14.00	26060	y
Kielder_For	target	2007-10-28	301	09:23:02.00	26061	y
Mana_5	target	2007-10-28	301	12:51:49.00	26063	y
Everglades_309	target	2007-10-28	301	14:20:26.00	26064	n
Pacific	scan	2007-10-28	301	19:08:35.00	26067	y
Marc_1	target	2007-10-29	302	02:45:29.00	26072	y
Railroad_Valley	target	2007-10-29	302	04:19:42.00	26073	n
Ft_Greely	target	2007-10-29	302	06:03:13.00	26074	y
Pacific	scan	2007-10-29	302	07:10:00.00	26075	y
Lefs_1	target	2007-10-29	302	14:24:33.00	26079	n
P_Khurdopin	target	2007-10-29	302	15:35:39.00	26080	n
White_Sands	target	2007-10-29	302	16:05:29.00	26080	n
Pacific	scan	2007-10-29	302	19:18:21.00	26082	y
ATW	scan	2007-10-29	302	21:07:23.00	26083	y

Bart_nh_rev	target	2007-10-30	303	01:17:40.00	26086	n
Bukit_rev	target	2007-10-30	303	01:53:44.00	26086	n
Sinharaga	target	2007-10-30	303	03:29:02.00	26087	y
Miss_1	target	2007-10-30	303	04:31:53.00	26088	y
Pacific	scan	2007-10-30	303	07:19:46.00	26090	y
Mudu_1	target	2007-10-30	303	15:38:49.00	26095	y
Pacific	scan	2007-10-30	303	17:51:28.00	26096	y
Nyiragongo	target	2007-10-30	303	18:48:38.00	26096	y
Oregon_asc	target	2007-10-31	304	04:40:39.00	26103	n
Pacific	scan	2007-10-31	304	05:52:53.00	26104	y
Edora1	target	2007-10-31	304	06:53:24.00	26104	y
Scheveluch	target	2007-10-31	304	09:34:06.00	26106	y
Luquillo	target	2007-10-31	304	13:15:31.00	26108	y
Mart_1	target	2007-10-31	304	14:46:15.00	26109	y
Wassatch_355	target	2007-10-31	304	16:22:53.00	26110	n
Pacific	scan	2007-10-31	304	18:01:14.00	26111	y
Odra_River	target	2007-10-31	304	19:12:28.00	26112	y
Uyuni_360	target	2007-11-01	305	01:20:04.00	26115	n
Haughton_NWT	target	2007-11-01	305	01:45:41.00	26116	y
Pacific	scan	2007-11-01	305	06:02:39.00	26119	y
Naes_3_dsc	target	2007-11-01	305	08:23:56.00	26120	y
Karymsky	target	2007-11-01	305	09:43:09.00	26121	n
Belem_3_dsc	target	2007-11-01	305	11:53:53.00	26122	n
Bonneville	target	2007-11-01	305	16:32:34.00	26125	n
Pacific	scan	2007-11-01	305	18:11:00.00	26126	y
Naes_1_asc	target	2007-11-01	305	19:24:52.00	26127	n
Popigai_Crater	target	2007-11-02	306	02:04:07.00	26131	y
Pacific	scan	2007-11-02	306	06:12:25.00	26134	y
Araguainha_Brazil	target	2007-11-02	306	12:07:49.00	26137	y
Pacific	scan	2007-11-02	306	18:20:46.00	26141	y
Yasu_1	target	2007-11-03	307	01:44:45.00	26145	y
Glee_1	target	2007-11-03	307	03:32:39.00	26147	y
Pacific	scan	2007-11-03	307	06:22:11.00	26149	y
Lamb_1	target	2007-11-03	307	13:02:36.00	26153	n
Galeras	target	2007-11-03	307	13:49:24.00	26153	n

Mexico_City	target	2007-11-03	307	15:21:11.00	26154	n
Pacific	scan	2007-11-03	307	18:30:32.00	26156	y
Lamb_1	target	2007-11-04	308	01:05:09.00	26160	y
Davis	target	2007-11-04	308	02:05:29.00	26161	n
Pacific	scan	2007-11-04	308	06:31:57.00	26164	y
Mt_St_Helens	target	2007-11-04	308	17:00:26.00	26170	y
Pacific	scan	2007-11-04	308	18:40:18.00	26171	y

Table E.14 TOOs, Ocean and ATW Scans executed during Campaign L3j

Location	Type	Date	DOY	Time	Rev Number	Set Window Parameters
La_Selva	target	2008-02-17	48	22:47:33.00	27738	y
Grand_1	target	2008-02-18	49	00:31:08.00	27739	y
Kilimanjaro	target	2008-02-18	49	02:47:06.00	27740	y
Pacific	scan	2008-02-18	49	03:22:01.00	27741	y
Mana_5	target	2008-02-18	49	09:13:37.00	27744	y
Pacific	scan	2008-02-18	49	15:30:22.00	27748	y
Mana_5	target	2008-02-18	49	21:17:10.00	27751	y
Reunion_I	target	2008-02-19	50	01:25:07.00	27754	n
Ft_Greely	target	2008-02-19	50	02:24:59.99	27755	y
Pacific	scan	2008-02-19	50	03:31:47.00	27756	y
Kunming	target	2008-02-19	50	10:17:36.00	27760	y
Lefs_1	target	2008-02-19	50	10:46:21.00	27760	y
Sinharaga	target	2008-02-19	50	11:49:27.00	27761	n
White_Sands	target	2008-02-19	50	12:27:17.00	27761	y
Pacific	scan	2008-02-19	50	15:40:08.00	27763	y
Santa_Ana_ES	target	2008-02-19	50	23:07:59.00	27768	y
Sinharaga	target	2008-02-19	50	23:50:51.00	27768	y
Bern_1	target	2008-02-20	51	00:50:06.00	27769	n
Pacific	scan	2008-02-20	51	03:41:33.00	27771	y
Pasoh	target	2008-02-20	51	10:21:39.00	27775	y
Mudu_1	target	2008-02-20	51	12:00:37.00	27776	y
Pacific	scan	2008-02-20	51	14:13:16.00	27777	y
Avachinsky	target	2008-02-20	51	18:58:04.00	27780	y
Sori_1	target	2008-02-20	51	23:22:17.00	27783	n
Mt_St_Helens	target	2008-02-21	52	01:03:06.00	27784	y
Pacific	scan	2008-02-21	52	03:51:20.00	27786	y
Nanj_1	target	2008-02-21	52	08:59:53.00	27789	y
Luq_1	target	2008-02-21	52	09:37:20.00	27789	y
Tibet_Dagmo	target	2008-02-21	52	10:38:31.00	27790	n
HoosierNF	target	2008-02-21	52	11:08:25.00	27790	y
Wassatch_1337	target	2008-02-21	52	12:44:41.00	27791	n
Pacific	scan	2008-02-21	52	14:23:02.00	27792	y

Haughton_NWT	target	2008-02-21	52	22:07:30.00	27797	y
Freeman	target	2008-02-21	52	23:31:58.00	27798	y
Pacific	scan	2008-02-22	53	02:24:27.00	27800	y
Asnes	target	2008-02-22	53	04:45:45.00	27801	y
Pacific	scan	2008-02-22	53	05:37:45.00	27802	y
Atlantic	scan	2008-02-22	53	06:29:33.00	27802	y
W_US_615_10	target	2008-02-22	53	12:56:14.00	27807	y
Pacific	scan	2008-02-22	53	14:32:49.00	27802	y
Asnes	target	2008-02-22	53	15:46:41.00	27809	n
P_Baltoro_B4	target	2008-02-23	54	00:12:18.00	27813	n
Pacific	scan	2008-02-23	54	02:34:14.00	27815	y
Pacific	scan	2008-02-23	54	05:47:32.00	27817	y
Atlantic	target	2008-02-23	54	06:39:19.00	27817	y
Bern_1	target	2008-02-23	54	13:05:55.00	27821	y
Pacific	scan	2008-02-23	54	14:42:35.00	27822	y
Niwo_rev_Asc	target	2008-02-23	54	23:54:07.00	27828	y
Pacific	scan	2008-02-24	55	02:44:00.00	27830	y
Ibiza	target	2008-02-24	55	05:11:11.00	27831	n
Pacific	scan	2008-02-24	55	05:57:18.00	27832	y
Atlantic	scan	2008-02-24	55	06:49:06.00	27832	y
Palokangas	target	2008-02-24	55	14:30:09.00	27837	y
Pacific	scan	2008-02-24	55	14:52:21.00	27837	y
Tang_1	target	2008-02-24	55	20:36:23.00	27840	y
Lamb_1	target	2008-02-24	55	21:26:59.99	27841	y
BCI	target	2008-02-24	55	22:18:58.00	27842	y
Pacific	scan	2008-02-25	56	02:53:46.00	27845	y
Pacific	scan	2008-02-25	56	06:07:04.00	27846	n
Atlantic	scan	2008-02-25	56	06:58:52.00	27846	n
Miss_1	target	2008-02-25	56	13:21:54.00	27851	y
Pacific	scan	2008-02-25	56	15:02:08.00	27852	y
Mart_1	target	2008-02-25	56	22:37:06.00	27857	y
Barringer_Crater	target	2008-02-26	57	00:12:20.00	27858	y
Kilimanjaro	target	2008-02-26	57	02:28:40.00	27859	y
Pacific	scan	2008-02-26	57	03:03:33.00	27860	y
GSFC	target	2008-02-26	57	10:20:39.00	27864	y

Kilimanjaro	target	2008-02-26	57	14:31:59.00	27866	y
Pacific	scan	2008-02-26	57	15:11:54.00	27867	y
Lefs_3	target	2008-02-26	57	21:12:12.00	27871	y
Starr_Noxubee_MS	target	2008-02-26	57	22:44:58.00	27872	y
Pacific	scan	2008-02-27	58	03:13:19.00	27875	y
Heihe	target	2008-02-27	58	10:02:57.00	27879	y
La_Selva	target	2008-02-27	58	10:38:04.00	27879	y
Haughton_NWT	target	2008-02-27	58	11:57:11.00	27880	n
Pacific	scan	2008-02-27	58	15:21:40.00	27882	y
l_Estartit	target	2008-02-27	58	16:30:29.00	27883	n
Luq_1	target	2008-02-27	58	21:14:05.00	27886	y
W_US_618_03	target	2008-02-28	59	00:31:56.00	27888	y
Pacific	scan	2008-02-28	59	03:23:05.00	27890	y
Korup	target	2008-02-28	59	04:22:40.00	27890	y
Popigai_Crater	target	2008-02-28	59	08:45:01.00	27893	y
Uyuni_85	target	2008-02-28	59	09:19:25.00	27893	n
Tenn_1	target	2008-02-28	59	10:41:07.00	27894	y
Glee_1	target	2008-02-28	59	12:16:12.00	27895	y
Pacific	scan	2008-02-28	59	15:31:26.00	27897	y
Karymsky	target	2008-02-28	59	18:39:23.00	27899	n
Pasoh	target	2008-02-28	59	22:06:24.00	27901	n
Taho_rev1	target	2008-02-29	60	00:42:53.00	27903	y
Pacific	scan	2008-02-29	60	01:56:12.00	27904	y
Nyamuragira	target	2008-02-29	60	02:57:32.00	27904	n
Palanan	target	2008-02-29	60	08:40:04.00	27908	y
Santa_Ana_ES	target	2008-02-29	60	10:56:42.00	27909	y
Wassatch_e	target	2008-02-29	60	12:26:12.00	27910	n
Pacific	scan	2008-02-29	60	14:04:33.00	27911	y
Augustine_AK	target	2008-02-29	60	15:34:25.00	27912	n
Haughton_NWT	target	2008-02-29	60	21:49:03.00	27916	n
Kunming	target	2008-02-29	60	22:10:26.00	27916	n
Mudu_1	target	2008-02-29	60	23:50:31.00	27917	y
Lefs_2	target	2008-03-01	61	00:55:24.00	27918	n
Pacific	scan	2008-03-01	61	02:05:58.00	27919	y
Pacific	scan	2008-03-01	61	14:14:20.00	27926	y

Belem_1	target	2008-03-01	61	20:01:32.00	27929	y
Palanan	target	2008-03-01	61	20:45:32.00	27930	y
Lefs_1	target	2008-03-01	61	21:51:29.00	27931	y
Doi_Inthanan	target	2008-03-01	61	22:21:47.00	27931	y
Mexico_City	target	2008-03-01	61	23:20:21.00	27932	y
Pacific	scan	2008-03-02	62	02:15:45.00	27934	y
ATW -excl Antarctic	scan	2008-03-02	62	05:29:00.00	27935	Y
W_US_618_06	target	2008-03-02	62	12:47:06.00	27940	y
Pacific	scan	2008-03-02	62	14:24:06.00	27941	y
Nanj_1	target	2008-03-02	62	20:53:57.00	27945	y
Niwo_rev_asc	target	2008-03-02	62	23:35:39.00	27947	y
P_Batura_B3	target	2008-03-03	63	00:03:21.00	27947	y
Pacific	scan	2008-03-03	63	02:25:31.00	27949	y
Barc	target	2008-03-03	63	04:52:03.00	27950	y
ATW -excl Antarctic	scan	2008-03-02	63	05:38:46.00	27950	Y
Yasu_1	target	2008-03-03	63	09:53:15.00	27953	y
Palokangas	target	2008-03-03	63	14:11:41.00	27956	y
Pacific	scan	2008-03-03	63	14:33:53.00	27956	y
White_Sands	target	2008-03-03	63	23:43:37.00	27962	y
Pacific	scan	2008-03-04	64	02:35:18.00	27964	y
Pacific	scan	2008-03-04	64	05:48:36.00	27966	y
Atlantic	scan	2008-03-04	64	06:40:23.00	27966	n
Rio_Tapajos	target	2008-03-04	64	08:26:54.00	27967	y
Miss_1	target	2008-03-04	64	13:03:26.00	27970	y
Alaska_163	target	2008-03-04	64	14:36:33.00	27971	y
Pacific	scan	2008-03-04	64	16:20:18.00	27972	n
HoosierNF	target	2008-03-04	64	22:18:15.00	27976	y
Pacific	scan	2008-03-05	65	02:45:04.00	27979	y
Changbai	target	2008-03-05	65	07:59:04.00	27982	y
Ply_rev	target	2008-03-05	65	10:03:01.00	27983	n
Colima_Mex	target	2008-03-05	65	11:44:02.00	27984	n
Pacific	scan	2008-03-05	65	13:16:46.00	27985	y
Alaska_178	target	2008-03-05	65	14:46:19.00	27986	n
Bonneville	target	2008-03-06	66	00:05:09.00	27992	n
Pacific	scan	2008-03-06	66	02:54:50.00	27994	y

Everglades_190	target	2008-03-06	66	10:15:03.00	27998	y
Haughton_NWT	target	2008-03-06	66	11:38:44.00	27999	y
Lefs_2	target	2008-03-06	66	13:22:19.00	28000	y
Pacific	scan	2008-03-06	66	15:03:12.00	28001	y
Milmadiera	target	2008-03-06	66	20:43:54.00	28004	n
Mississippi_rev	target	2008-03-06	66	22:36:06.00	28006	y
W.US_615_01	target	2008-03-07	67	00:12:59.99	28007	n
Pacific	scan	2008-03-07	67	03:04:37.00	28009	y
Popigai_Crater	target	2008-03-07	67	08:26:34.00	28012	n
Bukit_rev	target	2008-03-07	67	09:44:17.00	28013	y
P_Batura_B3	target	2008-03-07	67	11:30:22.00	28014	n
Pacific	scan	2008-03-07	67	15:12:58.00	28016	y
Ibiza	target	2008-03-07	67	16:20:57.00	28017	n
Scheveluch	target	2008-03-07	67	18:20:13.00	28018	y
TSP	target	2008-03-07	67	21:40:48.00	28020	y
Red_River_213	target	2008-03-07	67	22:50:10.00	28021	n
Frazier_Riv_214	target	2008-03-08	68	00:27:13.00	28022	y
Pacific	scan	2008-03-08	68	01:37:44.00	28023	y
Fushan	target	2008-03-08	68	08:23:41.00	28027	y
HKK	target	2008-03-08	68	09:57:52.00	28028	y
Reunion_I	target	2008-03-08	68	13:01:19.00	28029	y
Pacific	scan	2008-03-08	68	13:46:06.00	28030	y
Kebira_Crater	target	2008-03-08	68	14:50:15.00	28031	y
Haughton_NWT	target	2008-03-08	68	21:30:36.00	28035	y
Pacific	scan	2008-03-09	69	01:47:31.00	28038	y
Scheveluch	target	2008-03-09	69	05:28:43.00	28040	y
Starr_Nox_D_MS	target	2008-03-09	69	10:42:49.00	28043	n
Grand_1	target	2008-03-09	69	12:18:38.00	28044	y
Pacific	scan	2008-03-09	69	13:55:53.00	28045	y
Changbai	target	2008-03-09	69	20:20:15.00	28049	y
Lascar	target	2008-03-09	69	21:13:43.00	28049	n
HKK	target	2008-03-09	69	22:04:06.00	28050	y
Pacific	scan	2008-03-10	70	01:57:17.00	28053	y
Avachinsky	target	2008-03-10	70	05:37:35.00	28055	y
Pacific	scan	2008-03-10	70	14:05:39.00	28060	y

Asnes	target	2008-03-10	70	15:19:29.00	28061	y
Fushan	target	2008-03-10	70	20:34:47.00	28064	n
Popigai_Crater	target	2008-03-10	70	21:58:45.00	28065	n
Pacific	scan	2008-03-11	71	02:07:04.00	28068	y
Kebira_Crater	target	2008-03-11	71	03:01:25.00	28068	y
l_Estartit	target	2008-03-11	71	04:33:25.00	28069	y
ATW -excl Antarctic	scan	2008-03-11	71	05:20:19.00	28069	y
Lefs_3	target	2008-03-11	71	09:21:50.00	28072	y
Sori_1	target	2008-03-11	71	11:03:04.00	28073	y
Pacific	scan	2008-03-11	71	14:15:26.00	28075	y
Everglades_272	target	2008-03-11	71	21:46:26.00	28080	y
Tibet_Dagmo	target	2008-03-11	71	22:19:57.00	28080	y
White_Sands_D	target	2008-03-11	71	23:25:03.00	28081	y
Pacific	scan	2008-03-12	72	02:16:51.00	28083	y
Palokangas	target	2008-03-12	72	03:00:53.00	28083	y
Pacific	scan	2008-03-12	72	05:30:09.00	28085	y
Atlantic	scan	2008-03-12	72	06:21:56.00	28085	y
Tapa_8	target	2008-03-12	72	08:08:34.00	28086	y
Bart_nh_rev	target	2008-03-12	72	09:32:35.00	28087	y
Freeman	target	2008-03-12	72	11:13:02.00	28088	y
Taho_rev2	target	2008-03-12	72	12:47:05.00	28089	n
Pacific	scan	2008-03-12	72	14:25:12.00	28090	y
Sant_1	target	2008-03-12	72	20:11:54.00	28093	y
Upheaval_UT	target	2008-03-12	72	23:36:19.00	28096	y
Hawaii	target	2008-03-13	73	02:44:39.00	28098	n
Pacific	scan	2008-03-13	73	04:03:16.00	28099	y
Changbai	target	2008-03-13	73	07:40:39.00	28101	y
TSP	target	2008-03-13	73	09:13:51.00	28102	y
Sherman_D	target	2008-03-13	73	09:51:41.00	28102	n
Mt_St_Helens	target	2008-03-13	73	12:55:05.00	28104	y
Pacific	scan	2008-03-13	73	14:34:58.00	28105	y
La_Selva	target	2008-03-13	73	22:01:55.00	28110	y
Grand_1	target	2008-03-13	73	23:45:30.00	28111	y
Pacific	scan	2008-03-14	74	02:36:23.00	28113	y
Mana_5	target	2008-03-14	74	08:27:59.00	28116	y

Pacific	scan	2008-03-14	74	14:44:45.00	28120	y
Chien_feng	target	2008-03-14	74	21:15:30.00	28124	y
Marc_1	target	2008-03-14	74	22:21:39.00	28125	y
Railroad_Valley	target	2008-03-14	74	23:55:52.00	28126	n
Ft_Greely	target	2008-03-15	75	01:39:23.00	28127	y
Pacific	scan	2008-03-15	75	02:46:10.00	28128	y
Lefs_1	target	2008-03-15	75	10:00:43.00	28132	n
P_Khurdopin	target	2008-03-15	75	11:11:49.00	28133	n
White_Sands	target	2008-03-15	75	11:41:39.00	28133	n
Pacific	scan	2008-03-15	75	14:54:31.00	28135	y
Barc	target	2008-03-15	75	16:03:09.00	28136	y
Scheveluch	target	2008-03-15	75	18:01:47.00	28137	y
Bart_nh_rev	target	2008-03-15	75	20:53:50.00	28139	n
Bukit_rev	target	2008-03-15	75	21:29:55.00	28139	n
Sinharaga	target	2008-03-15	75	23:05:13.00	28140	y
Miss_1	target	2008-03-16	76	00:08:04.00	28141	y
Pacific	scan	2008-03-16	76	02:55:56.00	28143	y
Mudu_1	target	2008-03-16	76	11:14:59.00	28148	y
Pacific	scan	2008-03-16	76	13:27:39.00	28149	y
Nyiragongo	target	2008-03-16	76	14:24:48.00	28149	y
Oregon_asc	target	2008-03-17	77	00:16:50.00	28156	n
Pacific	scan	2008-03-17	77	01:29:04.00	28157	y
Scheveluch	target	2008-03-17	77	05:10:17.00	28159	y
Luquillo	target	2008-03-17	77	08:51:42.00	28161	y
Mart_1	target	2008-03-17	77	10:22:26.00	28162	y
Wassatch_355	target	2008-03-17	77	11:59:04.00	28163	n
Pacific	scan	2008-03-17	77	13:37:25.00	28164	y
Odra_River	target	2008-03-17	77	14:48:39.00	28165	y
Changbai	target	2008-03-17	77	20:01:49.00	28168	y
Uyuni_360	target	2008-03-17	77	20:56:15.00	28168	n
Haughton_NWT	target	2008-03-17	77	21:21:53.00	28169	y
Pacific	scan	2008-03-18	78	01:38:50.00	28172	y
Asnes	target	2008-03-18	78	04:00:08.00	28173	y
Karymsky	target	2008-03-18	78	05:19:20.00	28174	n
Belem_3_dsc	target	2008-03-18	78	07:30:04.00	28175	n

Bonneville	target	2008-03-18	78	12:08:46.00	28178	n
Pacific	scan	2008-03-18	78	13:47:11.00	28179	y
Asnes	target	2008-03-18	78	15:01:03.00	28180	n
Popigai_Crater	target	2008-03-18	78	21:40:19.00	28184	y
P_Chakoti_B2	target	2008-03-18	78	23:26:37.00	28185	y
Pacific	scan	2008-03-19	79	01:48:37.00	28187	y
ATW -excl Antarctic	scan	2008-03-19	79	05:01:52.00	28188	Y
Araguainha	target	2008-03-19	79	07:44:00.00	28190	y
Pacific	scan	2008-03-19	79	13:56:58.00	28194	y
Yasu_1	target	2008-03-19	79	21:20:58.00	28198	y
Glee_1	target	2008-03-19	79	23:08:51.00	28200	y
Pacific	scan	2008-03-20	80	01:58:23.00	28202	y
Palokangas	target	2008-03-20	80	02:42:27.00	28202	y
ATW -excl Antarctic	scan	2008-03-20	80	05:14:38.00	28203	Y
Lamb_1	target	2008-03-20	80	08:38:48.00	28206	n
Galeras	target	2008-03-20	80	09:25:36.00	28206	n
Mexico_City	target	2008-03-20	80	10:57:23.00	28207	n
Pacific	scan	2008-03-20	80	14:06:44.00	28209	y
Lamb_1	target	2008-03-20	80	20:41:22.00	28213	y
Davis	target	2008-03-20	80	21:41:41.00	28214	n
Pacific	scan	2008-03-21	81	02:08:09.00	28217	y
Chien_feng	target	2008-03-21	81	08:52:28.00	28221	y
Mt_St_Helens	target	2008-03-21	81	12:36:39.00	28223	y
Pacific	scan	2008-03-21	81	14:16:31.00	28224	y

Table E.15 TOOs, Ocean and ATW Scans executed during Campaign L3k

Location	Type	Date	DOY	Time	Rev Number	Set Window Parameters
Kilimanjaro	target	2008-10-04	278	19:28:43.00	31162	y
Pacific	scan	2008-10-05	279	08:11:58.00	31170	y
Ven_Sim	target	2008-10-05	279	14:02:14.00	31174	y
Reunion_I	target	2008-10-05	279	18:06:44.00	31176	y
Pacific	scan	2008-10-05	279	20:13:24.00	31178	y
Slat_Htown	target	2008-10-06	280	03:33:01.00	31182	n
White_Sands	target	2008-10-06	280	05:08:54.00	31183	y
Pacific	scan	2008-10-06	280	08:21:45.00	31185	y
Barcelona	target	2008-10-06	280	09:30:24.00	31186	y
Santa_Ana_ES	target	2008-10-06	280	15:49:37.00	31190	y
Pacific	scan	2008-10-06	280	20:23:11.00	31193	y
Pacific	scan	2008-10-07	281	08:31:32.00	31200	y
Avachinsky	target	2008-10-07	281	11:39:41.00	31202	y
Sori_1	target	2008-10-07	281	16:03:55.00	31205	n
Mt_St_Helens	target	2008-10-07	281	17:44:43.00	31206	y
Pacific	scan	2008-10-07	281	18:56:18.00	31207	y
Nanj_1	target	2008-10-08	282	01:41:30.00	31211	y
Luq_1	target	2008-10-08	282	02:18:57.00	31211	y
Tibet_Dagmo	target	2008-10-08	282	03:20:08.00	31212	n
HoosierNF	target	2008-10-08	282	03:50:03.00	31212	y
Wassatch_1337	target	2008-10-08	282	05:26:18.00	31213	n
Pacific	scan	2008-10-08	282	07:04:40.00	31214	y
Haughton_NWT	target	2008-10-08	282	14:49:08.00	31219	y
Freeman	target	2008-10-08	282	16:13:35.00	31220	y
Pacific	scan	2008-10-08	282	19:06:05.00	31222	y
Asnes	target	2008-10-08	282	21:27:23.00	31223	y
ATW -excl Antarctic	scan	2008-10-08	282	22:19:21.00	31223	y
W_US_615_10	target	2008-10-09	283	05:37:52.00	31228	y
Pacific	scan	2008-10-09	283	07:14:26.00	31229	y
Asnes	target	2008-10-09	283	08:28:18.00	31230	y
P_Baltoro_B4	target	2008-10-09	283	16:53:56.00	31235	n
Pacific	scan	2008-10-09	283	19:15:51.00	31237	y

Pacific	scan	2008-10-10	284	07:24:13.00	31244	y
Niwo_rev_Asc	target	2008-10-10	284	16:35:45.00	31250	y
Pacific	scan	2008-10-10	284	19:25:38.00	31252	y
Barcelona	target	2008-10-10	284	21:52:09.00	31253	y
Marc_1	target	2008-10-11	285	04:17:06.00	31257	y
Palokangas	target	2008-10-11	285	07:11:47.00	31259	y
Pacific	scan	2008-10-11	285	07:33:59.00	31259	y
Tang_1	target	2008-10-11	285	13:18:01.00	31262	y
Lamb_1	target	2008-10-11	285	14:08:38.00	31263	y
Tunguragua_Ec	target	2008-10-11	285	14:58:32.00	31264	y
Pacific	scan	2008-10-11	285	19:35:25.00	31267	y
Miss_1	target	2008-10-12	286	06:03:32.00	31273	y
Pacific	scan	2008-10-12	286	07:43:46.00	31274	y
Mart_1	target	2008-10-12	286	15:18:45.00	31279	y
Barringer_Crater	target	2008-10-12	286	16:53:58.00	31280	y
Kilimanjaro	target	2008-10-12	286	19:10:18.00	31281	y
Pacific	scan	2008-10-12	286	19:45:11.00	31282	y
GSFC	target	2008-10-13	287	03:02:17.00	31286	y
Kilimanjaro	target	2008-10-13	287	07:13:37.00	31288	y
Pacific	scan	2008-10-13	287	07:53:32.00	31289	y
Amazon_4*	target	2008-10-13	287	13:40:24.00	31292	n
Starr_Noxubee_MS	target	2008-10-13	287	15:26:36.00	31294	y
Pacific	scan	2008-10-13	287	19:54:57.00	31297	y
Heihe	target	2008-10-14	288	02:44:35.00	31301	y
La_Selva	target	2008-10-14	288	03:19:42.00	31301	y
Haughton_NWT	target	2008-10-14	288	04:38:50.00	31302	n
Pacific	scan	2008-10-14	288	08:03:19.00	31304	y
l_Estartit	target	2008-10-14	288	09:12:08.00	31305	y
Luq_1	target	2008-10-14	288	13:55:44.00	31308	y
W_US_618_03	target	2008-10-14	288	17:13:34.00	31310	n
Mozamb_Sim	target	2008-10-14	288	19:23:33.00	31311	y
Pacific	scan	2008-10-14	288	20:04:44.00	31312	y
Korup	target	2008-10-14	288	21:04:19.00	31312	y
Popigai_Crater	target	2008-10-15	289	01:26:39.00	31315	y
Uyuni_85	target	2008-10-15	289	02:01:03.00	31315	n

Tenn_1	target	2008-10-15	289	03:22:45.00	31316	y
Glee_1	target	2008-10-15	289	04:57:50.00	31317	y
Pacific	scan	2008-10-15	289	08:13:05.00	31319	y
Karymsky	target	2008-10-15	289	11:21:02.00	31321	n
Pasoh	target	2008-10-15	289	14:48:02.00	31323	n
Taho_rev1	target	2008-10-15	289	17:24:31.00	31325	y
Pacific	scan	2008-10-15	289	18:37:51.00	31326	y
Nyamuragira	target	2008-10-15	289	19:39:10.00	31326	n
Palanan	target	2008-10-16	290	01:21:42.00	31330	y
Santa_Ana_ES	target	2008-10-16	290	03:38:21.00	31331	y
Wassatch_e	target	2008-10-16	290	05:07:51.00	31332	n
Pacific	scan	2008-10-16	290	06:46:12.00	31333	y
Augustine_AK	target	2008-10-16	290	08:16:04.00	31334	n
Haughton_NWT	target	2008-10-16	290	14:30:41.00	31338	n
Kunming	target	2008-10-16	290	14:52:05.00	31338	n
Mudu_1	target	2008-10-16	290	16:32:09.00	31339	y
Lefs_2	target	2008-10-16	290	17:37:02.00	31340	n
Pacific	scan	2008-10-16	290	18:47:37.00	31341	y
ATW -excl Antarctic	scan	2008-10-16	290	22:00:53.00	31342	y
Pacific	scan	2008-10-17	291	06:55:59.00	31348	y
Belem_1	target	2008-10-17	291	12:43:10.00	31351	y
Palanan	target	2008-10-17	291	13:27:11.00	31352	y
Lefs_1	target	2008-10-17	291	14:33:08.00	31353	y
Doi_Inthanan	target	2008-10-17	291	15:03:26.00	31353	y
Mexico_City	target	2008-10-17	291	16:02:00.00	31354	y
Pacific	scan	2008-10-17	291	18:57:24.00	31356	y
W_US_618_06	target	2008-10-18	292	05:28:45.00	31362	y
Pacific	scan	2008-10-18	292	07:05:45.00	31363	y
Nanj_1	target	2008-10-18	292	13:35:36.00	31367	y
Niwo_rev_asc	target	2008-10-18	292	16:17:18.00	31369	y
P_Batura_B3	target	2008-10-18	292	16:44:59.99	31369	y
Pacific	scan	2008-10-18	292	19:07:10.00	31371	y
Barcelona	target	2008-10-18	292	21:33:42.00	31372	y

Table E.16 TOOs, Ocean and ATW Scans executed during Campaign L2d

Note: Times marked with * are not verified by the stored command log - the data was missing; Set window parameters denoted by * are not verified by the stored command log - the data was missing.

Location	Type	Date	DOY	Time	Rev Number	Set Window Parameters
Wassatch_e	target	2008-11-26	331	03:49:33.00	31942	n
Pacific	scan	2008-11-26	331	05:27:54.00	31943	y
Haughton_NWT	target	2008-11-26	331	13:12:24.00	31948	n
Mudu_1	target	2008-11-26	331	15:13:52.00	31949	y
Lefs_2	target	2008-11-26	331	16:18:44.00	31950	n
Pacific	scan	2008-11-26	331	17:29:19.00	31951	y
ATW -excl Antarctic	scan	2008-11-26	331	20:42:34.00	31952	y
Pacific	scan	2008-11-27	332	05:37:40.00	31958	y
Lefs_1	target	2008-11-27	332	13:14:50.00	31963	y
Doi_Inthanan	target	2008-11-27	332	13:45:08.00	31963	y
Mexico_City	target	2008-11-27	332	14:43:42	31964	y
Pacific	scan	2008-11-27	332	17:39:05	31966	y
W_US_618_06	target	2008-11-28	333	04:10:27	31972	y
Pacific	scan	2008-11-28	333	05:47:26	31973	y
P_Batura_B3	target	2008-11-28	333	15:30*	31979	y*
Pacific	scan	2008-11-28	333	17:48*	31981	y*
Yasu_1	target	2008-11-29	334	01:20*	31985	n*
Sierra_Nevada	target	2008-11-29	334	04:20*	31987	n*
Palokangas	target	2008-11-29	334	06:53*	31988	y*
Pacific	scan	2008-11-29	334	7:33*	31989	y*
Slat_Htwn	target	2008-11-29	334	13:29:20.00	31993	y
White_Sands	target	2008-11-29	334	15:06:58.00	31994	y
Pacific	scan	2008-11-29	334	17:58:37.00	31996	y
Rio_Tapajos	target	2008-11-29	334	23:50:15.00	31999	y
Alaska_163	target	2008-11-30	335	05:59:54.00	32003	y
Pacific	scan	2008-11-30	335	07:43:37.00	32004	y
HoosierNF	target	2008-11-30	335	13:41:36.00	32008	y
Pacific	scan	2008-11-30	335	18:08:22.00	32011	y
Changbai	target	2008-11-30	335	23:22:25.00	32014	y

Ply_rev	target	2008-12-01	336	01:26:22.00	32015	y
Colima_Mex	target	2008-12-01	336	03:07:23.00	32016	n
Pacific	scan	2008-12-01	336	04:40:05.00	32017	y
Mozambique	target	2008-12-01	336	05:43:09.00	32018	y
Alaska_178	target	2008-12-01	336	06:09:40.00	32018	n
Bonneville	target	2008-12-01	336	15:28:30.00	32024	n
Pacific	scan	2008-12-01	336	18:18:11.00	32026	y
Haughton_NWT	target	2008-12-02	337	03:02:04.00	32031	y
Lefs_2	target	2008-12-02	337	04:45:40.00	32032	n
Pacific	scan	2008-12-02	337	06:26:32.00	32033	y
Milmadiera	target	2008-12-02	337	12:07:14.00	32036	n
Mississippi_rev	target	2008-12-02	337	13:59:26.00	32038	y
W.US_615_01	target	2008-12-02	337	15:36:20.00	32039	n
Pacific	scan	2008-12-02	337	18:27:57.00	32041	y
Venez_Sim	target	2008-12-03	338	00:16:08.00	32044	y
P_Batura_B3	target	2008-12-03	338	02:53:42.00	32046	n
Pacific	scan	2008-12-03	338	06:36:18.00	32048	y
Ibiza	target	2008-12-03	338	07:44:17.00	32049	n
Scheveluch	target	2008-12-03	338	09:43:33.00	32050	y
Red_River_213	target	2008-12-03	338	14:13:30.00	32053	n
Sierra_Nevada	target	2008-12-03	338	15:47:02.00	32054	n
Pacific	scan	2008-12-03	338	17:01:04.00	32055	y
HKK	target	2008-12-04	339	01:21:12.00	32060	y
Reunion_I	target	2008-12-04	339	04:24:38.00	32061	y
Pacific	scan	2008-12-04	339	05:09:25.00	32062	y
Kebira_Crater	target	2008-12-04	339	06:13:35.00	32063	y
Haughton_NWT	target	2008-12-04	339	12:53:55.00	32067	y
TAMU_Forest	target	2008-12-04	339	14:18:24.00	32068	y
Pacific	scan	2008-12-04	339	17:10:50.00	32070	y
Scheveluch	target	2008-12-04	339	20:52:02.00	32072	y
Starr_Nox	target	2008-12-05	340	02:06:08.00	32075	n
Pacific	scan	2008-12-05	340	05:19:12.00	32077	y
Lascar_Chile	target	2008-12-05	340	12:37:02.00	32081	n
GSFC	target	2008-12-05	340	12:53:48.00	32082	n
HKK	target	2008-12-05	340	13:27:44.00	32082	y

Pacific	scan	2008-12-05	340	17:20:36.00	32085	y
ATW -excl Antarctic	scan	2008-12-05	340	20:33:52.00	32086	y
Pacific	scan	2008-12-06	341	05:28:58.00	32092	y
Popigai_Crater	target	2008-12-06	341	13:22*	32097	y*
P_Chogo_B2	target	2008-12-06	341	15:09*	32098	n*
Pacific	scan	2008-12-06	341	17:30*	32100	y*
Kebira_Crater	target	2008-12-06	341	18:25*	32100	y*
l_Estartit	target	2008-12-06	341	19:57*	32101	y*
Lefs_3	target	2008-12-07	342	00:45*	32104	y*
Sori_1	target	2008-12-07	342	02:27*	32105	y*
Pacific	scan	2008-12-07	342	05:38*	32107	y*
Tibet_Dagmo	target	2008-12-07	342	13:43:15.00	32112	y
White_Sands_Array	target	2008-12-07	342	14:48:30.00	32113	y
Pacific	scan	2008-12-07	342	17:40:09.00	32115	y
Bart_nh_rev	target	2008-12-08	343	00:55:53.00	32119	y
Freeman	target	2008-12-08	343	02:36:20.00	32120	y
Taho_rev2	target	2008-12-08	343	04:10:23.00	32121	n
Pacific	scan	2008-12-08	343	05:48:30.00	32122	y
Sant_1	target	2008-12-08	343	11:35:12.00	32125	y
Pacific	scan	2008-12-08	343	17:49:55.00	32130	y
TSP	target	2008-12-09	344	00:37:09.00	32134	y
Sherman_D	target	2008-12-09	344	01:14:59.00	32134	n
Mt_St_Helens	target	2008-12-09	344	04:18:23.00	32136	y
Pacific	scan	2008-12-09	344	05:58:16.00	32137	y
La_Selva	target	2008-12-09	344	13:25:13.00	32142	y
Pacific	scan	2008-12-09	344	17:59:41.00	32145	y
ATW -excl Antarctic	scan	2008-12-09	344	21:12:55.00	32146	y
Mana_5	target	2008-12-09	344	23:51:16.00	32148	y
Pacific	scan	2008-12-10	345	06:08:02.00	32152	y
Venez_Sim	target	2008-12-10	345	11:58:16.00	32156	y
Railroad_Valley	target	2008-12-10	345	15:19:10.00	32158	n
Pacific	scan	2008-12-10	345	18:09:27.00	32160	y
Lefs_1	target	2008-12-11	346	01:23:59.99	32164	n
P_Khurdopin	target	2008-12-11	346	02:35:06.00	32165	n
White_Sands_Array	target	2008-12-11	346	03:04:56.00	32165	n

Pacific	scan	2008-12-11	346	06:17:48.00	32167	y
Barcelona	target	2008-12-11	346	07:26:26.00	32168	y
Bart_nh_rev	target	2008-12-11	346	12:17:07.00	32171	n
Bukit_rev	target	2008-12-11	346	12:53:12.00	32171	n
Miss_1	target	2008-12-11	346	15:31:21.00	32173	y
Pacific	scan	2008-12-11	346	18:19:13.00	32175	y
Pacific	scan	2008-12-12	347	04:50:55.00	32181	y
Nyiragongo	target	2008-12-12	347	05:48:05.00	32181	y
Oregon_asc	target	2008-12-12	347	15:40:06.00	32188	n
Pacific	scan	2008-12-12	347	16:52:20.00	32189	y
Scheveluch	target	2008-12-12	347	20:33:33.00	32191	y
Mart_1	target	2008-12-13	348	01:45:43.00	32194	y
Wassatch_355	target	2008-12-13	348	03:22:21.00	32195	n
Pacific	scan	2008-12-13	348	05:00:41.00	32196	y
Odra_River	target	2008-12-13	348	06:11:55.00	32197	y
Changbai	target	2008-12-13	348	11:25:06.00	32200	y
Uyuni_360	target	2008-12-13	348	12:19:31.00	32200	n
Pacific	scan	2008-12-13	348	17:02:06.00	32204	y
Asnes	target	2008-12-13	348	19:23:24.00	32205	y
ATW -excl Antarctic	scan	2008-12-13	348	20:15:22.00	32205	y
Belem_3_dsc	target	2008-12-13	348	22:53:20.00	32207	n
Bonneville	target	2008-12-14	349	03:32:02.00	32210	n
Pacific	scan	2008-12-14	349	05:10:27.00	32211	y
Asnes	target	2008-12-14	349	06:24:19.00	32212	n
Popigai_Crater	target	2008-12-14	349	13:03:35.00	32216	y
P_Chakoti_B2	target	2008-12-14	349	14:49:53.00	32217	y
Pacific	scan	2008-12-14	349	17:11:52.00	32219	y
Pacific	scan	2008-12-15	350	05:20:14.00	32226	y
Pacific	scan	2008-12-15	350	17:21:39.00	32234	y
Palokangas	target	2008-12-15	350	18:05:43.00	32234	y
ATW -excl Antarctic	scan	2008-12-15	350	20:34:54.00	32235	y
Lamb_1	target	2008-12-16	351	00:02:05.00	32238	n
Galeras	target	2008-12-16	351	00:48:53.00	32238	n
Mexico_City	target	2008-12-16	351	02:20:40.00	32239	n
Pacific	scan	2008-12-16	351	05:30:01.00	32241	y

Davis	target	2008-12-16	351	13:04:57.00	32246	n
Pacific	scan	2008-12-16	351	17:31:26.00	32249	y
Chien_feng	target	2008-12-17	352	00:15:45.00	32253	y
Pacific	scan	2008-12-17	352	05:39:47.00	32256	y
Beaverhead_MT	target	2008-12-17	352	14:52:33.00	32262	n

Table E.17 TOOs, Ocean and ATW Scans executed during Campaign L2e

Location	**Type**	**Date**	**DOY**	**Time**	**Rev Number**	**Set Window Parmeters**
Pacific	scan	2009-03-09	68	15:05:28.00	33484	y
Pacific	scan	2009-03-10	69	03:13:50.00	33491	y
Reunion_I	target	2009-03-10	69	13:08:35.00	33497	n
Pacific	scan	2009-03-10	69	15:15:14.00	33499	y
Slat_Htown	target	2009-03-10	69	22:34:52.00	33503	n
White_Sands	target	2009-03-11	70	00:10:45.00	33504	y
Pacific	scan	2009-03-11	70	03:23:36.00	33506	y
Barcelona	target	2009-03-11	70	04:32:14.00	33507	y
Bern_1	target	2009-03-11	70	12:33:34.00	33512	n
Pacific	scan	2009-03-11	70	15:25:01.00	33514	y
Pacific	scan	2009-03-12	71	03:33:23.00	33521	y
Avachinsky	target	2009-03-12	71	06:41:32.00	33523	y
Sori_1	target	2009-03-12	71	11:05:45.00	33526	n
Mt_St_Helens	target	2009-03-12	71	12:46:34.00	33527	y
Pacific	scan	2009-03-12	71	13:58:08.00	33528	y
Nanj_1	target	2009-03-12	71	20:43:21.00	33532	y
Luq_1	target	2009-03-12	71	21:20:48.00	33532	y
Tibet_Dagmo	target	2009-03-12	71	22:21:59.00	33533	n
HoosierNF	target	2009-03-12	71	22:51:53.00	33533	y
Wassatch_1337	target	2009-03-13	72	00:28:09.00	33534	n
Pacific	scan	2009-03-13	72	02:06:30.00	33535	y
Canencia	target	2009-03-13	72	04:51:40.00	33537	y
Pacific	scan	2009-03-13	72	14:07:55.00	33543	y
Asnes	target	2009-03-13	72	16:29:14.00	33544	y
ATW -excl Antarctic	scan	2009-03-13	72	17:21:11.00	33544	y

W_US_615_10	target	2009-03-14	73	00:39:42.00	33549	y
Pacific	scan	2009-03-14	73	02:16:17.00	33550	y
Asnes	target	2009-03-14	73	03:30:09.00	33551	y
Biospec_Torre	target	2009-03-14	73	05:01:10.00	33552	y
Pacific	scan	2009-03-14	73	14:17:41.00	33558	y
Pacific	scan	2009-03-15	74	02:26:03.00	33565	y
Niwo_rev_Asc	target	2009-03-15	74	11:37:35.00	33571	y
Pacific	scan	2009-03-15	74	14:27:28.00	33573	y
Barcelona	target	2009-03-15	74	16:53:59.00	33574	y
Marc_1	target	2009-03-15	74	23:18:56.00	33578	y
Palokangas	target	2009-03-16	75	02:13:37.00	33580	y
Pacific	scan	2009-03-16	75	02:35:49.00	33580	y
Tang_1	target	2009-03-16	75	08:19:51.00	33583	y
Lamb_1	target	2009-03-16	75	09:10:28.00	33584	y
Tunguragua_Ec	target	2009-03-16	75	10:00:22.00	33585	y
Pacific	scan	2009-03-16	75	14:37:14.00	33588	y
Miss_1	target	2009-03-17	76	01:05:22.00	33594	y
Pacific	scan	2009-03-17	76	02:45:36.00	33595	y
Barringer_Crater	target	2009-03-17	76	11:55:48.00	33601	y
Kilimanjaro	target	2009-03-17	76	14:12:08.00	33602	y
Pacific	scan	2009-03-17	76	14:47:00.00	33603	y
Canencia	target	2009-03-17	76	17:13:39.00	33604	y
GSFC	target	2009-03-17	76	22:04:07.00	33607	y
Kilimanjaro	target	2009-03-18	77	02:15:26.00	33609	y
Pacific	scan	2009-03-18	77	02:55:22.00	33610	y
Amazon_4*	target	2009-03-18	77	08:42:14.00	33614	n
Starr_Noxubee_MS	target	2009-03-18	77	10:28:26.00	33615	y
Pacific	scan	2009-03-18	77	14:56:47.00	33618	y
Heihe	target	2009-03-18	77	21:46:25.00	33622	y
Haughton_NWT	target	2009-03-18	77	23:40:40.00	33623	n
Pacific	scan	2009-03-19	78	03:05:08.00	33625	y
l_Estartit	target	2009-03-19	78	04:13:57.00	33626	n
Luq_1	target	2009-03-19	78	08:57:33.00	33629	y
W_US_618_03	target	2009-03-19	78	12:15:24.00	33631	n
Pacific	scan	2009-03-19	78	15:06:33.00	33633	y

Korup	target	2009-03-19	78	16:06:09.00	33633	y
Popigai_Crater	target	2009-03-19	78	20:28:29.00	33636	y
Uyuni_85	target	2009-03-19	78	21:02:53.00	33636	n
Pacific	scan	2009-03-20	79	03:14:55.00	33640	y
Karymsky	target	2009-03-20	79	06:22:52.00	33642	n
Pasoh	target	2009-03-20	79	09:49:52.00	33644	n
Pacific	scan	2009-03-20	79	13:39:40.00	33647	y
Nyamuragira	target	2009-03-20	79	14:41:00.00	33647	n
Palanan	target	2009-03-20	79	20:23:32.00	33651	y
Santa_Ana_ES	target	2009-03-20	79	22:40:10.00	33652	y
Wassatch_e	target	2009-03-21	80	00:09:41.00	33653	n
Pacific	scan	2009-03-21	80	01:48:02.00	33654	y
Augustine_AK	target	2009-03-21	80	03:17:54.00	33655	n
Haughton_NWT	target	2009-03-21	80	09:32:31.00	33659	n
Kunming	target	2009-03-21	80	09:53:55.00	33659	n
Mudu_1	target	2009-03-21	80	11:33:59.00	33660	y
Lefs_2	target	2009-03-21	80	12:38:52.00	33661	n
Pacific	scan	2009-03-21	80	13:49:26.00	33662	y
ATW -excl Antarctic	scan	2009-03-21	80	17:02:42.00	33663	y
Pacific	scan	2009-03-22	81	01:57:48.00	33669	y
Belem_1	target	2009-03-22	81	07:44:59.99	33672	y
Palanan	target	2009-03-22	81	08:29:01.00	33673	y
Lefs_1	target	2009-03-22	81	09:34:58.00	33674	y
Doi_Inthanan	target	2009-03-22	81	10:05:16.00	33674	y
Mexico_City	target	2009-03-22	81	11:03:50.00	33675	y
Pacific	scan	2009-03-22	81	13:59:13.00	33677	y
W_US_618_06	target	2009-03-23	82	00:30:35.00	33683	y
Pacific	scan	2009-03-23	82	02:07:35.00	33684	y
P_Batura_B3	target	2009-03-23	82	11:46:50.00	33690	y
Pacific	scan	2009-03-23	82	14:08:59.00	33692	y
Barcelona	target	2009-03-23	82	16:35:32.00	33693	y
Yasu_1	target	2009-03-23	82	21:36:44.00	33696	y
Sierra_Nevada	target	2009-03-24	83	00:39:56.00	33698	n
Palokangas	target	2009-03-24	83	01:55:09.00	33699	y
Pacific	scan	2009-03-24	83	02:17:21.00	33699	y

White_Sands	target	2009-03-24	83	11:27:05.00	33705	y
Pacific	scan	2009-03-24	83	14:18:46.00	33707	y
Rio_Tapajos	target	2009-03-24	83	20:10:23.00	33710	y
Alaska_163	target	2009-03-25	84	02:20:01.00	33714	y
Pacific	scan	2009-03-25	84	04:03:46.00	33715	y
HoosierNF	target	2009-03-25	84	10:01:44.00	33719	y
Pacific	scan	2009-03-25	84	14:28:32.00	33722	y
Ply_rev	target	2009-03-25	84	21:46:30.00	33726	n
Colima_Mex	target	2009-03-25	84	23:27:31.00	33727	n
Pacific	scan	2009-03-26	85	01:00:14.00	33728	y
Mozambique	target	2009-03-26	85	02:03:18.00	33729	n
Alaska_178	target	2009-03-26	85	02:29:48.00	33729	n
Bonneville	target	2009-03-26	85	11:48:39.00	33735	n
Pacific	scan	2009-03-26	85	14:38:18.00	33737	y
Haughton_NWT	target	2009-03-26	85	23:22:13.00	33742	y
Lefs_2	target	2009-03-27	86	01:05:48.00	33743	n
Pacific	scan	2009-03-27	86	02:46:40.00	33744	y
Milmadiera	target	2009-03-27	86	08:27:23.00	33747	n
Mississippi_rev	target	2009-03-27	86	10:19:35.00	33749	y
W.US_615_01	target	2009-03-27	86	11:56:29.00	33750	n
Pacific	scan	2009-03-27	86	14:48:04.00	33752	y
Venez_Sim	target	2009-03-27	86	20:36:16.00	33755	y
P_Batura_B3	target	2009-03-27	86	23:13:51.00	33757	n
Pacific	scan	2009-03-28	87	02:56:26.00	33759	y
Ibiza	target	2009-03-28	87	04:04:26.00	33760	n
Scheveluch	target	2009-03-28	87	06:03:42.00	33761	y
Red_River_213	target	2009-03-28	87	10:33:39.00	33764	n
Sierra_Nevada	target	2009-03-28	87	12:07:11.00	33765	n
Pacific	scan	2009-03-28	87	13:21:13.00	33766	y
HKK	target	2009-03-28	87	21:41:21.00	33771	y
Reunion_I	target	2009-03-29	88	00:44:48.00	33772	y
Pacific	scan	2009-03-29	88	01:29:34.00	33773	y
Kebira_Crater	target	2009-03-29	88	02:33:44.00	33774	y
Haughton_NWT	target	2009-03-29	88	09:14:05.00	33778	y
TAMU_Forest	target	2009-03-29	88	10:38:34.00	33779	y

Pacific	scan	2009-03-29	88	13:30:59.00	33781	y
Scheveluch	target	2009-03-29	88	17:12:12.00	33783	y
Starr_Nox	target	2009-03-29	88	22:26:18.00	33786	n
Pacific	scan	2009-03-30	89	01:39:21.00	33788	y
Lascar_Chile	target	2009-03-30	89	08:57:12.00	33792	n
GSFC	target	2009-03-30	89	09:13:57.00	33793	n
HKK	target	2009-03-30	89	09:47:34.00	33793	y
Pacific	scan	2009-03-30	89	13:40:46.00	33796	y
ATW -excl Antarctic	scan	2009-03-30	89	16:54:02.00	33797	y
Pacific	scan	2009-03-31	90	01:49:08.00	33803	y
Fushan	target	2009-03-31	90	08:18:16.00	33807	n
Popigai_Crater	target	2009-03-31	90	09:42:14.00	33808	n
P_Chogo_B2	target	2009-03-31	90	11:28:33.00	33809	n
Pacific	scan	2009-03-31	90	13:50:33.00	33811	y
Kebira_Crater	target	2009-03-31	90	14:44:54.00	33811	y
l_Estartit	target	2009-03-31	90	16:16:54.00	33812	y
Lefs_3	target	2009-03-31	90	21:05:19.00	33815	y
Sori_1	target	2009-03-31	90	22:46:33.00	33816	y
Pacific	scan	2009-04-01	91	01:58:54.00	33818	y
Tibet_Dagmo	target	2009-04-01	91	10:03:26.00	33823	y
White_Sands_D	target	2009-04-01	91	11:08:32.00	33824	y
Pacific	scan	2009-04-01	91	14:00:19.00	33826	y
Bart_nh_rev	target	2009-04-01	91	21:16:04.00	33830	y
Freeman	target	2009-04-01	91	22:56:30.00	33831	y
Taho_rev2	target	2009-04-02	92	00:30:34.00	33832	n
Pacific	scan	2009-04-02	92	02:08:41.00	33833	y
Sant_1	target	2009-04-02	92	07:55:23.00	33836	y
IN_ng	target	2009-04-02	92	09:43:23.00	33838	y
Upheaval_UT	target	2009-04-02	92	11:19:48.00	33839	y
Pacific	scan	2009-04-02	92	14:10:06.00	33841	y
TSP	target	2009-04-02	92	20:57:20.00	33845	y
Sherman_D	target	2009-04-02	92	21:35:10.00	33845	n
Mt_St_Helens	target	2009-04-03	93	00:38:34.00	33847	y
Pacific	scan	2009-04-03	93	02:18:27.00	33848	y
La_Selva	target	2009-04-03	93	09:45:24.00	33853	y

Grand_1	target	2009-04-03	93	11:28:59.00	33854	y
Pacific	scan	2009-04-03	93	14:19:52.00	33856	y
Biospec_ES	target	2009-04-03	93	16:46:47.00	33857	y
Mana_5	target	2009-04-03	93	20:11:28.00	33859	y
Pacific	scan	2009-04-04	94	02:28:14.00	33863	y
Venez_Sim	target	2009-04-04	94	08:18:28.00	33867	y
Railroad_Valley	target	2009-04-04	94	11:39:22.00	33869	n
Ft_Greely	target	2009-04-04	94	13:22:52.00	33870	y
Pacific	scan	2009-04-04	94	14:29:39.00	33871	y
Lefs_1	target	2009-04-04	94	21:44:12.00	33875	n
P_Khurdopin	target	2009-04-04	94	22:55:18.00	33876	n
White_Sands_Array	target	2009-04-04	94	23:25:08.00	33876	n
Pacific	scan	2009-04-05	95	02:38:00.00	33878	y
Barcelona	target	2009-04-05	95	03:46:38.00	33879	y
Bart_nh_rev	target	2009-04-05	95	08:37:19.00	33882	n
Bukit_rev	target	2009-04-05	95	09:13:23.00	33882	y
Miss_1	target	2009-04-05	95	11:51:33.00	33884	y
Pacific	scan	2009-04-05	95	14:39:25.00	33886	y
Pacific	scan	2009-04-06	96	01:11:08.00	33892	y
Nyiragongo	target	2009-04-06	96	02:08:17.00	33892	y
Oregon_asc	target	2009-04-06	96	12:00:19.00	33899	n
Pacific	scan	2009-04-06	96	13:12:33.00	33900	y
Scheveluch	target	2009-04-06	96	16:53:46.00	33902	y
Mart_1	target	2009-04-06	96	22:05:55.00	33905	y
Wassatch_355	target	2009-04-06	96	23:42:33.00	33906	n
Pacific	scan	2009-04-07	97	01:20:54.00	33907	y
Odra_River	target	2009-04-07	97	02:32:08.00	33908	y
Canencia	target	2009-04-07	97	04:06:04.00	33909	n
Changbai	target	2009-04-07	97	07:45:18.00	33911	y
Uyuni_360	target	2009-04-07	97	08:39:44.00	33911	n
Pacific	scan	2009-04-07	97	13:22:19.00	33915	y
Asnes	target	2009-04-07	97	15:43:37.00	33916	y
ATW -excl Antarctic	scan	2009-04-07	97	16:35:35.00	33916	y
Belem_3_dsc	target	2009-04-07	97	19:13:33.00	33918	n
Bonneville	target	2009-04-07	97	23:52:15.00	33921	n

Pacific	scan	2009-04-08	98	01:30:40.00	33922	y
Asnes	target	2009-04-08	98	02:44:32.00	33923	n
Popigai_Crater	target	2009-04-08	98	09:23:48.00	33927	y
P_Chakoti_B2	target	2009-04-08	98	11:10:06.00	33928	y
Pacific	scan	2009-04-08	98	13:32:06.00	33930	y
Pacific	scan	2009-04-09	99	01:40:27.00	33937	y
Pacific	scan	2009-04-09	99	13:41:52.00	33945	y
Palokangas	target	2009-04-09	99	14:25:56.00	33945	y
Lamb_1	target	2009-04-09	99	20:22:18.00	33949	n
Galeras	target	2009-04-09	99	21:09:05.00	33949	n
Mexico_City	target	2009-04-09	99	22:40:53.00	33950	n
Pacific	scan	2009-04-10	100	01:50:13.00	33952	y
Davis	target	2009-04-10	100	09:25:10.00	33957	n
Pacific	scan	2009-04-10	100	13:51:38.00	33960	y
Chien_feng	target	2009-04-10	100	20:35:58.00	33964	y
Pacific	scan	2009-04-11	101	02:00:00.00	33967	y
Beaverhead_MT	target	2009-04-11	101	11:12:46.00	33973	n
Test_TOO	target	2009-04-11	101	14:13:43.00	33975	n

Table E.18 TOOs, Ocean and ATW Scans executed during Campaign L2f

Location	Type	Date	DOY	Time	Rev Number	Set Window Parameters
Pacific	scan	2009-10-01	274	08:32:26.15	36549	y
Pacific	scan	2009-10-01	274	20:40:47.88	36556	y
Reunion_I	target	2009-10-02	275	06:35:32.00	36562	y
Pacific	scan	2009-10-02	275	08:42:12.23	36564	y
Slat_Htown	target	2009-10-02	275	16:01:49.00	36568	n
White_Sands	target	2009-10-02	275	17:37:42.00	36569	y
Pacific	scan	2009-10-02	275	20:50:33.96	36571	y
Barcelona	target	2009-10-02	275	21:59:11.00	36572	n
Pacific	scan	2009-10-03	276	08:51:58.71	36579	y
Pacific	scan	2009-10-03	276	21:00:20.59	36586	y
Sori_1	target	2009-10-04	277	04:32:42.00	36591	n
Pacific	scan	2009-10-04	277	07:25:05.69	36593	y
Luq_1	target	2009-10-04	277	14:47:45.00	36597	y

Tibet_Dagmo	target	2009-10-04	277	15:48:56.00	36598	n
Wassatch_1337	target	2009-10-04	277	17:55:05.00	36599	n
Pacific	scan	2009-10-04	277	19:33:27.24	36600	y
Pacific	scan	2009-10-05	278	07:34:51.62	36608	y
ATW -excl Antarctic	scan	2009-10-05	278	10:48:07.95	36609	y
W_US_615_10	target	2009-10-05	278	18:06:39.00	36614	y
Pacific	scan	2009-10-05	278	19:43:13.47	36615	y
Pacific	scan	2009-10-06	279	07:44:38.05	36623	y
Pacific	scan	2009-10-06	279	19:52:59.87	36625	y
Pacific	scan	2009-10-07	280	07:54:24.07	36638	y
Ibiza	target	2009-10-07	280	10:21:36.00	36639	n
Marc_1	target	2009-10-07	280	16:45:53.00	36643	y
Pacific	scan	2009-10-07	280	20:02:46.86	36645	y
Tang_1	target	2009-10-08	281	01:46:48.00	36648	y
Pacific	scan	2009-10-08	281	08:04:11.78	36653	y
Pacific	scan	2009-10-08	281	20:12:33.68	36660	y
Pacific	scan	2009-10-09	282	08:13:58.07	36668	y
GSFC	target	2009-10-09	282	15:31:04.00	36672	y
Pacific	scan	2009-10-09	282	20:22:19.91	36675	y
Starr_Noxubee_MS	target	2009-10-10	283	03:55:23.00	36680	y
Pacific	scan	2009-10-10	283	08:23:44.63	36683	y
Haughton_NWT	target	2009-10-10	283	17:07:37.00	36688	n
Pacific	scan	2009-10-10	283	20:32:06.51	36690	y
l_Estartit	target	2009-10-10	283	21:40:55.00	36691	n
Luq_1	target	2009-10-11	284	02:24:31.00	36694	y
W_US_618_03	target	2009-10-11	284	05:42:21.00	36696	n
Pacific	scan	2009-10-11	284	08:33:31.24	36698	y

Appendix F: Laser 1 Campaign Command Table

Commanded instrument activities during the Laser 1 campaign, Feb 20, 2003 - March 29, 2003

Command	Date/Time (YYYY/DOY-hh:mm:ss.sss)	Date/Time (mm/dd/yyyy hh:mm:ss.sss)	Notes
Power on Laser 1	2003/051-17:31	02/20/2003 17:31	
Enable Laser 1 Firing	2003/051-22:18	02/20/2003 22:18	
Set LPA Box Coordinates to (32,30)	2003/052-03:15:45	02/21/2003 03:15:45	To optimize LPA spot
GLAS One-shot mode	2003/052-16:05:48	02/21/2003 16:05:48	During one-shot mode AD data is not transmitted while the one-shot full waveform is transmitted to the ground. Time without apid 12 and 13?
Adjust Etalon Heater setpoint to 45.2C (165 counts)	2003/052-17:41:56	02/21/2003 17:41:56	Adjust etalon to assess impact on pin data.
Set LPA Box Coordinates to (32,26)	2003/052-19:17:26	02/21/2003 19:17:26	To optimize LPA spot
Adjust Etalon Heater setpoint to 162 counts	2003/052-22:28:09	02/21/2003 22:28:09	Adjust etalon to optimize 532nm energy throughput.
Adjust Etalon Heater setpoint to xxC (159 counts)	2003/053-00:13:24	02/22/2003 00:13:24	Adjust etalon to optimize 532nm energy throughput.
Set LPA Box Coordinates to (36,30)	2003/053-01:39:55	02/22/2003 01:39:55	To optimize LPA spot
Adjust Etalon Heater setpoint to 43.1C (144 counts)	2003/055-19:00:44	02/24/2003 19:00:44	Adjust etalon to optimize 532nm energy throughput.
Adjust Etalon Heater setpoint to 43.4C (147 counts)	2003/055-22:11:54	02/24/2003 22:11:54	Adjust etalon to optimize 532nm energy throughput.
Etalon Heater closed loop test	2003/056-16:45:58	02/25/2003 16:45:58	Assess stability of closed loop etalon adjustment and impact on 532nm energy throughput.
Etalon Heater open loop test	2003/056-19:57:18	02/25/2003 19:57:18	Assess stability of open loop etalon adjustment and impact

			on 532nm energy throughput.
Halted etalon open loop test and adjusted Etalon Heater setpoint to 147 counts	2003/056-23:17:32	02/25/2003 23:17:32	Halted test and set the etalon temperature to pretest value to assess impact on 532nm energy throughput.
Background Search Offset Start set to 20 KM (133420 counts)	2003/057-15:19:51	02/26/2003 15:19:51	Adjusted the background search offset from 1KM to 20KM (133420 counts) to test the impact on the science quality of the AD data.
Background Search Offset Start reset to 1 KM (6671 counts)	2003/057-18:31:44	02/26/2003 18:31:44	Reset the background search offset from 20 KM to 1 KM (6671 counts).
Set LPA Box Coordinates to (36,24)	2003/057-22:31:42	02/26/2003 22:31:42	To optimize LPA spot
Set return gain to 250 Set return gain to 125 Set return gain to 40 Set return gain to 10 Set return gain to auto	2003/057-20:21:01.990 2003/058-02:50:01.997 2003/058-09:20:01.986 2003/058-15:50:01.991 2003/058-22:20:01.991	02/26/2003 20:21:01.990 02/27/2003 02:50:01.997 02/27/2003 09:20:01.986 02/27/2003 15:50:01.991 02/27/2003 22:20:01.991	Test of fixed return gain settings to determine effect of saturated returns
Set AGC parameter VREF=>150	2003/058-22:41:34	02/27/2003 22:41:34	Adjusted AGC parameter VREF to 150 (from 180) per engineering team request to minimize saturated returns
Adjust Etalon Heater setpoint to 42.7C (140 counts) Adjust Etalon Heater setpoint to 43.4C (147 counts)	2003/059-15:43 2003/059-19:08	02/28/2003 15:43 02/28/2003 19:08	Adjust etalon cooler to 42.7C for 2 orbits; then reset to 43.4C to assess impact on 532nm energy throughput.
Background Search Offset Start set to 20KM (133420 counts)	2003/062-19:24:59	03/03/2003 19:24:59	Adjusted the background search offset from 1KM to 20KM to improve the science quality of the AD data.
Set LPA box coordinates to (28,30)	2003/063-22:47	03/04/2003 22:47	Adjusted the LPA box coordinates to (28,30) from (x,y) to improve image in FOV.
LRS power off	2003/064-16:41	03/05/2003 16:41	To recover from LRS

			software hang-up
LRS power on	2003/065	03/06/2003	To complete recovery from LRS software hang-up and load updated LRS operating procedure
LRS power off	2003/065	03/06/2003	To recover from LRS software hang-up
LRS power on	2003/066	03/07/2003	To complete recovery from LRS software hang-up and load updated LRS operating procedure
Set Etalon Heater setpoint to 153 counts (44C)	2003/072-12:58:13	03/13/2003 12:58:13	In preparation of running the etalon automatic control algorithm
Start Etalon MODIFIED Closed loop Tracking mode	2003/072-17:56:15	03/13/2003 17:56:15	Start algorithm to automatically adjust the etalon temperature
Load GLAS flight software, version 4.2	2003/072-21:07:10	03/13/2003 21:07:10	Patched the GLAS flight software (to V4.2) to allow for values of AGC parameter Gmin from 3-250.
Set AGC parameter Gain minimum = 13	2003/072-21:09:23	03/13/2003 21:09:23	Adjusted AGC parameter GMIN to 13 per engineering team request to aid determination of saturated returns
Disable use of the 8ns filter for AGC	2003/076-17:00:17	03/17/2003 17:00:17	Test to determine if using the selected filter works better to keep the gain from oscillating of the cloud returns.
Enable use of the 8ns filter for AGC	2003/077-17:13:32	03/18/2003 17:13:32	Test completed
Set WMIN to 1KM	2003/077-17:14:58	03/18/2003 17:14:58	Tested affect of change of Range Window minimum (WMIN) to eliminate effect of cloud on the gain calculation.
Disable IST Virtual Tracker 5	2003/078-12:35:13	03/19/2003 12:35:13	Due to LRS hang-ups
LRS upset	2003/078	03/19/2003	To recover from LRS

			software hang-up
Reset WMIN to 2KM	2003/078-17:20:50	03/19/2003 17:20:50	Rest WMIN to 2KM
Power on LRS	2003/079-22:16:51	03/20/2003 22:16:51	LRS Flight software problems caused unstable LRS behavior
LRS upset	2003/080-02:43	03/21/2003 02:43	To recover from LRS software hang-up
Power Cycle LRS	2003/081-04:54:12	03/22/2003 04:54:12	LRS Flight software problems caused unstable LRS behavior; power cycle to return to operations
Spacecraft entry to sun acquire mode	2003/085-11:41	03/26/2003 11:41	Due to Attitude erro spacecraft entered Sun Acquire Mode (SAM). Altimeter detector powered off; no science data collection.
Set RBMAX to 0.00000E+00	2003/085-13:34:06	03/26/2003 13:34:06	To recover from loss of stored command during s/c acquire sun mode entry
Power off LRS	2003/085-20:11:26	03/26/2003 20:11:26	While spacecraft is in SAM and waiting for spftware patch.
Power on the Altimeter Detector	2003/086-00:57:25	03/27/2003 00:57:25	To recover from power off during s/c acquire sun mode entry; begin science data collection.
Lower Laser 1 reference temperature (L1RefT) to 25 degrees, set the LLHP to 15.37 degrees	2003/086-12:05:17	03/27/2003 12:05:17	Lowered laser temperature in two steps per recommendation of the engineering team to put the laser in a cooler environment which is thought to be more stabilizing
Lower L1RefT to 22 degrees, set the LLHP to 12.34 degrees	2003/086-17:04:15	03/27/2003 17:04:15	
Patch GLAS FSW to accept negative numbers for the background search offset start setting	2003/087-17:17:26	03/28/2003 17: 17:26	Due to failure of command to execute

Background Search Offset Start set to -100KM (-667000 counts)	2003/087-17:19:15	03/28/2003 17:19:15	Move the Background Noise region to be above the atmosphere
Disable Laser 1 Firing	2003/088-19:01:20	03/29/2003 19:01:20	Due to catastrophic failure of Laser 1.

Appendix G: Command Tables for the Laser 2 Campaigns (a - c)

CAMPAIGN L2a COMMAND TABLE

Commanded instrument activities during the Laser 2a campaign (September 25, 2003 - November 19, 2003)

Activity	Date/Time (YYYY/DOY-hh:mm:ss.sss)	Date/Time (mm/dd/yyyy hh:mm:ss.sss)	Notes
Enable Laser 2 firing	2003/268-17:17:45	09/25/2003 17:17:45	Campaign L2a start
Stop etalon tracking	2003/268-20:27:47	09/25/2003 20:27:47	Not working as expected
Set the etalon temperature to 43.2C	2003/268-20:28:05	09/25/2003 20:28:05	Manual setting
Reconfigure the LRS VT	2003/268-20:29:40	09/25/2003 20:29:40	To better track the laser spot
Reconfigure the LRS VT	2003/268-20:31:21	09/25/2003 20:31:21	To better track the laser spot
Set LPA box to 32,26	2003/268-22:06:31	09/25/2003 22:06:31	To center the laser spot in the FOV
Reconfigure the LRS VT	2003/268-22:07:36	09/25/2003 22:07:36	To better track the laser spot
Reconfigure the LRS VT	2003/268-22:08:01	09/25/2003 22:08:01	To better track the laser spot
Start modified etalon temperature tracking	2003/268-23:45:42	09/25/2003 23:45:42	To prepare for SPCM power on
Reconfigure the LRS VT	2003/268-23:46:46	09/25/2003 23:46:46	To better track the laser spot
Power on SPCM 5	2003/269-14:16:12	09/26/2003 14:16:12	Only SPCM 2 was powered and enabled for campaign start
Power on SPCM 6	2003/269-15:50:34	09/26/2003 15:50:34	Only SPCM 2 was powered and enabled for campaign start
Power on SPCM 8	2003/269-17:36:57	09/26/2003 17:36:57	Only SPCM 2 was powered and enabled for campaign start
Enable science data collection for all 4 SPCMs	2003/269-19:02:44	09/26/2003 19:02:44	Only SPCM 2 was powered and enabled for campaign start
532nm boresight coarse and fine calibration	2003/269-21:44:58.000	09/26/2003 21:44:58	Two consecutive scans after SPCM power on; 15 minute execution time
Reset PCMODE to SCIENCE	2003/269-22:00:00.000	09/26/2003 22:00:00	532nm boresight scan complete; leave LBSM in 'best' position

Set XPOS/YPOS to 2100/2070	2003/272-21:18:25	09/29/2003 21:18:25	Recenter the LBSM per science team request
Set XPOS/YPOS to 2100/2070	2003/273-14:53:41	09/30/2003 14:53:41	Bad scan left XPOS/YPOS in a bad spot; recenter the LBSM per science team request
Reset the pulse width violation threshold	2003/273-18:06:01	09/30/2003 18:06:01	It was set too large
532nm boresight scan	2003/274-06:34:56.000	10/01/2003 06:34:56	To center the 532nm beam in the FOV.
Reset PCMODE to SCIENCE	2003/274-06:37:00.000	10/01/2003 06:37:00	532nm boresight scan complete
Center LBSM X/Y to 2100/2070	2003/274-06:37:02.000	10/01/2003 06:37:02	per atmosphere team request
Disable SPCM 8 data collection	2003/276-18:46:10	10/03/2003 18:46:10	To test SPCM behavior
Enable only SPCM 2 data collection	2003/276-19:47:00	10/03/2003 19:47:00	To test SPCM behavior
Enable only SPCM 5 data collection	2003/276-19:51:00	10/03/2003 19:51:00	To test SPCM behavior
Enable only SPCM 6 data collection	2003/276-19:55:00	10/03/2003 19:55:00	To test SPCM behavior
Enable only SPCM 8 data collection	2003/276-19:59:00	10/03/2003 19:59:00	To test SPCM behavior
Enable SPCM 2, 5, 6 data collection	2003/276-20:03:00	10/03/2003 20:03:00	To test SPCM behavior
Enable all SPCM data collection	2003/276-20:15:00	10/03/2003 20:15:00	Test complete
532nm boresight scan	2003/281-04:32:56.000	10/08/2003 04:32:56	To center the 532nm beam in the FOV.
Reset PCMODE to SCIENCE	2003/281-04:35:00.000	10/08/2003 04:35:00	532nm boresight scan complete
Loaded updated etalon modified tracking algorithm	2003/283-13:20:50	10/10/2003 13:20:50	To improve the on-board Etalon thermal control
Started etalon modified tracking algorithm	2003/283-13:25:49	10/10/2003 13:25:49	Begin automated etalalon thermal control
Raised LLHP setpoint	2003/286-17:59:58.000	10/13/2003 17:59:58	Intended to raise the CLHP setpoint 1 degree - fryed laser
Lower LLHP setpoint	2003/286-18:54:29	10/13/2003 18:54:29	Recovery after incorrect command caused the LLHP to be set to max setpoint instead of raising the CLHP setpoint
Lower LLHP setpoint	2003/286-20:28:57	10/13/2003 20:28:57	Recovery after incorrect command caused the LLHP to

			be set to max setpoint instead of raising the CLHP setpoint
Raise CLHP temperature to 11.7C	2003/287-17:17:04	10/14/2003 17:17:04	Raise Bench Temperature to center the laser spot in the telescope boresight
Raise CLHP temperature to 12.7	2003/287-22:46:01	10/14/2003 22:46:01	Raise Bench Temperature to center the laser spot in the telescope boresight
532nm boresight coarse and fine calibration	2003/288-23:00:00.000	10/15/2003 23:00:00	To center the 532nm beam in the FOV.
Center LBSM X/Y to 2010/2010	2003/288-23:06:06.000	10/15/2003 23:06:06	per atmosphere team request
Reset PCMODE to SCIENCE	2003/288-23:06:10.000	10/15/2003 23:06:10	532nm boresight scan complete
532nm boresight scan	2003/288-23:31:56.000	10/15/2003 23:31:56	To center the 532nm beam in the FOV.
Reset PCMODE to SCIENCE	2003/288-23:34:00.000	10/15/2003 23:34:00	532nm boresight scan complete; leave at best X/Y
Set YPOS to 2026	2003/290-03:09:20	10/17/2003 03:09:20	per atmosphere team request
Set LPA box to 28,26	2003/297-01:13:25	10/24/2003 01:13:25	To center the laer spot in the LPA FOV
Raise CLHP temperature to 13.9C	2003/301-16:23:02	10/28/2003 16:23:02	Raise Bench Temperature to center the laser spot in the telescope boresight
Raise CLHP temperature to 14.8C	2003/301-22:42:29	10/28/2003 22:42:29	Raise Bench Temperature to center the laser spot in the telescope boresight
Raise CLHP temperature to 16.6C	2003/302-21:14:37	10/29/2003 21:14:37	Raise Bench Temperature to center the laser spot in the telescope boresight
532nm boresight scan	2003/312-06:15:00.000	11/08/2003 06:15:00	To center the 532nm beam in the FOV.
Reset PCMODE to SCIENCE	2003/312-06:17:04.000	11/08/2003 06:17:04	532nm boresight scan complete
Center LBSM X/Y to 2040/2000	2003/312-06:17:06.000	11/08/2003 06:17:06	per atmosphere team request
Set XPOS/ YPOS to 2035/1960	2003/314-00:47:47	11/10/2003 00:47:47	per atmosphere team request
Reconfigure the LRS VT0	2003/315-23:24:49	11/11/2003 23:24:49	LRS VT0 is tracking laser spot trail as star; set track threshold to 10 to return to star tracking
532nm boresight scan	2003/317-05:40:00.000	11/13/2003 05:40:00	To center the 532nm beam in the FOV.
Reset PCMODE to	2003/317-05:44:08.000	11/13/2003 05:44:08	532nm boresight scan

SCIENCE			complete
Center LBSM X/Y to 2040/1980	2003/317-05:44:10.000	11/13/2003 05:44:10	upon completion of the scans
Set XPOS/ YPOS to 2055/2010	2003/317-23:44:10	11/13/2003 23:44:10	per atmosphere team request to recenter the spot in the FOV
532nm boresight scan	2003/322-17:46:00.00	11/18/2003 17:46:00	To center the 532nm beam in the FOV.
Reset PCMODE to SCIENCE	2003/322-17:48:04.00	11/18/2003 17:48:04	532nm boresight scan complete
Unexpected end of campaign	2003/323-00:37:45	11/19/2003 00:37:45	Failed attempt to load new s/c vtcw base time and slope precipitated entry into Sun Acquire Mode; payload powered off

CAMPAIGN L2b COMMAND TABLE

Commanded instrument activities during the Laser 2b campaign (February 17, 2004 - March 21, 2004)

Activity	Date/Time (YYYY/DOY-hh:mm:ss.sss)	Date/Time (mm/dd/yyyy hh:mm:ss.sss)	Notes
Enable Laser 2 Firing	2004/048-21:43:26	02/17/2004 21:43:26	Start of campaign 2b
Set etalon temp to 42.6	2004/048-23:20:53	02/17/2004 23:20:53	Etalon sweep at start of campaign
Set etalon to 42.8C	2004/049-03:00:00.000	02/17/2004 23:20:53	Continued etalon mini-sweep
Set etalon to 43C	2004/049-06:00:00.000	02/18/2004 06:00:00	Continued etalon mini-sweep
Adjust LPA Box to 36, 26	2004/049-02:32:24	02/18/2004 02:32:24	per engineering team request to center spot
Adjust LRS VT2	2004/049-02:33:11	02/18/2004 02:33:11	per engineering team request
Adjust LRS VT2	2004/049-02:36:49	02/18/2004 02:36:49	per engineering team request
Adjust LRS VT2	2004/049-04:11:51	02/18/2004 04:11:51	per engineering team request
Start modified etalon tracking algorithm	2004/049-09:10:00.000	02/18/2004 09:10:00	to automatically set the optimum etalon temperature based on laser temperature
532nm boresight scan	2004/049-12:30:00.000	02/18/2004 12:30:00	3 minute execution time
Enable SPCM 1 / disable SPCMs 2, 5, 6, 8	2004/049-13:56:59.000	02/18/2004 13:56:59	Test SPCM 1 behavior per science team request
Disable SPCM 1 / Enable 2, 5, 6, 8	2004/049-14:06:59.000	02/18/2004 14:06:59	Continue SPCM 1 test
Enable SPCMs 1, 2, 5, 6, 8	2004/049-14:16:59.000	02/18/2004 14:16:59	Continue SPCM 1 test
Disable SPCM 1 Enable 2, 5, 6, 8	2004/049-15:53:38.000	02/18/2004 15:53:38	Complete SPCM 1 test
Enable SPCM 1	2004/049-22:42:55	02/18/2004 22:42:55	Science team request
Spacecraft entered ACQSUN	2004/050-16:08:25	02/19/2004 16:08:25	s/c detected sun within the avoidance zone around the GLAS boresight
Power on the altimeter detector	2004/051-02:57:34	02/20/2004 02:57:34	Complete ACQSUN Recovery activities
Power on SPCMs 1, 2, 5, 6, 8	2004/051-06:06:34	02/20/2004 06:06:34	Complete ACQSUN Recovery activities
Adjust LBSM XPOS/YPOS to 2090/2010	2004/051-06:12:13	02/20/2004 06:12:13	Complete ACQSUN Recovery activities
532nm boresight scan	2004/051-11:10:02.000	02/20/2004 11:10:02	execution time 2 minutes
Set LBSM XPOS/YPOS to 2090/2010	2004/051-11:12:06.000	02/20/2004 11:12:06	per science team request

Power off SPCM 5	2004/055-22:46:03	02/24/2004 22:46:03	due to low s/c power
532nm boresight scan	2004/056-04:05:02.000	02/25/2004 04:05:02	execution time 4 minutes
Set LBSM XPOS/YPOS to 2085/2020	2004/056-04:09:10.000	02/25/2004 04:09:10	per science team request
Adjust LRS VT1	2004/056-18:06:54	02/25/2004 18:06:54	per engineering team request
Adjust LRS VT2	2004/056-18:07:18	02/25/2004 18:07:18	per engineering team request
Adjust LBSM XPOS to 2075	2004/056-18:07:53	02/25/2004 18:07:53	per science team request
Power off SPCM 1	2004/061-18:56:00	03/01/2004 18:56:00	per science team request - data not good
Power on SPCM 5	2004/062-01:20:13	03/02/2004 01:20:13	upon approval of s/c engineer
Adjust LBSM XPOS/YPOS to 2075/2020	2004/062-06:14:39	03/02/2004 06:14:39	per science team request
532nm boresight scan	2004/065-02:25:47.000	03/05/2004 02:25:47	execution time 5 minutes
Set XPOS/YPOS to 2080/2010	2004/065-02:30:53.000	03/05/2004 02:30:53	per science team request
Test fixed return gain = 13	2004/065-11:30:00.00	03/05/2004 11:30:00	per engineering team request
Return to auto gain	2004/065-11:30:12.00	03/05/2004 11:30:12	Fixed return gain = 13 test completed
Adjust LRS VT2	2004/065-22:52:17	03/05/2004 22:52:17	per engineering team request
Stop etalon modified tracking algorithm	2004/069-01:00:30	03/09/2004 01:00:30	per engineering team request - not working as desired
Set etalon temp to 43.2	2004/069-01:00:58	03/09/2004 01:00:58	per engineering team request - to optimize etalon throughput
Disable Laser 2 firing	2004/081-20:38:46	03/21/2004 20:38:46	Campaign 2b completed

CAMPAIGN L2c COMMAND TABLE

Commanded instrument activities during the Laser 2c campaign (May 18, 2004 - June 21, 2004)

Activity	Date/Tme (YYYY/DOY - hh:mm:ss.sss)	Date/Tme (MM/DD/YYYY - hh:mm:ss.sss)	Notes
Enable Laser 2 firing	2004/139-16:57:03	05/18/2004 - 16:57:03	Start of Campaign L2c
Lower laser temperature to minimum setting - start	2004/141-19:20:00.00	05/20/2004-19:20:00	per GARB recommendation - adjust laser temperature at the rate of 0.1C per 80 minutes
Set etalon to 42.2C	2004/141-20:45:27	05/20/2004 - 20:45:24	Since lowering laser temperature adjust etalon temperature
Adjust 532nm FOV center X/Y to 2020/1990	2004/146-23:13:21	05/25/2004-23:13:21	adjust FOV center per science team request
Lower laser temperature to minimum setting - complete	2004/147-06:55:00	05/26/2004-06:55:00	Laser temperature adjustment completed
Raise laser temperature	2004/147-10:21:40	05/26/2004-10:21:40	Laser temperature minimum setting triggered survival heater on.
Adjust LRS VT1 settings	2004/147-23:16:28	05/26/2004-23:16:28	after laser temperature adjustment
Start etalon temperature sweep; set etalon to 43.5C	2004/149-01:31:06	05/28/2004-01:31:06	to determine optimum etalon temperature after laser temperature adjustment
Set etalon to 43C	2004/149-04:44:24	05/28/2004-04:44:24	continue etalon sweep
Set etalon to 42.5C	2004/149-07:57:43	05/28/2004-07:57:43	continue etalon sweep
Set etalon to 42C	2004/149-11:11:01	05/28/2004-11:11:01	continue etalon sweep
Set etalon to 41C	2004/149-14:24:19	05/28/2004-14:24:19	continue etalon sweep
Set etalon to 40.5C	2004/149-17:37:37	05/28/2004-17:37:37	continue etalon sweep
Set etalon to 40C	2004/149-20:50:56	05/28/2004-20:50:56	continue etalon sweep
Set transmit gain to 142	2004/149-21:57:11	05/28/2004-21:57:11	per engineering team request in response to decling laser energy
Set etalon to 39.5C	2004/150-00:04:14	05/29/2004-00:04:14	continue etalon sweep
Set etalon to 41.5C	2004/150-03:17:32	05/29/2004-03:17:32	Etalon sweep complete; Set etalon to predicted optimum setting
LRS Reset and offline	2004/153-03:00:00	06/01/2004-03:00:00	Time of LRS reset is approximate
LRS back online after reset	2004/153-19:22:22	06/01/2004-19:22:22	LRS recovery complete
Set etalon temperature to 41.2C	2004/154-22:54:39	06/02/2004-22:54:39	per engineering team request to strengthen the 532nm output
adjust LRS VT1	2004/162-22:30:20	06/10/2004-22:30:20	lower LRS VT1 threshold to better track the laser spot
Set transmit gain to 250	2004/163-22:46:53	06/11/2004-22:46:53	per engineering team request in response to declining laser energy
Disable Laser 2 firing	2004/173-14:38:53	06/21/2004-14:38:53	Campaign L2c Completed

Appendix H: Command Tables for the Laser 3 Campaigns (a - k)

CAMPAIGN L3a COMMAND TABLE

Commanded instrument activities during the Laser 3a campaign (October 3 - November 8, 2004)

Activity	Date/Tme (YYYY/DOY - hh:mm:ss.sss)	Date/Tme (MM/DD/YYYY - hh:mm:ss.sss)	Notes
Enable Laser 3 firing	2004/277-21:30:22	10/03/2004-21:30:18	Start of campaign L3a
532nm boresight scan	2004/277-22:27:02.000	10/03/2004-22:27:02	Initial calibration for Laser 3; execution time 4 minutes
Adjust 532nm FOV center X/Y to 2080/1990	2004/277-22:31:08.000	10/03/2004-22:31:08	Adjust to estimated best center
Adjust LRS Virtual Tracker settings	2004/278-12:44:40	10/04/2004-12:44:36	Troubleshooting; laser spot not seen in the CRS due to low 532nm energy
532nm boresight scan	2004/278-14:40:02.000	10/04/2004-14:40:02	Upon request of Science team due to low 532nm energy; execution time 8 minutes
Adjust 532nm FOV center X/Y to 2040/2040	2004/278-14:48:08.000	10/04/2004-14:48:08	Adjust to estimated best center
Adjust etalon to 41C	2004/278-15:59:47	10/04/2004-15:59:42	To determine optimal value
Adjust etalon to 42C	2004/278-19:13:34	10/04/2004-19:13:29	To determine optimal value
Adjust 532nm FOV center X/Y to 2030/2090	2004/278-20:53:52	10/04/2004-20:53:48	To collect data determine best center
Adjust 532nm FOV center X/Y to 2010/2050	2004/279-22:38:39	10/05/2004-22:38:35	To collect data determine best center
Disable SPCM8 science data collection	2004/279-22:39:37	10/05/2004-22:39:33	To determine if SPCM8 is behaving anomalously
Re-enable SPCM8 science data collection	2004/280-14:42:29	10/06/2004-14:42:25	End of SPCM8 test; SPCM8 behavior is nominal.
Disable SPCM6 & SPCM8 science data collection	2004/281-03:54:48.000	10/07/2004-03:54:48	532nm boresight scan performed with only SPCM2 and SPCM5 enabled (SPCMs with lower dark counts); trouble-shooting Laser 3 spot shape
532nm boresight scan	2004/281-03:54:50.000	10/07/2004-03:54:50	Upon request of Science team to investigate Laser 3 spot shape; execution time 8 minutes
Re-enable SPCM6 & SPCM8 science data collection	2004/281-04:02:56.000	10/07/2004-04:02:56	End of trouble-shooting
Adjust 532nm FOV center X/Y to 2010/2050	2004/281-04:03:00.000	10/07/2004-04:03:00	Adjust to estimated best center
Adjust 532nm FOV center Y to 2100	2004/281-22:57:42	10/07/2004-22:57:39	Adjust to estimated best center; X position remained 2010.
Adjust etalon to 41.7C	2004/281-22:58:09	10/07/2004-22:58:06	To optimize etalon performance to increase

			532nm signal strength.
Adjust etalon to 41.5C	2004/282-23:07:12	10/08/2004-23:07:08	To optimize etalon performance to increase 532nm signal strength.
Raise Laser 3 Temperature to 16C - start	2004/293-00:00:00.00	10/19/2004-00:00:00.00	Raise the Laser 3 temperature at the rate of 0.1C per 55 minutes to increase the transmit energy therefore increasing the 532nm energy to improve its shape and return.
Raise Laser 3 Temperature to 16C - complete	2004/293-17:25:00.000	10/19/2004-17:25:00.00	Complete the temperature change sequence.
Adjust etalon to 41.8C	2004/293-18:17:24	10/19/2004-18:17:20	In response to higher Laser 3 temperature.
532nm boresight scan	2004/293-18:36:32.000	10/19/2004-18:36:32	Execute series of 532nm boresight scans to determine 532nm spot shape and location after raising the Laser 3 temperature
Scans complete	2004/293-18:54:38.000	10/19/2004-18:54:38	Back to PC science mode; series of scans had timing errors
Adjust 532nm FOV center X/Y to 2010/2100	2004/293-18:54:42.000	10/19/2004-18:54:42	To estimated best center
532nm boresight scan	2004/294-07:28:40.000	10/20/2004-18:36:32	Execute second series of 532nm boresight scans to determine 532nm spot shape and location after raising the Laser 3 temperature
Scans complete	2004/294-07:48:46.000	10/20/2004-18:54:38	Back to PC science mode
Adjust 532nm FOV center X/Y to 2010/2100	2004/294-07:48:50.000	10/20/2004-18:54:42	To estimated best center
532nm boresight scan	2004/294-21:58:26.000	10/20/2004-21:58:26	Repeat series of 532nm boresight scans to determine 532nm spot shape and location after raising the Laser 3 temperature; execution time 20 minutes
Adjust 532nm FOV center X/Y to 2010/2100	2004/294-22:18:36.000	10/20/2004-22:18:36	To estimated best center
Adjust 532nm FOV center X/Y to 2070/2040	2004/295-18:47:29	10/21/2004-18:47:25	To estimated best center after reviewing data from scans
532nm boresight scan	2004/296-04:34:40.000	10/22/2004-04:34:40	Repeat series of 532nm boresight scans to determine 532nm spot shape and location; execution time 20 minutes
Adjust 532nm FOV center X/Y to 2070/2120	2004/296-04:54:50.000	10/22/2004-04:54:50	To estimated best center
532nm boresight scan	2004/301-03:46:12.000	10/27/2004-03:46:12	Repeat series of 532nm boresight scans to determine 532nm spot shape and location; execution time 20

			minutes
Adjust 532nm FOV center X/Y to 2010/2090	2004/301-04:06:22.000	10/27/2004-04:06:22	To estimated best center
Adjust 532nm FOV center X/Y to 2110/2020	2004/302-00:35:23	10/28/2004-00:35:19	To estimated best center after analysis of scan data
Adjust 532nm FOV center X/Y to 2090/2080	2004/302-23:09:18	10/28/2004-23:09:14	Adjusted center after analysis of scan data
Adjust 532nm FOV center X/Y to 2010/2120	2004/303-21:43:50	10/29/2004-21:43:46	Adjusted center after analysis of scan data
Adjust 532nm FOV center X/Y to 2060/2110	2004/306-22:13:04	11/01/2004-22:13:00	Adjusted center after analysis of scan data
532nm boresight scan	2004/311-03:45:50.000	11/06/2004-03:45:50	Repeat series of 532nm boresight scans to determine 532nm spot shape and location prior to end of campaign; execution time 20 minutes
Adjust 532nm FOV center X/Y to 2060/2110	2004/311-04:06:00.000	11/06/2004-04:06:00	To estimated best center
Enable PC Range Gate Dithering	2004/311-09:00:00.000	11/06/2004-09:00:00	Test the PC Range Gate dthering mode (when enabled moves the start range gate up and down every 5 shots to increase the resolution from 76m to 20m)
Disable Dithering	2004/311-23:30:00.000	11/06/2004-23:30:00	Dithering test complete
Adjust etalon to 43.5C	2004/312-11:28:00.000	11/07/2004-11:28:00	Execute a sweep of etalon temperatures at the end of the campaign to characterize the etalon behavior for Laser 3.
Adjust etalon to 43C	2004/312-14:41:18.000	11/07/2004-14:41:18	Continue etalon sweep
Adjust etalon to 42.5C	2004/312-17:54:36.000	11/07/2004-17:54:36	Continue etalon sweep
Adjust etalon to 41C	2004/313-00:21:12.000	11/08/2004-00:21:12	Continue etalon sweep
Adjust etalon to 40.5C	2004/313-03:34:30.000	11/08/2004-03:34:30	Continue etalon sweep
Adjust etalon to 40C	2004/313-06:47:48.000	11/08/2004-06:47:48	Continue etalon sweep
Adjust etalon to 41.5C	2004/313-13:14:24.000	11/08/2004-13:14:24	Complete etalon sweep
Start one-shot engineering mode	2004/313-13:15:00.000	11/08/2004-13:15:00	Partial dump of full digitizer for one shot for engineering analysis
Disable Laser 3 Firing	2004/313-15:09:02	11/08/2004-15:09:02	Complete campaign L3a

CAMPAIGN L3b COMMAND TABLE

Commanded instrument activities during the Laser 3b campaign (February 17 - March 24, 2005)

Activity	**Date/Tme (YYYY/DOY - hh:mm:ss.sss)**	**Date/Tme (MM/DD/YYYY - hh:mm:ss.sss)**	**Notes**
Enable Laser 3 firing	05/048-16:08:19	02/17/2005-16:08:19	Start of Campaign L3b
532nm boresight scan	2005/048-18:56:04.000	02/17/2005-18:56:04.000	Initial calibration for campaign; execution time 5 minutes

Adjust 532nm FOV center X/Y to 2060/2110	2005/048-19:01:08.000	02/17/2005-19:01:08.000	Adjust to estimated best center
Adjust etalon to 41.6C	2005/048-19:05:00.000	02/17/2005-19:05:00.000	To determine optimal etalon setting
Adjust etalon to 42C	2005/048-20:41:00.000	02/17/2005-20:41:00.000	To determine optimal etalon setting
SPCM 5 power-on	05/049-17:53:12	02/18/2005-17:53:12	Due to s/c power SPCM 5 power-on delayed until after laser startfire
Adjust 532nm FOV center X/Y to 2060/2040	05/049-17:55:13	02/18/2005-17:55:13	adjust FOV center based on data analysis
532nm boresight scan	2005/051-16:10:04.000	02/20/2005-16:10:04.000	Execute series of 532nm FOV scans to characterize laser spot; execution time 15 minutes
Adjust 532nm FOV center X/Y to 2060/2040	2005/051-16:25:24.000	02/20/2005-16:25:24.000	Adjust to estimated best center
532nm boresight scan	2005/051-17:46:04.000	02/20/2005-17:46:04.000	Execute series of 532nm FOV scans to characterize laser spot; execution time 15 minutes
Adjust 532nm FOV center X/Y to 2060/2040	2005/051-18:01:24.000	02/20/2005-18:01:24.000	Adjust to estimated best center
Adjust 532nm FOV center X/Y to 2030/2060	05/052-23:10:52	02/21/2005-23:10:52	adjust FOV center based on data analysis
532nm boresight scan	2005/057-01:01:04.000	02/26/2005-01:01:04.000	Execute series of 532nm FOV scans to characterize laser spot; execution time 15 minutes
Adjust 532nm FOV center X/Y to 2030/2060	2005/057-01:16:24.000	02/26/2005-01:16:24.000	Adjust to estimated best center
Adjust 532nm FOV center X/Y to 2060/2020	05/060-00:27:18	03/01/2005-00:27:18	adjust FOV center based on data analysis
GPS Reset and configure	05/060-18:05:56	03/01/2005-18:05:56	Manual reset due to GPS tracking less than 8 satellites
532nm boresight scan	2005/081-14:30:04.000	03/22/2005-14:30:04.000	Execute series of 532nm FOV scans to characterize laser spot; execution time 20 minutes
Adjust 532nm FOV center X/Y to 2030/2060	2005/081-14:50:24.000	03/22/2005-14:50:24.000	Adjust to estimated best center
532nm boresight scan	2005/081-16:07:04.000	03/22/2005-16:07:04.000	Execute series of 532nm FOV scans to characterize laser spot; execution time 20 minutes

Adjust 532nm FOV center X/Y to 2030/2060	2005/081-16:27:24.000	03/22/2005-16:27:24.000	Adjust to estimated best center
Adjust etalon to 44.5C	2005/082-23:00:00	03/23/2005-23:00:00	Execute a sweep of etalon temperatures at the end of the campaign to characterize the etalon behavior for Laser 3.
Adjust etalon to 43.5C	2005/083-01:00:00.000	03/24/2005-01:00:00.000	Continue etalon sweep
Adjust etalon to 43C	2005/083-03:00:00.000	03/24/2005-03:00:00.000	Continue etalon sweep
Adjust etalon to 42.5C	2005/083-05:00:00.000	03/24/2005-05:00:00.000	Continue etalon sweep
Adjust etalon to 41.5C	2005/083-07:00:00.000	03/24/2005-07:00:00.000	Continue etalon sweep
Adjust etalon to 41C	2005/083-09:00:00.000	03/24/2005-09:00:00.000	Continue etalon sweep
Adjust etalon to 40.5C	2005/083-11:00:00.000	03/24/2005-11:00:00.000	Continue etalon sweep
Adjust etalon to 49.5C	2005/083-15:00:00.000	03/24/2005-15:00:00.000	Complete etalon sweep
Disable Laser 3 Firing	05/083-16:59:41	03/24/2005-16:59:41	Complete campaign L3b

CAMPAIGN L3c COMMAND TABLE

Commanded instrument activities during the Laser 3c campaign (May 20 - June 23, 2005)

Activity	**Date/Tme (YYYY/DOY - hh:mm:ss.sss)**	**Date/Tme (MM/DD/YYYY - hh:mm:ss.sss)**	**Notes**
Enable Laser 3 firing	2005/140-16:35:56	05/20/2005-16:35:56	Start of campaign L3c
532nm boresight scan	2005/140-19:17:04.000	05/20/2005-19:17:04.000	Initial calibration for campaign; execution time 5 minutes
Adjust 532nm FOV center X/Y to 2030/2060	2005/140-19:22:08.000	05/20/2005-19:22:08.000	Adjust to estimated best center
Adjust etalon to 41.2C	2005/140-19:25:00.000	05/20/2005-19:25:00.000	To determine optimal etalon setting
Adjust etalon to 41.6C	2005/140-21:03:00.000	05/20/2005-21:03:00.000	To determine optimal etalon setting
SPCM 5 power-on	2005/142-16:54:51	05/22/2005-16:54:51	Due to s/c power SPCM 5 power-on delayed until after laser startfire
Adjust 532nm FOV center X/Y to 2030/2060	2005/142-16:56:27	05/22/2005-16:56:27	Reset FOV center after SPCM5 power-on
Adjust etalon to 40.8C	2005/145-00:54:40.00	05/25/2005-00:54:40.00	To determine optimal etalon setting
Adjust etalon to 41.2C	2005/145-02:31:19.00	05/25/2005-02:31:19.00	To determine optimal etalon setting
532nm boresight scan	2005/152-00:07:20.000	06/01/2005-00:07:20.000	Execute series of 532nm FOV scans to characterize

			laser spot; execution time 17 minutes
Adjust 532nm FOV center X/Y to 2030/2060	2005/152-00:34:26.000	06/01/2005-00:34:26.000	Adjust to estimated best center
Clear transmit peak failure flag	2005/153-18:54:26	06/02/2005-18:54:26	Flag is latched upon a transmit peak value not reaching the threshold; must be cleared by ground command
Adjust etalon to 41.4C	2005/156-04:49:00.000	06/05/2005-04:49:00.000	Optimal setting based on analysis
532nm boresight scan	2005/156-08:52:06.000	06/05/2005-08:52:06.000	Execute series of 532nm FOV scans to characterize laser spot after etalon adjustment; execution time 27 minutes
Adjust 532nm FOV center X/Y to 2030/2060	2005/156-09:19:12.000	06/05/2005-09:19:12.000	Adjust to estimated best center
Enable PC Range Gate Dithering	2005/166-22:25:14	06/15/2005-22:25:14	Science team request; dithering enabled may allow ground processing to be able to separate out the ground returns from the blowing snow
Adjust etalon to 44C	2005/173-11:45:00.000	06/22/2005-11:45:00.000	Execute a sweep of etalon temperatures at the end of the campaign to characterize the etalon behavior for Laser 3.
Adjust etalon to 42.9C	2005/173-13:45:00.000	06/22/2005-13:45:00.000	Continue etalon sweep
Adjust etalon to 42.4C	2005/173-15:45:00.000	06/22/2005-15:45:00.000	Continue etalon sweep
Adjust etalon to 41.9C	2005/173-17:45:00.000	06/22/2005-17:45:00.000	Continue etalon sweep
Adjust etalon to 40.9C	2005/173-19:45:00.000	06/22/2005-19:45:00.000	Continue etalon sweep
Adjust etalon to 40.4C	2005/173-21:45:00.000	06/22/2005-21:45:00.000	Continue etalon sweep
Adjust etalon to 39.9C	2005/173-23:45:00.000	06/22/2005-23:45:00.000	Continue etalon sweep
Adjust etalon to 39.4C	2005/174-01:45:00.000	06/23/2005-01:45:00.000	Continue etalon sweep
Adjust etalon to 38.9C	2005/174-03:45:00.000	06/23/2005-03:45:00.000	Complete etalon sweep
Disable Laser 3 Firing	2005/174-05:46:50	06/23/2005-05:46:50	Complete campaign L3c

CAMPAIGN L3d COMMAND TABLE

Commanded instrument activities during the Laser 3d campaign (October 21 - November 23, 2005)

Activity	**Date/Tme (YYYY/DOY - hh:mm:ss.sss)**	**Date/Tme (MM/DD/YYYY - hh:mm:ss.sss)**	**Notes**
Enable Laser 3 firing	2005/294-22:56:45	10/21/2005-22:56:45	Start of Campaign L3d
Adjust etalon to 41.1C	2005/295-00:40:08.000	10/22/2005-00:40:08.000	To determine optimal etalon setting
Adjust etalon to 41.4C	2005/295-02:18:14.000	10/22/2005-02:18:14.000	To determine optimal etalon setting
532nm boresight scan	2005/295-03:21:04.000	10/22/2005-03:21:04.000	Initial calibration for campaign; due to weak 532nm signal several scans were executed; execution time 9 minutes
Adjust 532nm FOV center X/Y to 2060/2020	2005/295-03:30:06.000	10/22/2005-03:30:06.000	Adjust to estimated best center
532nm boresight scan	2005/295-05:00:55.000	10/22/2005-05:00:55.000	Continue Initial calibration for campaign; execution time 4 minutes
Adjust 532nm FOV center X/Y to 2060/2020	2005/295-05:09:57.000	10/22/2005-05:09:57.000	Adjust to estimated best center
532nm boresight scan	2005/295-06:38:55.000	10/22/2005-06:38:55.000	Continue initial calibration for campaign; execution time 9 minutes
Adjust 532nm FOV center X/Y to 2060/2020	2005/295-06:47:57.000	10/22/2005-06:47:57.000	Adjust to estimated best center
Adjust 532nm FOV center X/Y to 2000/2080	2005/298-00:30:02.00	10/25/2005-00:30:02.00	Since the pre-programmed 532nm FOV scans are not effective due to low 532nm signal strength and two lobed shape, the science team requested a series of dwells at different locations in the FOV to characterize the 532nm energy signal strength and shape. Each dwell is for two orbits.
Adjust 532nm FOV center X/Y to 2080/2000	2005/298-03:44:00.000	10/25/2005-03:44:00.000	532nm FOV dwell at next X/Y position
Adjust 532nm FOV center X/Y to 2040/2040	2005/298-06:57:00.00	10/25/2005-06:57:00.00	532nm FOV dwell at next X/Y position
Adjust 532nm FOV center X/Y to 2110/2010	2005/298-10:10:04.00	10/25/2005-10:10:04.00	532nm FOV dwell at next X/Y position

Adjust 532nm FOV center X/Y to 1910/1910	2005/298-13:23:00.000	10/25/2005-13:23:00.000	532nm FOV dwell at next X/Y position
Adjust 532nm FOV center X/Y to 2060/2020	2005/298-16:36:00.000	10/25/2005-16:36:00.000	532nm FOV dwells complete
Adjust 532nm FOV center X/Y to 2080/2010	2005/299-22:11:05	10/26/2005-22:11:05	Estimated best center based on analysis of dwell data.
Adjust etalon to 41.6C	2005/300-23:56:58	10/27/2005-23:56:58	To optimize etalon performance
Adjust 532nm FOV center X/Y to 2080/2080	2005/302-01:20:02.00	10/29/2005-01:20:02.00	Series of dwells at different locations in the 532nm FOV to characterize the 532nm energy signal strength and shape. Each dwell is for two orbits.
Adjust 532nm FOV center X/Y to 2080/2040	2005/302-04:33:20.000	10/29/2005-04:33:20.000	532nm FOV dwell at next X/Y position
Adjust 532nm FOV center X/Y to 2080/1990	2005/302-07:46:39.00	10/29/2005-07:46:39.00	532nm FOV dwell at next X/Y position
Adjust 532nm FOV center X/Y to 2090/2000	2005/302-10:59:57.00	10/29/2005-10:59:57.00	532nm FOV dwell at next X/Y position
Adjust 532nm FOV center X/Y to 2080/2010	2005/302-14:13:15.000	10/29/2005-14:13:15.000	532nm FOV dwells complete; return to estimated best center.
Raise transmit gain to 71 counts	2005/319-17:28:13	11/15/2005-17:28:13	Due to lower laser transmit energy and pulse amplitude.
LRS Lockup	2005/324-17:42:00	11/20/2005-17:42:00	LRS hung at approximately 11/20/2005-17:42.
LRS Power cycle	2005/324-21:22:58	11/20/2005-21:22:58	LRS power cycle to start recovery.
Configure LRS	2005/324-23:03:05	11/20/2005-23:03:05	LRS recovery complete
Adjust 532nm FOV center X/Y to 2070/2000	2005/326-18:56:08.000	11/22/2005-18:56:08.000	Series of dwells at different locations in the 532nm FOV to characterize the 532nm energy signal strength and shape. Each dwell is for two orbits.
Adjust 532nm FOV center X/Y to 2080/2020	2005/326-22:09:26.000	11/22/2005-22:09:26.000	532nm FOV dwell at next X/Y position
Adjust 532nm FOV center X/Y to 2090/2010	2005/327-01:22:44.000	11/23/2005-01:22:44.000	532nm FOV dwell at next X/Y position
Adjust 532nm FOV center X/Y to 2100/2030	2005/327-04:36:02.000	11/23/2005-04:36:02.000	532nm FOV dwell at next X/Y position
Adjust etalon to 44C	2005/327-07:00:00.000	11/23/2005-07:00:00.000	Execute a sweep of etalon temperatures at the end of the campaign to characterize the

			etalon behavior for Laser 3.
Adjust 532nm FOV center X/Y to 2080/2010	2005/327-07:49:20.000	11/23/2005-07:49:20.000	532nm FOV dwells complete; return to estimated best center.
Adjust etalon to 42.9C	2005/327-09:00:00.000	11/23/2005-09:00:00.000	Continue etalon sweep
Adjust etalon to 42.4C	2005/327-11:00:00.000	11/23/2005-11:00:00.000	Continue etalon sweep
Adjust etalon to 41.9C	2005/327-13:00:00.000	11/23/2005-13:00:00.000	Continue etalon sweep
Adjust etalon to 40.9C	2005/327-15:00:00.000	11/23/2005-15:00:00.000	Continue etalon sweep
Adjust etalon to 40.4C	2005/327-17:00:00.000	11/23/2005-17:00:00.000	Continue etalon sweep
Adjust etalon to 39.9C	2005/327-19:00:00.000	11/23/2005-19:00:00.000	Continue etalon sweep
Adjust etalon to 39.4C	2005/327-21:00:00.000	11/23/2005-21:00:00.000	Continue etalon sweep
Adjust etalon to 38.9C	2005/327-23:00:00.000	11/23/2005-23:00:00.000	Complete etalon sweep
Disable Laser 3 Firing	2005/328-01:09:20	11/24/2005-01:09:20	Complete campaign L3d

CAMPAIGN L3e COMMAND TABLE

Commanded instrument activities during the Laser 3e campaign (February 22 - March 28, 2006)

Activity	**Date/Tme (YYYY/DOY - hh:mm:ss.sss)**	**Date/Tme (MM/DD/YYYY - hh:mm:ss.sss)**	**Notes**
Enable Laser 3 firing	2006/053-20:37:10	02/22/2006-20:37:10	Start of campaign L3e
Update the AGC algorithm's initial Z values with a load to flight software table 443.	2006/065-17:47:54	03/06/2006-17:47:54	Per engineering team recommendation to compensate for the lower transmit peak. The new Z_init values are: z1_init=3.0 z2_init=6.5 z3_init=3.0 z4_init=3.0 The Z_init values were: z1_init=0.3 z2_init=3.0 z3_init=0.3 z4_init=0.3
Adjust 532nm FOV center X/Y to 2090/2010	2006/080-14:58:42.000	03/21/2006-14:58:42.000	Series of dwells at different locations in the 532nm FOV to characterize the 532nm energy signal strength and shape. Each dwell is for two orbits.
Adjust 532nm FOV center X/Y to 2080/2020	2006/080-18:12:00.000	03/21/2006-18:12:00.000	532nm FOV dwell at next X/Y position

Adjust 532nm FOV center X/Y to 2070/2000	2006/080-21:25:18.000	03/21/2006-21:25:18.000	532nm FOV dwell at next X/Y position
Adjust 532nm FOV center X/Y to 2075/2005	2006/081-00:38:36.000	03/22/2006-00:38:36.000	532nm FOV dwell at next X/Y position
Adjust 532nm FOV center X/Y to 2080/2010	2006/081-03:51:54.000	03/22/2006-03:51:54.000	532nm FOV dwells complete; return to estimated best center.
Return gain fixed to 26	2006/082-19:56:41.00	03/23/2006-19:56:41.00	Range Calibration Data Collection during Uyuni overpass
Auto gain enabled	2006/082-20:03:58.00	03/23/2006-20:03:58.00	Test complete
Adjust etalon to 44C	2006/086-06:00:00.000	03/27/2006-06:00:00.000	Execute a sweep of etalon temperatures at the end of the campaign to characterize the etalon behavior for Laser 3.
Adjust etalon to 42.9C	2006/086-08:00:00.000	03/27/2006-08:00:00.000	Continue etalon sweep
Adjust etalon to 42.4C	2006/086-10:00:00.000	03/27/2006-10:00:00.000	Continue etalon sweep
Adjust etalon to 41.9C	2006/086-12:00:00.000	03/27/2006-12:00:00.000	Continue etalon sweep
Adjust etalon to 40.9C	2006/086-14:00:00.000	03/27/2006-14:00:00.000	Continue etalon sweep
Adjust etalon to 40.4C	2006/086-16:00:00.000	03/27/2006-16:00:00.000	Continue etalon sweep
Adjust etalon to 39.9C	2006/086-18:00:00.000	03/27/2006-18:00:00.000	Continue etalon sweep
Adjust etalon to 39.4C	2006/086-20:00:00.000	03/27/2006-20:00:00.000	Continue etalon sweep
Set Transmit gain (Tx gain) to 120	2006/086-21:34:02.000	03/27/2006-21:34:02.000	Engineering Tests to optimize the energy calculation and return signal strength: 1. Sweep of transmit gain (Tx gain) setting
Set Tx gain to 140	2006/086-21:34:31.000	03/27/2006-21:34:31.000	Continue Tx gain sweep
Set Tx gain to 160	2006/086-21:35:00.000	03/27/2006-21:35:00.000	Continue Tx gain sweep
Set Tx gain to 180	2006/086-21:35:29.000	03/27/2006-21:35:29.000	Continue Tx gain sweep
Set Tx gain to 200	2006/086-21:35:58.000	03/27/2006-21:35:58.000	Continue Tx gain sweep
Set Tx gain to 225	2006/086-21:36:27.000	03/27/2006-21:36:27.000	Continue Tx gain sweep
Set Tx gain to 250	2006/086-21:36:56.000	03/27/2006-21:36:56.000	Complete Tx gain sweep
Lower transmit threshold (Tx threshold) to 45	2006/086-21:37:25.000	03/27/2006-21:37:25.000	Execute a Tx gain sweep at lower transmit threshold (Tx threshold)
Set Tx gain to 100	2006/086-21:37:29.000	03/27/2006-21:37:29.000	Sweep of Tx gain settings
Set Tx gain to 80	2006/086-21:37:58.000	03/27/2006-21:37:58.000	Continue Tx gain sweep
Set Tx gain to 70	2006/086-21:38:27.000	03/27/2006-21:38:27.000	Continue Tx gain sweep
Set Tx gain to 60	2006/086-21:38:56.000	03/27/2006-21:38:56.000	Continue Tx gain sweep

Set Tx gain to 50	2006/086-21:39:25.000	03/27/2006-21:39:25.000	Continue Tx gain sweep
Set Tx gain to 40	2006/086-21:39:54.000	03/27/2006-21:39:54.000	Continue Tx gain sweep
Set Tx gain to 120	2006/086-21:40:27.000	03/27/2006-21:40:27.000	Complete Tx gain sweep
Set Tx threshold to 35	2006/086-21:40:31.000	03/27/2006-21:40:31.000	2: Sweep through Tx threshold setting keeping the Tx gain fixed to 120 counts
Set Tx threshold to 40	2006/086-21:40:56.000	03/27/2006-21:40:56.000	Continue Tx threshold sweep
Set Tx threshold to 50	2006/086-21:41:21.000	03/27/2006-21:41:21.000	Continue Tx threshold sweep
Set Tx threshold to 60	2006/086-21:41:46.000	03/27/2006-21:41:46.000	Continue Tx threshold sweep
Set Tx threshold to 70	2006/086-21:42:11.000	03/27/2006-21:42:11.000	Continue Tx threshold sweep
Set Tx threshold to 80	2006/086-21:42:36.000	03/27/2006-21:42:36.000	Continue Tx threshold sweep
Set Tx threshold to 90	2006/086-21:43:01.000	03/27/2006-21:43:01.000	Continue Tx threshold sweep
Set Tx threshold to 100	2006/086-21:43:26.000	03/27/2006-21:43:26.000	Continue Tx threshold sweep
Set Tx threshold to 110	2006/086-21:43:51.000	03/27/2006-21:43:51.000	Continue Tx threshold sweep
Set Tx threshold to 120	2006/086-21:44:16.000	03/27/2006-21:44:16.000	Complete Tx threshold sweep
Reset Tx gain to 71	2006/086-21:44:47.000	03/27/2006-21:44:47.000	Engineering test complete; reset to operational value
Reset Tx threshold to 80	2006/086-21:44:51.000	03/27/2006-21:44:51.000	Engineering test complete; reset to operational value
Adjust etalon to 38.9C	2006/086-22:00:00.000	03/27/2006-22:00:00.000	Complete etalon sweep
Lower the AGC algorithm's filter weight to 60 with a load to flight software table 443.	06/086-22:48:51	03/27/2006-22:48:51	Current filter weight is 150; lower filter weight may improve AGC results.
Set Tx gain to 120	2006/086-23:10:02.000	03/27/2006-23:10:02.000	Repeat Engineering Test: 1. Sweep of Tx gain setting
Set Tx gain to 140	2006/086-23:10:31.000	03/27/2006-23:10:31.000	Continue Tx gain sweep
Set Tx gain to 160	2006/086-23:11:00.000	03/27/2006-23:11:00.000	Continue Tx gain sweep
Set Tx gain to 180	2006/086-23:11:29.000	03/27/2006-23:11:29.000	Continue Tx gain sweep
Set Tx gain to 200	2006/086-23:11:58.000	03/27/2006-23:11:58.000	Continue Tx gain sweep
Set Tx gain to 225	2006/086-23:12:27.000	03/27/2006-23:12:27.000	Continue Tx gain sweep
Set Tx gain to 250	2006/086-23:12:56.000	03/27/2006-23:12:56.000	Complete Tx gain sweep
Set Tx threshold to 45	2006/086-23:13:25.000	03/27/2006-23:13:25.000	Lower Tx threshold
Set Tx gain to 100	2006/086-23:13:29.000	03/27/2006-23:13:29.000	Sweep lower Tx gain settings
Set Tx gain to 80	2006/086-23:13:58.000	03/27/2006-23:13:58.000	Continue Tx gain sweep
Set Tx gain to 70	2006/086-23:14:27.000	03/27/2006-23:14:27.000	Continue Tx gain sweep
Set Tx gain to 60	2006/086-23:14:56.000	03/27/2006-23:14:56.000	Continue Tx gain sweep
Set Tx gain to 50	2006/086-23:15:25.000	03/27/2006-23:15:25.000	Continue Tx gain sweep

Set Tx gain to 40	2006/086-23:15:54.000	03/27/2006-23:15:54.000	Continue Tx gain sweep
Set Tx gain to 120	2006/086-23:16:27.000	03/27/2006-23:16:27.000	Complete Tx gain sweep
Set Tx threshold to 35	2006/086-23:16:31.000	03/27/2006-23:16:31.000	2. Sweep through Tx threshold settings with Tx gain fixed to 120 counts
Set Tx threshold to 40	2006/086-23:16:56.000	03/27/2006-23:16:56.000	Continue Tx threshold sweep
Set Tx threshold to 50	2006/086-23:17:21.000	03/27/2006-23:17:21.000	Continue Tx threshold sweep
Set Tx threshold to 60	2006/086-23:17:46.000	03/27/2006-23:17:46.000	Continue Tx threshold sweep
Set Tx threshold to 70	2006/086-23:18:11.000	03/27/2006-23:18:11.000	Continue Tx threshold sweep
Set Tx threshold to 80	2006/086-23:18:36.000	03/27/2006-23:18:36.000	Continue Tx threshold sweep
Set Tx threshold to 90	2006/086-23:19:01.000	03/27/2006-23:19:01.000	Continue Tx threshold sweep
Set Tx threshold to 100	2006/086-23:19:26.000	03/27/2006-23:19:26.000	Continue Tx threshold sweep
Set Tx threshold to 110	2006/086-23:19:51.000	03/27/2006-23:19:51.000	Continue Tx threshold sweep
Set Tx threshold to 120	2006/086-23:20:16.000	03/27/2006-23:20:16.000	Complete Tx threshold sweep
Reset Tx gain to 71	2006/086-23:20:47.000	03/27/2006-23:20:47.000	Engineering test complete; reset to operational value
Reset Tx threshold to 80	2006/086-23:20:51.000	03/27/2006-23:20:51.000	Engineering test complete; reset to operational value
Reset the AGC algorithm's filter weight to 150 with a load to flight software table 443.	06/087-00:15:56	03/28/2006-00:15:56	Complete test of lower filter weight.
Set the background noise coefficient, A1 to 5.0 for all filters.	06/087-00:16:26	03/28/2006-00:16:26	Current setting is 7.0; test lower value's impact on AGC results. Note: A1 reset to 7.0 after campaign L3e completion.
Disable Laser 3 firing	06/087-01:52:55	03/28/2006-01:52:55	Complete campaign L3e

CAMPAIGN L3f COMMAND TABLE

Commanded instrument activities during the Laser 3f campaign (May 24 - June 26, 2006)

Activity	**Date/Tme (YYYY/DOY - hh:mm:ss.sss)**	**Date/Tme (MM/DD/YYYY - hh:mm:ss.sss)**	**Notes**
Enable Laser 3 firing	2006/144-17:43:27	05/24/2006-17:43:27	Start of Campaign L3f
Adjust etalon to 41.1C	2006/144-19:27:36.000	05/24/2006-19:27:36	To determine optimal etalon setting
Adjust etalon to 41.4C	2006/144-21:05:55.000	05/24/2006-21:05:55	To determine optimal etalon setting

Adjust etalon to 41.6C	2006/144-22:43:55.000	05/24/2006-22:43:55	To determine optimal etalon setting
LRS lockup	2006/167-18:00:00	06/16/2006-18:00:00	LRS lockup; time approximate
LRS power off	2006/168-00:44:06	06/17/2006-00:44:06	Power off LRS to stop error messages.
LRS power on	2006/168-16:47:04	06/17/2006-16:47:04	Power on LRS; start recovery
Configure LRS	2006/168-21:33:54	06/17/2006-21:33:54	LRS recovery complete
Return gain fixed to 250	2006/173-17:03:04.00	06/22/2006-17:03:04.00	Range Calibration Data Collection during Uyuni overpass
Auto return gain enabled	2006/173-17:10:21.00	06/22/2006-17:10:21.00	Test complete
Adjust 532nm FOV center X/Y to 2085/2005	2006/175-14:20:47.000	06/24/2006-14:20:47	Series of dwells at different locations in the 532nm FOV to characterize the 532nm energy signal strength and shape. Each dwell is for two orbits.
Adjust 532nm FOV center X/Y to 2085/2015	2006/175-17:34:05.000	06/24/2006-17:34:05	532nm FOV dwell at next X/Y position
Adjust 532nm FOV center X/Y to 2075/2015	2006/175-20:47:23.000	06/24/2006-20:47:23	532nm FOV dwell at next X/Y position
Adjust 532nm FOV center X/Y to 2070/2010	2006/176-00:00:42.000	06/25/2006-00:00:42	532nm FOV dwell at next X/Y position
Adjust 532nm FOV center X/Y to 2080/2010	2006/176-03:14:00.000	06/25/2006-03:14:00	532nm FOV dwells complete; return to estimated best center.
Adjust etalon to 44C	2006/176-21:00:00.000	06/25/2006-21:00:00	Execute a sweep of etalon temperatures at the end of the campaign to characterize the etalon behavior for Laser 3.
Adjust etalon to 42.9C	2006/176-23:00:00.000	06/25/2006-23:00:00	Continue etalon sweep
Adjust etalon to 42.4C	2006/177-01:00:00.000	06/26/2006-01:00:00	Continue etalon sweep
Adjust etalon to 41.9C	2006/177-03:00:00.000	06/26/2006-03:00:00	Continue etalon sweep
Adjust etalon to 40.9C	2006/177-05:00:00.000	06/26/2006-05:00:00	Continue etalon sweep
Adjust etalon to 40.4C	2006/177-07:00:00.000	06/26/2006-07:00:00	Continue etalon sweep
Adjust etalon to 39.9C	2006/177-09:00:00.000	06/26/2006-09:00:00	Continue etalon sweep
Adjust etalon to 39.4C	2006/177-11:00:00.000	06/26/2006-11:00:00	Continue etalon sweep
Adjust etalon to 38.9C	2006/177-13:00:00.000	06/26/2006-13:00:00	Continue etalon sweep
Adjust etalon to 41.6C	2006/177-15:00:00.000	06/26/2006-15:00:00	Complete etalon sweep
Disable Laser 3 firing	2006/177-18:17:51	06/26/2006-18:17:51	Complete campaign L3f

CAMPAIGN L3g COMMAND TABLE

Commanded instrument activities during the Laser 3g campaign (October 25 - November 27, 2006)

Activity	Date/Tme (YYYY/DOY - hh:mm:ss.sss)	Date/Tme (MM/DD/YYYY - hh:mm:ss.sss)	Notes
Enable Laser 3 firing	2006/298-12:49:38	10/25/2006-12:49:38	Start of Campaign L3g
Adjust etalon to 41.1C	2006/298-15:45:18.000	10/25/2006-15:45:18	To determine optimal etalon setting
Adjust etalon to 41.4C	2006/298-17:21:57.000	10/25/2006-17:21:57	To determine optimal etalon setting
Adjust etalon to 41.6C	2006/298-18:58:36.000	10/25/2006-18:58:36	To determine optimal etalon setting
Adjust 532nm FOV center X/Y to 2085/2005	2006/315-15:13:09.000	11/11/2006-15:13:09	Series of dwells at different locations in the 532nm FOV to characterize the 532nm energy signal strength and shape. Each dwell is for two orbits.
Adjust 532nm FOV center X/Y to 2085/2015	2006/315-18:26:27.000	11/11/2006-18:26:27	532nm FOV dwell at next X/Y position
Adjust 532nm FOV center X/Y to 2075/2015	2006/315-21:39:45.000	11/11/2006-21:39:45	532nm FOV dwell at next X/Y position
Adjust 532nm FOV center X/Y to 2070/2010	2006/316-00:53:04.000	11/12/2006-00:53:04	532nm FOV dwell at next X/Y position
Adjust 532nm FOV center X/Y to 2080/2010	2006/316-04:06:22.000	11/12/2006-04:06:22	532nm FOV dwells complete; return to estimated best center.
Return gain fixed to 128	2006/327-12:08:59.99	11/23/2006-12:08:59.99	Range Calibration Data Collection during Uyuni overpass
Auto return gain enabled	2006/327-12:16:17.00	11/23/2006-12:16:17.00	Test complete
Adjust etalon to 44C	2006/330-22:15:00.000	11/26/2006-22:15:00	Execute a sweep of etalon temperatures at the end of the campaign to characterize the etalon behavior for Laser 3.
Adjust etalon to 42.9C	2006/331-00:15:00.000	11/27/2006-00:15:00	Continue etalon sweep
Adjust etalon to 42.4C	2006/331-02:15:00.000	11/27/2006-02:15:00	Continue etalon sweep
Adjust etalon to 41.9C	2006/331-04:15:00.000	11/27/2006-04:15:00	Continue etalon sweep
Adjust etalon to 40.9C	2006/331-06:15:00.000	11/27/2006-06:15:00	Continue etalon sweep
Adjust etalon to 40.4C	2006/331-08:15:00.000	11/27/2006-08:15:00	Continue etalon sweep
Adjust etalon to 39.9C	2006/331-10:15:00.000	11/27/2006-10:15:00	Continue etalon sweep
Adjust etalon to 39.4C	2006/331-12:15:00.000	11/27/2006-12:15:00	Continue etalon sweep

Set transmit threshold (Tx threshold) to 45	2006/331-13:27:58.000	11/27/2006-13:27:58	Engineering Tests to optimize the energy calculation and return signal strength: 1. Sweep of transmit gain (Tx gain) setting with Tx threshold = 45
Set Tx gain to 100	2006/331-13:28:02.000	11/27/2006-13:28:02	Sweep of Tx gain settings
Set Tx gain to 80	2006/331-13:28:31.000	11/27/2006-13:28:31	Continue Tx gain sweep
Set Tx gain to 70	2006/331-13:29:00.000	11/27/2006-13:29:00	Continue Tx gain sweep
Set Tx gain to 60	2006/331-13:29:29.000	11/27/2006-13:29:29	Continue Tx gain sweep
Set Tx gain to 40	2006/331-13:29:58.000	11/27/2006-13:29:58	Continue Tx gain sweep
Set Tx gain to 30	2006/331-13:30:27.000	11/27/2006-13:30:27	Continue Tx gain sweep
Set Tx gain to 20	2006/331-13:30:56.000	11/27/2006-13:30:56	Continue Tx gain sweep
Set Tx gain to 15	2006/331-13:31:25.000	11/27/2006-13:31:25	Continue Tx gain sweep
Set Tx gain to 13	2006/331-13:31:54.000	11/27/2006-13:31:54	Continue Tx gain sweep
Set Tx gain to 10	2006/331-13:32:23.000	11/27/2006-13:32:23	Complete Tx gain sweep
Set Tx threshold to 35	2006/331-13:32:50.000	11/27/2006-13:32:50	Engineering Tests: 2. Sweep of Tx gain setting with Tx threshold = 35
Set Tx gain to 100	2006/331-13:32:54.000	11/27/2006-13:32:54	Sweep of Tx gain settings
Set Tx gain to 80	2006/331-13:33:23.000	11/27/2006-13:33:23	Continue Tx gain sweep
Set Tx gain to 70	2006/331-13:33:52.000	11/27/2006-13:33:52	Continue Tx gain sweep
Set Tx gain to 60	2006/331-13:34:21.000	11/27/2006-13:34:21	Continue Tx gain sweep
Set Tx gain to 40	2006/331-13:34:50.000	11/27/2006-13:34:50	Continue Tx gain sweep
Set Tx gain to 30	2006/331-13:35:19.000	11/27/2006-13:35:19	Continue Tx gain sweep
Set Tx gain to 20	2006/331-13:35:48.000	11/27/2006-13:35:48	Continue Tx gain sweep
Set Tx gain to 15	2006/331-13:36:17.000	11/27/2006-13:36:17	Continue Tx gain sweep
Set Tx gain to 13	2006/331-13:36:46.000	11/27/2006-13:36:46	Continue Tx gain sweep
Set Tx gain to 10	2006/331-13:37:15.000	11/27/2006-13:37:15	Complete Tx gain sweep
Set Tx gain to 100	2006/331-13:37:44.000	11/27/2006-13:37:44	Engineering test complete; Set Tx Gain to 100 for the rest of the campaign
Set Tx threshold to 80	2006/331-13:37:48.000	11/27/2006-13:37:48	Engineering test complete; reset to operational value
Set transmit threshold (Tx threshold) to 45	2006/331-14:07:58.000	11/27/2006-14:07:58	Repeat Engineering Test: 1. Sweep of Tx gain setting with Tx threshold = 45
Set Tx gain to 100	2006/331-14:08:02.000	11/27/2006-14:08:02	Sweep of Tx gain settings
Set Tx gain to 80	2006/331-14:08:31.000	11/27/2006-14:08:31	Continue Tx gain sweep
Set Tx gain to 70	2006/331-14:09:00.000	11/27/2006-14:09:00	Continue Tx gain sweep

Set Tx gain to 60	2006/331-14:09:29.000	11/27/2006-14:09:29	Continue Tx gain sweep
Set Tx gain to 40	2006/331-14:09:58.000	11/27/2006-14:09:58	Continue Tx gain sweep
Set Tx gain to 30	2006/331-14:10:27.000	11/27/2006-14:10:27	Continue Tx gain sweep
Set Tx gain to 20	2006/331-14:10:56.000	11/27/2006-14:10:56	Continue Tx gain sweep
Set Tx gain to 15	2006/331-14:11:25.000	11/27/2006-14:11:25	Continue Tx gain sweep
Set Tx gain to 13	2006/331-14:11:54.000	11/27/2006-14:11:54	Continue Tx gain sweep
Set Tx gain to 10	2006/331-14:12:23.000	11/27/2006-14:12:23	Complete Tx gain sweep
Set Tx threshold to 35	2006/331-14:12:50.000	11/27/2006-14:12:50	Repeat Engineering Tests: 2. Sweep of Tx gain setting with Tx threshold = 35
Set Tx gain to 100	2006/331-14:12:54.000	11/27/2006-14:12:54	Sweep of Tx gain settings
Set Tx gain to 80	2006/331-14:13:23.000	11/27/2006-14:13:23	Continue Tx gain sweep
Set Tx gain to 70	2006/331-14:13:52.000	11/27/2006-14:13:52	Continue Tx gain sweep
Set Tx gain to 60	2006/331-14:14:21.000	11/27/2006-14:14:21	Continue Tx gain sweep
Set Tx gain to 40	2006/331-14:14:50.000	11/27/2006-14:14:50	Continue Tx gain sweep
Adjust etalon to 38.9C	2006/331-14:15:00.000	11/27/2006-14:15:00	Complete etalon sweep
Set Tx gain to 30	2006/331-14:15:19.000	11/27/2006-14:15:19	Continue Tx gain sweep
Set Tx gain to 20	2006/331-14:15:48.000	11/27/2006-14:15:48	Continue Tx gain sweep
Set Tx gain to 15	2006/331-14:16:17.000	11/27/2006-14:16:17	Continue Tx gain sweep
Set Tx gain to 13	2006/331-14:16:46.000	11/27/2006-14:16:46	Continue Tx gain sweep
Set Tx gain to 10	2006/331-14:17:15.000	11/27/2006-14:17:15	Complete Tx gain sweep
Set Tx gain to 100	2006/331-14:17:44.000	11/27/2006-14:17:44	Engineering test complete; Set Tx Gain to 100 for the rest of the campaign
Set Tx threshold to 80	2006/331-14:17:48.000	11/27/2006-14:17:48	Engineering test complete; reset to operational value
Update AGC parameters A1, A2, A3, A4, B1, B2, B3, B4	2006/331-15:39:20	11/27/2006-15:39:20	Test AGC parameters to attempt to speed up the AGC loop processing to reduce the amount of saturated returns during the gain transition. A1= -1.364, A2=1.364, A3=1.228, A=0.0, B1=0.08558, B2= 0.8347, B3=0.0, B4= 0.0
Reset AGC parameters A1, A2, A3, A4, B1, B2, B3, B4	2006/331-15:57:59	11/27/2006-15:57:59	Reset AGC parameters A1=-0.6170, A2=0.6170, A3=0.6090, A4=0.0D, B1=0.0, B2=0.9030, B3=0.0, B4=0.0
Disable Laser 3 firing	2006/331-16:38:10	11/27/2006-16:38:10	Complete campaign L3g

CAMPAIGN L3h COMMAND TABLE

Commanded instrument activities during the Laser 3h campaign (March 12 - April 14, 2007)

Activity	**Date/Tme (YYYY/DOY - hh:mm:ss.sss)**	**Date/Tme (MM/DD/YYYY - hh:mm:ss.sss)**	**Notes**
Enable laser 3 firing	2007/071-02:05:25	03/12/2007-02:05:25	Start of campaign L3h
Return gain fixed to 80	2007/100-07:45:17.00	04/10/2007-07:45:17.00	Range Calibration Data Collection during Uyuni overpass
Auto return gain enabled	2007/100-07:52:34.00	04/10/2007-07:52:34.00	Test complete
Adjust etalon to 44C	2007/103-14:20:00.000	04/13/2007-14:20:00	Execute a sweep of etalon temperatures at the end of the campaign to characterize the etalon behavior for Laser 3.
Adjust etalon to 42.9C	2007/103-16:20:00.000	04/13/2007-16:20:00	Continue etalon sweep
Adjust etalon to 42.4C	2007/103-18:20:00.000	04/13/2007-18:20:00	Continue etalon sweep
Adjust etalon to 41.9C	2007/103-20:20:00.000	04/13/2007-20:20:00	Continue etalon sweep
Adjust etalon to 40.9C	2007/103-22:20:00.000	04/13/2007-22:20:00	Continue etalon sweep
Adjust etalon to 40.4C	2007/104-00:20:00.000	04/14/2007-00:20:00	Continue etalon sweep
Adjust etalon to 39.9C	2007/104-02:20:00.000	04/14/2007-02:20:00	Continue etalon sweep
Adjust etalon to 39.4C	2007/104-04:20:00.000	04/14/2007-04:20:00	Continue etalon sweep
Adjust etalon to 38.9C	2007/104-06:20:00.000	04/14/2007-06:20:00	Continue etalon sweep
Adjust etalon to 41.7C	2007/104-08:20:00.000	04/14/2007-08:20:00	Complete etalon sweep
Set AGC algorithm weight limit to 80 with a flight software table 443 load	2007/104-10:37:36	04/14/2007-10:37:36	Test AGC algorithm weight to determine if lower values keep saturated return rates low while allowing the gain to increase. Test 1: weight = 80
Set AGC algorithm weight limit to 0 with a flight software table 443 load	2007/104-13:50:45	04/14/2007-13:50:45	test 2: weight = 0; Weight reset to 150 after campaign is completed.
Disable Laser 3 firing	2007/104-17:03:41	04/14/2007-17:03:41	Complete campaign L3h

CAMPAIGN L3i COMMAND TABLE

Commanded instrument activities during the Laser 3i campaign (October 2 - November 5, 2007)

Activity	**Date/Tme (YYYY/DOY - hh:mm:ss.sss)**	**Date/Tme (MM/DD/YYYY - hh:mm:ss.sss)**	**Notes**
Enable Laser 3 firing	2007/275-21:10:26	10/02/2007-21:10:26	Start of campaign L3i
Adjust etalon to 41.4C	2007/276-00:00:29.000	10/03/2007-00:00:29.000	To determine optimal etalon setting
Adjust etalon to 41.6C	2007/276-01:37:08.000	10/03/2007-01:37:08.000	To determine optimal etalon setting
Adjust etalon to 41.7C	2007/276-03:13:47.000	10/03/2007-03:13:47.000	To determine optimal etalon setting
LRS Lockup	2007/280-15:00:00	10/07/2007-15:00:00	LRS in hung state; time approximate
Power cycle LRS	2007/280-21:57:22	10/07/2007-21:57:22	Power cycle LRS and start recovery
Configure LRS	2007/280-23:29:36	10/07/2007-23:29:36	Configure LRS; recovery complete
Return gain fixed to 250	2007/305-16:26:44.00	11/01/2007-16:26:44.00	Range Calibration Data Collection during Bonneville overpass
Auto return gain enabled	2007/305-16:33:53.00	11/01/2007-16:33:53.00	Test complete
LRS Lockup	2007/306-17:00	11/02/2007-17:00	LRS in hung state; time approximate
LRS power cycle	2007/306-19:36:40	11/02/2007-19:36:40	Power cycle LRS and start recovery
Configure LRS	2007/306-21:17:17	11/02/2007-21:17:17	Configure LRS; recovery complete
Set AGC algorithm filter weight limit to -1000 and gain peak limit to 0 via a flight software table 443 load	2007/308-23:12:32	11/04/2007-23:12:32	Test whether settings will bypass the AGC patch allowing the AGC algorithm to operate as originally designed (pre-launch).
Set AGC algorithm filter weight limit to 80 and gain peak limit to 35 via a flight software table 443 load	2007/309-00:49:52	11/05/2007-00:49:52	Test whether settings reduce the number of times the AGC algorithm is called keeping saturated return rate low and allowing the AGC algorithm to operate as originally designed (this test was also executed at the end of L3i). Filter weight limit= 80 will be used for subsequent campaigns.
Disable laser 3 firing	2007/309-02:28:35	11/05/2007-02:28:35	Complete campaign L3i

CAMPAIGN L3j COMMAND TABLE

Commanded instrument activities during the Laser 3i campaign (February 17 - March 21, 2008)

Activity	Date/Tme (YYYY/DOY - hh:mm:ss.sss)	Date/Tme (MM/DD/YYYY - hh:mm:ss.sss)	Notes
Enable laser 3 firing	2008/048-19:52:21	02/17/2008-19:52:21	Start of campaign L3j
LRS Lockup	2008/053-03:45:00	02/22/2008-03:45:00	LRS in hung state; time approximate
LRS power cycle	2008/053-12:35:14	02/22/2008-12:35:14	Power cycle LRS and start recovery
Configure LRS	2008/053-20:42:40	02/22/2008-20:42:40	Configure LRS VT1 only (operating in full sun; glint in trackers could be causing s/w hangup; recovery complete.
Clear transmit peak failure flag	2008/060-23:25:29	02/29/2008-23:25:29	Flag is latched upon a transmit peak value not reaching the threshold; must be cleared by ground command
Return gain fixed to 40	2008/077-20:50:15.00	03/17/2008-20:50:15.00	Range Calibration Data Collection during Uyuni overpass
Auto return gain enabled	2008/077-20:57:32.00	03/17/2008-20:57:32.00	Test complete
Set transmit gain to 128	2008/080-17:02:47	03/20/2008-17:02:47	Upon engineering team request due to lower transmit energy
Load patch to remove AGC algorithm bypass	2008/081-18:53:55	03/21/2008-18:53:55	Bypass was invoked when a weak signal return is detected assuming that the return is from a cloud not the ground. With the low Laser 3 energy weak returns can be an actual ground return therefore, the AGC algorithm should be invoked.
Disable Laser 3 firing	2008/081-23:34:49	03/21/2008-23:34:49	Complete Campaign L3j

CAMPAIGN L3k COMMAND TABLE

Commanded instrument activities during the Laser 3k campaign (October 4 - October 19, 2008)

Activity	Date/Tme (YYYY/DOY - hh:mm:ss.sss)	Date/Tme (MM/DD/YYYY - hh:mm:ss.sss)	Notes
Enable Laser 3 firing	2008/278-14:13:12	10/04/2008-14:13:12	Start of Campaign L3k
Adjust etalon to 41.4C	2008/278-17:03:09.000	10/04/2008-17:03:09.000	To determine optimal etalon

			setting
Adjust etalon to 41.6C	2008/278-18:39:48.000	10/04/2008-18:39:48.000	To determine optimal etalon setting
Adjust etalon to 41.7C	2008/278-20:16:27.000	10/04/2008-20:16:27.000	To determine optimal etalon setting
Power on SPCMs	2008/280-17:41:55	10/06/2008-17:41:55	Due to s/c power SPCM power-on delayed until after laser startfire
Adjust 532nm FOV center X/Y to 2080/2010	2008/280-17:42:28	10/06/2008-17:42:28	Reset FOV center after SPCM power-on
Clear transmit peak failure flag	2008/282-22:58:31	10/08/2008-22:58:31	Flag is latched upon a transmit peak value not reaching the threshold; must be cleared by ground command
Laser 3 stopped firing	2008/293-02:00:00	10/19/2008-02:00:00	Laser 3 abruptly stopped firing ending campaign L3k.; time is approximate.

Appendix I: Command Tables for the Laser 2 Campaigns (d - f)

CAMPAIGN L2d COMMAND TABLE

Commanded instrument activities during the Laser 2d campaign (November 25 - December 17, 2008)

Activity	Date/Tme (YYYY/DOY - hh:mm:ss.sss)	Date/Tme (MM/DD/YYYY - hh:mm:ss.sss)	Notes
Enable Laser 2 firing	2008/330-17:49:03	11/25/2008-17:49:03	Start of Campaign L2d
Set etalon to 43C	2008/330-22:22:19.000	11/25/2008-22:22:19.000	Etalon sweep to determine optimum etalon temperature for Laser 2 operations
Set etalon to 42.5C	2008/330-23:58:58.000	11/25/2008-23:58:58.000	continue etalon sweep
Set etalon to 42C	2008/331-01:35:37.000	11/26/2008-01:35:37.000	continue etalon sweep
Set etalon to 41.5C	2008/331-03:12:17.000	11/26/2008-03:12:17.000	continue etalon sweep
Set etalon to 41C	2008/331-04:48:56.000	11/26/2008-04:48:56.000	continue etalon sweep
Set etalon to 40.5C	2008/331-06:25:35.000	11/26/2008-06:25:35.000	continue etalon sweep
Set etalon to 40C	2008/331-08:02:14.000	11/26/2008-08:02:14.000	continue etalon sweep
Set etalon to 41.8C	2008/331-09:38:53.000	11/26/2008-09:38:53.000	complete etalon sweep
Start 532nm boresight scan	2008/331-10:04:04.000	11/26/2008-10:04:04.000	Initial calibration for Laser 2
Scan complete	2008/331-10:31:08.000	11/26/2008-10:31:08.000	Back to PC science mode
Adjust 532nm FOV center X/Y to 2090/2020	2008/331-10:31:10.000	11/26/2008-10:31:10.000	Adjust to estimated best center based on campaign L2c
Set the background noise coefficient, A1, to 5.0 for all filters.	2008/331-17:56:17	11/26/2008-17:56:17	To lower the calculated filter threshold to improve the return signal detection rate at the low 1064nm transmit energy. Current setting was 7.0.
Adjust LPA box coordinates to 32,22	2008/331-17:56:46	11/26/2008-17:56:46	To center the laser spot in the LPA FOV.
Set the background noise coefficient, A1, to 4.0 for all filters.	2008/338-22:29:51	12/03/2008-22:29:51	To compensate for the low transmit energy
Set the transmit pulse threshold to 60	2008/338-22:30:10	12/03/2008-22:30:10	Lower the threshold from 80 to improve the peak and shape of the transmit pulse to compensate for the low transmit energy
Adjust LRS VT1 settings: ROW=248, COL=256, TT=10, TEE=5	2008/340-17:47:14	12/05/2008-17:47:14	As the 1064nm transmit energy gets lower, LRS VT1 is not able to distinguish the laser spot from stray light and is not

			tracking efficiently; settings adjusted to improve tracking.
Raise laser temperature to 22C - start	2008/343-06:20:00.000	12/08/2008-06:20:00.000	per GARB recommendation to attempt to increase the laser output - adjust laser temperature at the rate of 0.1C per 50 minutes
Raise laser temperature to 22C - complete	2008/344-19:00:00.000	12/09/2008-19:00:00.000	Laser temperature adjustment completed
Adjust Etalon to 44.6C	2008/346-22:10:56	12/11/2008-22:10:56	Raise etalon temperature in response to warmer laser temperature
Adjust LRS VT1 settings: ROW=248, COL=256, TT=5, TEE=10	2008/351-22:59:50	12/16/2008-22:59:50	Settings adjusted to improve tracking and prepare for next campaign.
Adjust Etalon to 41.8C	2008/351-23:01:40	12/16/2008-23:01:40	To optimize etalon performance, previous update degraded 532nm data.
Set Transmit (Tx) threshold to 58	2008/352-12:36:34.000	12/17/2008-12:36:34.000	Engineering test: Sweep through several transmit (Tx) threshold settings to determine the optimum setting for the next campaign.
Set Tx threshold to 56	2008/352-12:36:37.000	12/17/2008-12:36:37.000	Continue Tx threshold sweep
Set Tx threshold to 54	2008/352-12:36:40.000	12/17/2008-12:36:40.000	Continue Tx threshold sweep
Set Tx threshold to 52	2008/352-12:36:43.000	12/17/2008-12:36:43.000	Continue Tx threshold sweep
Set Tx threshold to 50	2008/352-12:36:46.000	12/17/2008-12:36:46.000	Continue Tx threshold sweep
Set Tx threshold to 48	2008/352-12:36:49.000	12/17/2008-12:36:49.000	Continue Tx threshold sweep
Set Tx threshold to 46	2008/352-12:36:52.000	12/17/2008-12:36:52.000	Continue Tx threshold sweep
Set Tx threshold to 44	2008/352-12:36:55.000	12/17/2008-12:36:55.000	Continue Tx threshold sweep
Set Tx threshold to 42	2008/352-12:36:58.000	12/17/2008-12:36:58.000	Continue Tx threshold sweep
Set Tx threshold to 40	2008/352-12:37:01.000	12/17/2008-12:37:01.000	Continue Tx threshold sweep
Set Tx threshold to 38	2008/352-12:37:04.000	12/17/2008-12:37:04.000	Continue Tx threshold sweep
Set Tx threshold to 36	2008/352-12:37:07.000	12/17/2008-12:37:07.000	Continue Tx threshold sweep
Set Tx threshold to 34	2008/352-12:37:10.000	12/17/2008-12:37:10.000	Continue Tx threshold sweep
Set Tx threshold to 33	2008/352-12:37:13.000	12/17/2008-12:37:13.000	Continue Tx threshold sweep
Set Tx threshold to 60	2008/352-12:37:16.000	12/17/2008-12:37:16.000	Complete Tx threshold sweep
Set Tx threshold to 58	2008/352-15:49:52.000	12/17/2008-15:49:52.000	Repeat engineering test
Set Tx threshold to 56	2008/352-15:49:55.000	12/17/2008-15:49:55.000	Continue Tx threshold sweep
Set Tx threshold to 54	2008/352-15:49:58.000	12/17/2008-15:49:58.000	Continue Tx threshold sweep

Set Tx threshold to 52	2008/352-15:50:01.000	12/17/2008-15:50:01.000	Continue Tx threshold sweep
Set Tx threshold to 50	2008/352-15:50:04.000	12/17/2008-15:50:04.000	Continue Tx threshold sweep
Set Tx threshold to 48	2008/352-15:50:07.000	12/17/2008-15:50:07.000	Continue Tx threshold sweep
Set Tx threshold to 46	2008/352-15:50:10.000	12/17/2008-15:50:10.000	Continue Tx threshold sweep
Set Tx threshold to 44	2008/352-15:50:13.000	12/17/2008-15:50:13.000	Continue Tx threshold sweep
Set Tx threshold to 42	2008/352-15:50:16.000	12/17/2008-15:50:16.000	Continue Tx threshold sweep
Set Tx threshold to 40	2008/352-15:50:19.000	12/17/2008-15:50:19.000	Continue Tx threshold sweep
Set Tx threshold to 38	2008/352-15:50:22.000	12/17/2008-15:50:22.000	Continue Tx threshold sweep
Set Tx threshold to 36	2008/352-15:50:25.000	12/17/2008-15:50:25.000	Continue Tx threshold sweep
Set Tx threshold to 34	2008/352-15:50:28.000	12/17/2008-15:50:28.000	Continue Tx threshold sweep
Set Tx threshold to 33	2008/352-15:50:31.000	12/17/2008-15:50:31.000	Continue Tx threshold sweep
Set Tx threshold to 60	2008/352-15:50:34.000	12/17/2008-15:50:34.000	Complete Tx threshold sweep
Disable Laser 2 firing	2008/352-16:42:54	12/17/2008-16:42:54	Complete campaign L2d

CAMPAIGN L2e COMMAND TABLE

Commanded instrument activities during the Laser 2e campaign (March 9 - April 11, 2009)

Activity	**Date/Tme (YYYY/DOY - hh:mm:ss.sss)**	**Date/Tme (MM/DD/YYYY - hh:mm:ss.sss)**	**Notes**
Enable Laser 2 firing	2009/068-14:06:47	03/09/2009-14:06:47	Start of campaign L2e
Set etalon to 43C	2009/068-16:54:58.000	03/09/2009-16:54:58.000	Etalon sweep to determine optimum etalon temperature
Set etalon to 42.5C	2009/068-18:31:37.000	03/09/2009-18:31:37.000	continue etalon sweep
Set etalon to 42C	2009/068-20:08:16.000	03/09/2009-20:08:16.000	continue etalon sweep
Set etalon to 41.5C	2009/068-21:44:55.000	03/09/2009-21:44:55.000	continue etalon sweep
Set etalon to 41C	2009/068-23:21:34.000	03/09/2009-23:21:34.000	continue etalon sweep
Set etalon to 40.5C	2009/069-00:58:14.000	03/10/2009-00:58:14.000	continue etalon sweep
Set etalon to 40C	2009/069-02:34:53.000	03/10/2009-02:34:53.000	continue etalon sweep
Set etalon to 41.8C	2009/069-04:11:32.000	03/10/2009-04:11:32.000	complete etalon sweep
Commanded LRS VT2 offline	2009/070-20:52:12	03/11/2009-20:52:12	To avoid hangups caused by sunlight in the tracker while ICESat is in full sun (no eclipse)
Clear transmit peak failure flag	2009/070-20:52:36	03/11/2009-20:52:36	Flag is latched upon a transmit peak value not reaching the threshold; must be cleared by ground command

Set the transmit pulse threshold to 33	2009/079-17:29:06	03/20/2009-17:29:06	Lower the threshold from 60 to improve the peak and shape of the transmit pulse to compensate for the low transmit energy
Clear transmit peak failure flag	2009/082-17:57:57	03/23/2009-17:57:57	Must be cleared by ground command
Raise laser temperature to 24C - start	2009/094-18:00:00.000	04/04/2009-18:00:00.000	per GARB recommendation to attempt to increase the laser output - adjust laser temperature at the rate of 0.1C per 60 minutes
Raise laser temperature to 24C - complete	2009/095-11:00:00.000	04/05/2009-11:00:00.000	Laser temperature adjustment completed
Return gain fixed to 250	2009/097-08:33:45.00	04/07/2009-08:33:45.00	Range Calibration Data Collection during Uyuni overpass
Auto return gain enabled	2009/097-08:41:01.00	04/07/2009-08:41:01.00	Test complete
Return gain fixed to 250	2009/101-11:00:57.000	04/11/2009-11:00:57.000	Engineering Test 1: Disable the AGC algorithm to determine affect amount on good science returns.
Set Transmit (Tx) threshold to 32	2009/101-12:08:00.000	04/11/2009-12:08:00.000	Engineering test 2: sweep through several lower transmit threshold settings to determine optimum setting
Set Tx threshold to 30	2009/101-12:08:05.000	04/11/2009-12:08:05.000	Continue Tx threshold sweep
Set Tx threshold to 29	2009/101-12:08:10.000	04/11/2009-12:08:10.000	Continue Tx threshold sweep
Set Tx threshold to 28	2009/101-12:08:15.000	04/11/2009-12:08:15.000	Continue Tx threshold sweep
Set Tx threshold to 33	2009/101-12:08:20.000	04/11/2009-12:08:20.000	Complete Tx threshold sweep
Auto return gain enabled	2009/101-12:37:36.000	04/11/2009-12:37:36.000	Engineering test 1 complete.
Set Tx threshold to 32	2009/101-13:46:00.000	04/11/2009-13:46:00.000	Repeat engineering test 2
Set Tx threshold to 30	2009/101-13:46:05.000	04/11/2009-13:46:05.000	Continue Tx threshold sweep
Set Tx threshold to 29	2009/101-13:46:10.000	04/11/2009-13:46:10.000	Continue Tx threshold sweep
Set Tx threshold to 28	2009/101-13:46:15.000	04/11/2009-13:46:15.000	Continue Tx threshold sweep
Set Tx threshold to 33	2009/101-13:46:20.000	04/11/2009-13:46:20.000	Complete Tx threshold sweep
Disable Laser 2 firing	2009/101-14:30:23	04/11/2009-14:30:23	Complete campaign L2e

CAMPAIGN L2f COMMAND TABLE

Commanded instrument activities during the Laser 2f campaign (September 30 - October 11, 2009)

Activity	**Date/Tme (YYYY/DOY - hh:mm:ss.sss)**	**Date/Tme (MM/DD/YYYY - hh:mm:ss.sss)**	**Notes**
Enable Laser 2 firing	2009/273-21:57:00	09/30/2009-21:57:00	Start of campaign L2f
Power on SPCMs	2009/275-17:22:57	10/02/2009-17:22:57	Due to s/c power SPCM power-on delayed until after laser startfire
Adjust 532nm FOV center X/Y to 2090/2020	2009/275-17:23:30	10/02/2009-17:23:30	Series of dwells at different locations in the 532nm FOV to characterize the 532nm energy signal strength and shape. Each dwell is for two orbits.
Adjust 532nm FOV center X/Y to 2170/2100	2009/275-18:35:00	10/02/2009-18:35:00	532nm FOV dwell at next X/Y position
Adjust 532nm FOV center X/Y to 2090/2100	2009/276-01:01:34	10/03/2009-01:01:34	532nm FOV dwell at next X/Y position
Adjust 532nm FOV center X/Y to 2010/2100	2009/276-07:28:11	10/03/2009-07:28:11	532nm FOV dwell at next X/Y position
Adjust 532nm FOV center X/Y to 2170/2020	2009/276-13:54:47	10/03/2009-13:54:47	532nm FOV dwell at next X/Y position
Adjust 532nm FOV center X/Y to 2100/2020	2009/276-20:21:23	10/03/2009-20:21:23	532nm FOV dwell at next X/Y position
Adjust 532nm FOV center X/Y to 2170/1940	2009/277-02:47:59	10/04/2009-02:47:59	532nm FOV dwell at next X/Y position
Adjust 532nm FOV center X/Y to 2090/1940	2009/277-09:14:36	10/04/2009-09:14:36	532nm FOV dwell at next X/Y position
Adjust 532nm FOV center X/Y to 2010/1940	2009/277-15:41:12	10/04/2009-15:41:12	532nm FOV dwell at next X/Y position
Adjust 532nm FOV center X/Y to 2090/2020	2009/277-22:07:49	10/04/2009-22:07:49	532nm FOV dwells complete; return to estimated best center.
Laser 2 stopped firing	2009/284-13:30:00	10/11/2009-13:30:00	Laser 2 abruptly stopped firing ending campaign L2f.; time is approximate.

Appendix J: ICESat Post Laser Campaign Test Report

J-1 Single Photon Counting Module Responsivity, Dark Count Rate, and Radiation Damage Effect (Test 1) and Annealing Effect Tests (Test 10)

Initiators: Xiaoli Sun, Peggy Jester, Steve Palm

Objectives:

- To complete monitoring the radiation damage and degradation of the Si avalanche photodiode (APD) single photon counting modules (SPCM) 8 years in space;
- To experiment annealing the space radiation damage of SPCMs in orbit

Tests:

- Collect SPCM output count rate and trend the results since ICESat launch;
- Heat the SPCMs to >20 degrees Celsius for several days and compare the SPCM dark count rates before and after the temperature change.

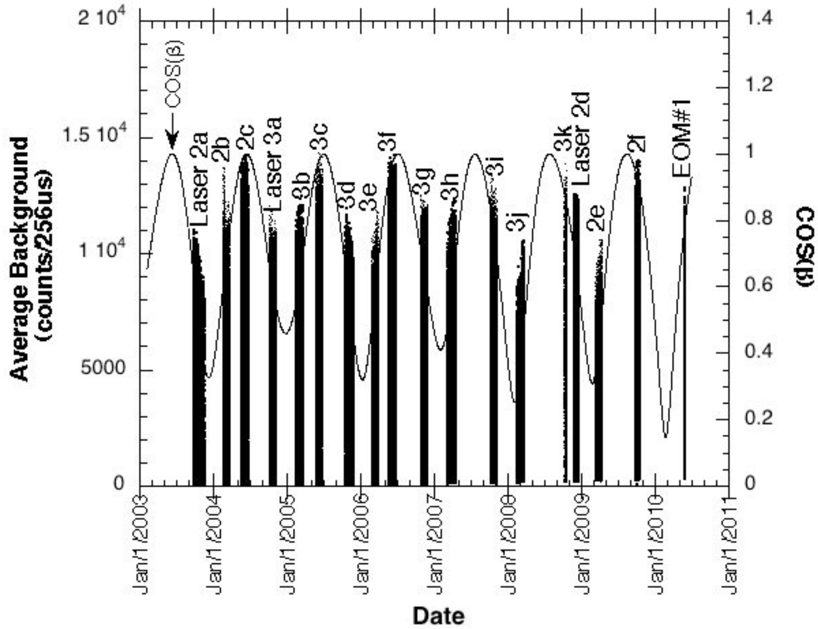
Test Timeline:

- The SPCM temperatures rose from the nominal 5-13°C to 18°C since Laser 2 initial failure while we attempted to resurrect the laser. The SPCM temperatures were specifically raised to the highest point the thermal control allowed, 23°C degrees, from 4/20/2010 to 6/7/2010 and output count rate were monitored over the entire period.

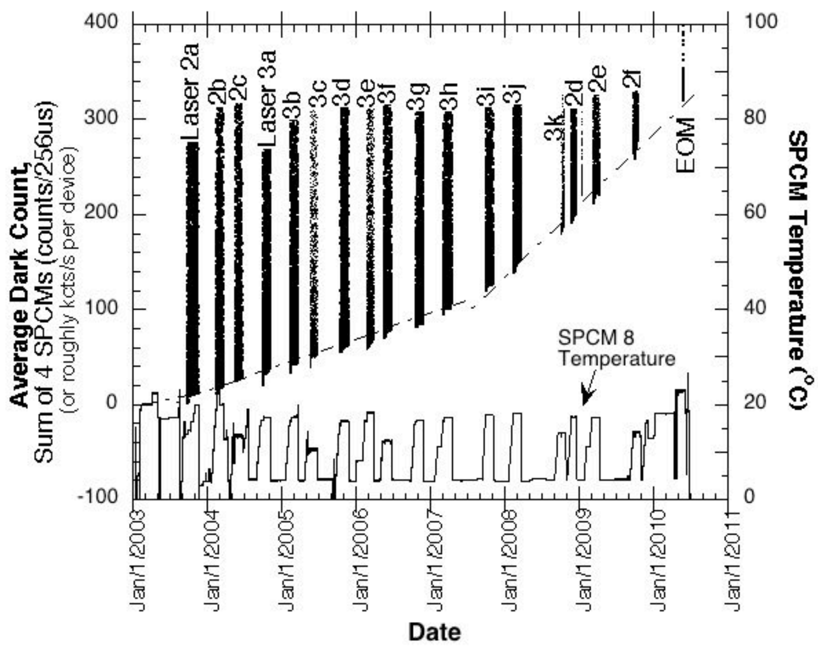
Test results:

The SPCMs responsivity stayed nearly unchanged as seen from the peak count rates over the sunlit side of the Earth over a full range of sun angles. The SPCM dark count rates continued to degrade, at about 60 counts/s per day from 2003 to 2007 when GLAS was operated three times a year to about 200 counts/s per day per device since 2007 when GLAS was operated two times a year. There appeared to be a correlation of the damage rate to the device duty cycle or average device temperature. Warming up the devices to 23°C for more than a month near the end of the mission did not reduce the dark count rate or the decay rate. These were in contract to what we saw during ground testing that raising the temperature to >15°C caused a significant annealing immediately after irradiation at an accelerated rate. It appeared there was no annealing to radiation damage accumulated at a normal rate in space.

These are the first ever solid state single photon counting detectors in space for this long period. They remained fully functional 8 years in space, with a significant rise in dark count rate due to space radiation but still useful for atmosphere backscattering measurements. The rate of the radiation damage is about what we expected based on prelaunch studies.



SPCM output count rates in response to the earth background light since launch. The peak count rate corresponds to the sunlit earth at local noon time and gives a measure of the SPCM responsivity after correcting for the sun angle effects. It shows no apparent SPCM responsivity degradation 8 years in space.



The minimum of SPCM output count rate vs. time since launch. It represents the trend of the SPCM dark count rates due to space radiation damages. The dark count rate increased from 1000/s to 300,000/s over 8 years in space. The rate of increase was approximately 60/s per day per device when the instrument was powered on three times a year and 200/s of the devices after the instrument was powered on twice a year. The rate of increased was slightly lower than the original estimate (<500,000/s over 5 years).

J-2 ICESat to MESSENGER/MLA Laser Ranging Tests (Test 2)

Initiators: Xiaoli Sun, Gregory Neumann, Peggy Jester, David Hancock, Charles Baker, NASA GSFC

ICESat Mission Operation team, Ball Aerospace and Technology Corp.

MESSENGER Mission Operation team, The Johns Hopkins University Applied Physics Laboratory

Bob Schutz, Sungkoo Bae, Center for Space Research, University of Texas

Objectives:

- Calibrate Mercury Laser Altimeter (MLA) boresight at the last chance before MESSENGER enter the Mercury orbit in March 2011
- Calibrate MLA laser pulse shape and energy
- Verify/calibrate MESSENGER time base
- Demonstrate laser link between two spacecrafts over about 1 AU distance

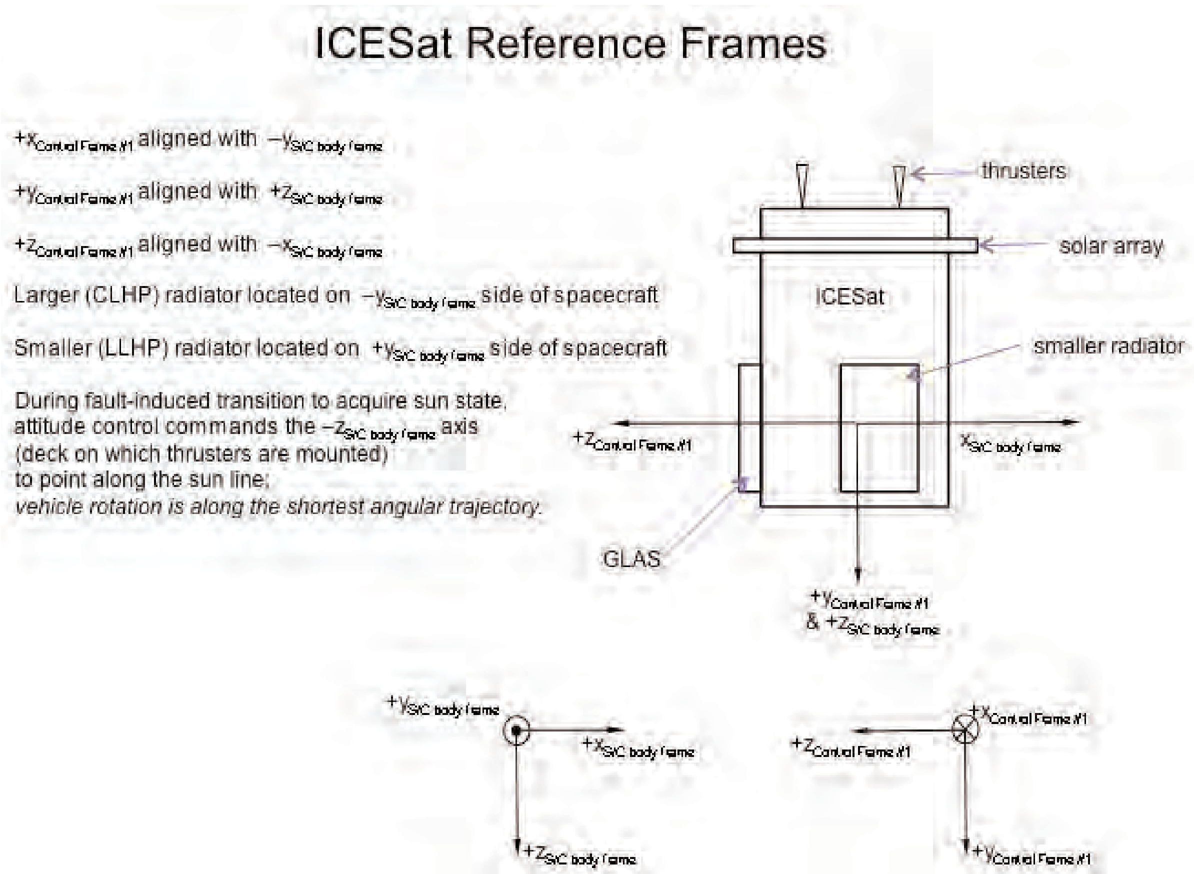
Test Execution:

- Point and track ICESat/GLAS receiver boresight at MESSENGER spacecraft to keep MESSENGER within the 95 arcsec GLAS FOV for approximately 30 minutes;
- Point MESSENGER/MLA laser beam at earth and scan in a raster pattern to cover the region of pointing uncertainty (80 urad laser beam divergence, footprint size about same as the size of earth);
- Fire the MLA laser at ICESat while scanning, for about 30 minutes and repeat the test three times over a few day period.
- Set GLAS receiver in normal science mode but widen the range gate to its maximum (10 km) and raising the detection threshold to reduce the false alarm rate (e.g. 10x noise stdev).
- Set the MLA receiver in the passive radiometry mode to detect earth shine to verify the spacecraft pointing.

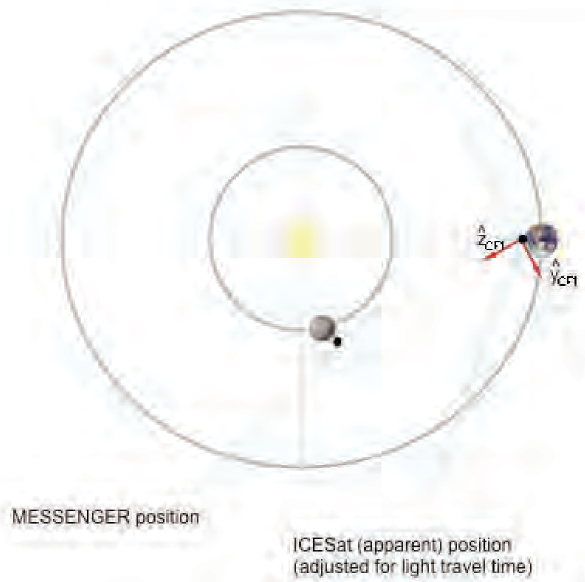
The MESSENGER spacecraft had performed similar pointing maneuvers a number of time in the past and successfully acquired laser signals from the earth satellite laser ranging station at GSFC and earth, Venus, and Mercury shine over about 1 AU distance. There were only a narrow window of opportunity for MESSENGER to perform these tests with the angle between sun-spacecraft-earth about 90 degrees and before a prescheduled trajectory correction maneuver on 2/22/2010.

However it was the first time for ICESat to face its nadir panel toward the sun and point and dwell at a moving spacecraft in deep space. The spacecraft had to keep all the subsystem temperature within their save operation range. In particular, the spacecraft had to temporarily set the sun avoidance angle from 40 degrees to 14 degrees and keep the radiator panels parallel to the sun light (surface normal vector perpendicular to the sun light) during the maneuvers. The spacecraft had to design its maneuver to avoid the sunlight getting into the receiver to damage the detectors. ICESat had to complete its final laser power on attempts on 2/12/2010 before the MESSENGER pointing tests.

The following figures show more details related to the test planning:



GLAS-MESSENGER Recommended Pointing Geometry



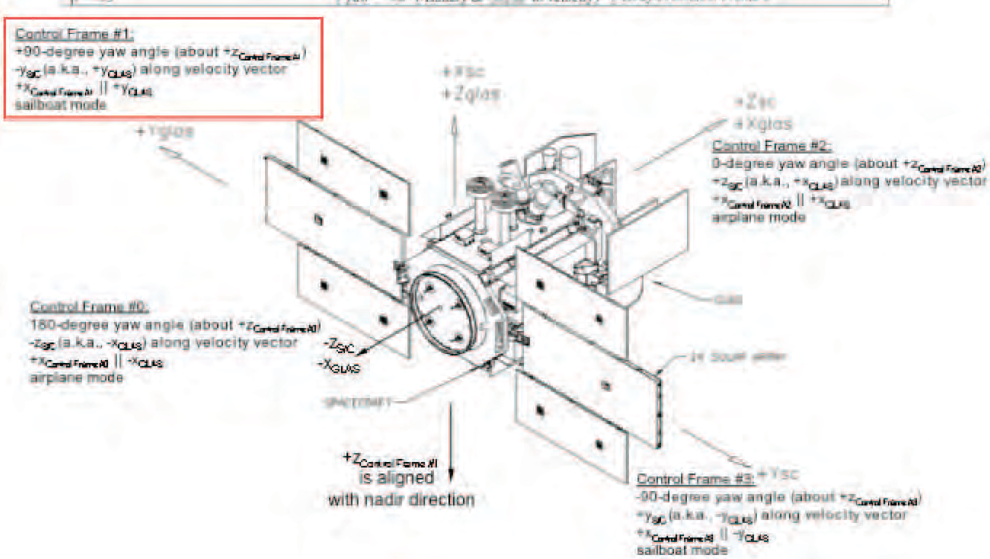
Point z-axis of Control Frame #1 along (apparent) position vector from ICESat to MESSENGER. This points GLAS boresight at MESSENGER.

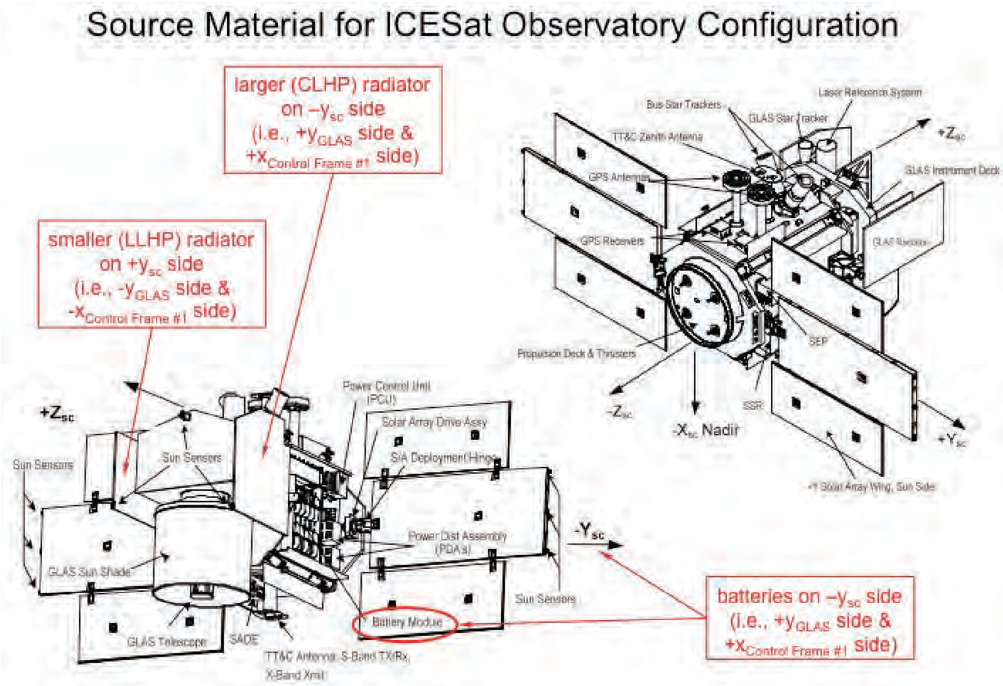
Point +y-axis of Control Frame #1 along line of intersection between ecliptic plane and plane orthogonal to (apparent) position vector from MESSENGER to ICESat.

This orientation:
(i) moves the GLAS FoV away from the sun line during a fault-initiated transition to acquire sun state
(ii) maintains both radiators orthogonal to the sun line

Source Material for ICESat Reference Frames

Beta Angle	Yaw Attitude	(Table 46)
$0° < \beta < 33°$	yaw = 180° (-GLAS & $-x_{GLAS}$ to velocity)	Body to Control Frame 0
$\beta > 33°$	yaw = 90° (Battery & $+y_{GLAS}$ to velocity)	Body to Control Frame 1
$-33° < \beta < 0°$	yaw = 0° (GLAS & $+x_{GLAS}$ to velocity)	Body to Control Frame 2
$\beta < -33°$	yaw = -90° (-Battery & $-y_{GLAS}$ to velocity)	Body to Control Frame 3




Source Material for ICESat Observatory Configuration
larger (CLHP) radiator on $-y_{sc}$ side (i.e., $+y_{GLAS}$ side & $+x_{Control\ Frame\ \#1}$ side)
smaller (LLHP) radiator on $+y_{sc}$ side (i.e., $-y_{GLAS}$ side & $-x_{Control\ Frame\ \#1}$ side)
batteries on $-y_{sc}$ side (i.e., $+y_{GLAS}$ side & $+x_{Control\ Frame\ \#1}$ side)
Laser Reference System
Bus Star Trackers
GLAS Star Tracker
TT&C Zenith Antenna
GPS Antennas
GPS Receivers
GLAS Instrument Deck
SEP
SSR
Propulsion Deck & Thrusters
$+Z_{sc}$
$-Z_{sc}$
$-X_{sc}$ Nadir
$+Y_{sc}$
$-Y_{sc}$
Power Control Unit (PCU)
Solar Array Drive Assy
S/A Deployment Hinge
Sun Sensors
Power Dist Assembly (PDA's)
GLAS Sun Shade
GLAS Telescope
SADE
TT&C Antenna: S-Band TX/Rx, X-Band Xmit
Battery Module

Test Timeline:

2/16/2010: ICESat reconfiguration

2/17/2010: ICESat practice run of MESSENGER pointing

Three attempts of ICESat-MESSENGER laser ranging tests with MLA laser firing at: 2/19/2010 13:30 (UTC); 2/19/2010 23:15; and 2/20/2010 12:15.

It took 7.5 to 7.7 minutes for the MESSENGER laser pulses to arrive at earth

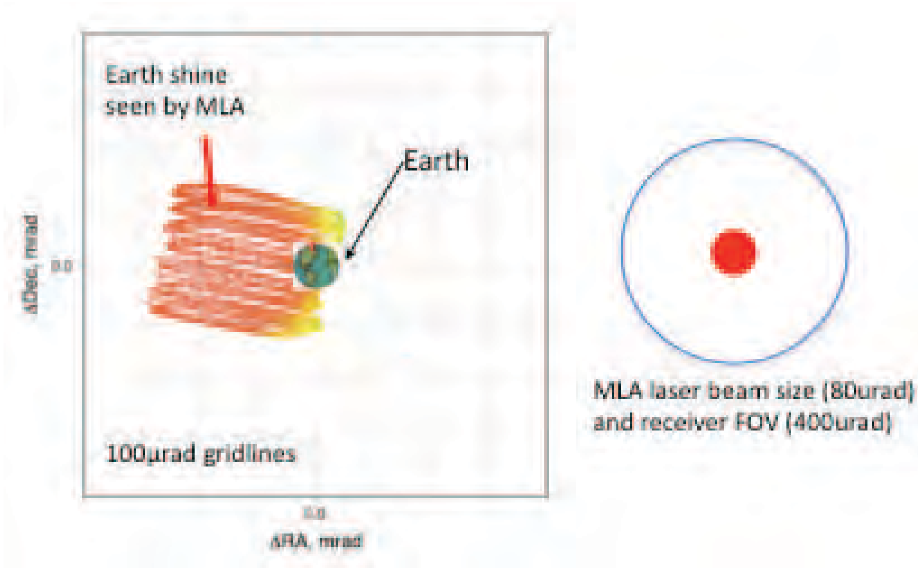
Test results:

1. ICESat Spacecraft Maneuver Results

The ICESat spacecraft maneuvers were executed successfully with the GLAS optical axis pointed toward MESSENGER. Although ICESat was not designed and never tested to face the nadir panel toward the sun, all the telemetry data were within the limit except for the OMNI antenna on the nadir panel that the temperature rose to above the yellow limit near the end of the maneuver. The field of views of the star trackers were blocked by earth during most of the scan, which could affect the accuracy of the precision altitude determination. It was hoped that the pointing accuracy was about 10 arcsec and well within the GLAS field of view (45 arcsec).

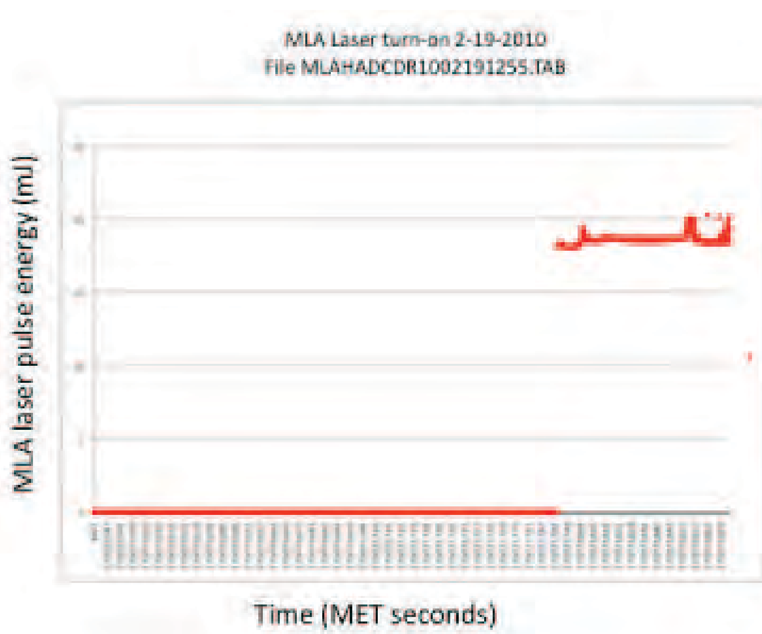
2. MESSENGER/MLA Results

MESSENGER spacecraft executed the maneuver flawlessly. The MLA laser beam scanned a 200 by 200 urad region. The pointing bias appeared to be about 50 urad in DEC direction, which could be improved if a pointing calibration test had been performed prior to this test. However, the scan was centered on earth based on the time when the laser pulses were emitted instead of when the laser pulses arrived at the earth. Because of the 7-8 minute light time and the motion of the earth, the center of the scan was 200 urad from the center of the earth, as shown in the figure below. Although the center of the scan was offset, there should still be chances that the laser pulses hit ICESat during these tests.



MLA responses to earth shine during the Feb. 2010 scan (scene brightness vs. RA and DEC). The MLA laser beam size was about the same as the size of the earth. The center of the raster scan was offset because the motion of the earth over the light time (7-8 minutes) was not accounted for when designing the scan patterns. The chances for the laser beam to hit ICESat were reduced by about 50% due to this oversight.

The MLA instrument performed nominally with the laser pulse energy of about 20 mJ and nominal receiver dark noise level and responsivity to earthshine. The figure below shows a plot of the laser pulse energy during one of the scan.



MLA laser pulse energy vs. time in MET during the Feb. 19 scan.

3. ICESat Pointing Maneuver Results

The actual ICESat pointing angles were analyzed by UT-CSR and the results is given in the table below. Based on this analysis, the pointing offset between MESSENGER spacecraft position and the actual ICESat boresight were about 5 mrad during the three scans and well outside the GLAS FOV (0.460 urad). There was no possibility that GLAS could detect MLA laser pulses during these tests.

GLAS Boresight Vector in ICRF

(GLAS boresight is assumed to be aligned and opposite to the IST boresight)

Test	seconds from 12:35:00	seconds from midnight	GLAS boresight vector in ICRF X	Y	Z
TEST #1 2/19/2010 Day 50	1500	46800	0.49462361	-0.80121499	-0.33675217
	2000	47300	0.49471814	-0.80123557	-0.33656430
	2500	47800	0.49493986	-0.80108446	-0.33659801
	3000	48300	0.49406872	-0.80160776	-0.33663199
	3500	48800	0.49329729	-0.80212998	-0.33651935

Test	seconds from 22:20:00	seconds from midnight	GLAS boresight vector in ICRF X	Y	Z
TEST #2 2/19/2010 Day 50	1500	81900	0.49954008	-0.79815043	-0.33677233
	2000	82400	0.50004538	-0.79799342	-0.33639430
	2500	82900	0.49965063	-0.79819746	-0.33649675
	3000	83400	0.49864191	-0.79883724	-0.33647483
	3500	83900	0.49795246	-0.79930290	-0.33638999

Test	seconds from 11:20:00	seconds from midnight	GLAS boresight vector in ICRF X	Y	Z
TEST #3 2/20/2010 Day 51	1500	42300	0.50624442	-0.79396519	-0.33665393
	2000	42800	0.50641228	-0.79401430	-0.33628544
	2500	43300	0.50683306	-0.79396621	-0.33576465
	3000	43800	0.50459484	-0.79526965	-0.33605095
	3500	44300	0.50668271	-0.79384183	-0.33628525

Results of the ICESat pointing analysis by UT-CSR of the three maneuvers.

4. GLAS Receiver Response during the Maneuvers

There was an anomaly in the GLAS instrument that the receiver stopped responding to light when electrical power was applied to Laser 1 in the first attempt to resurrect it on 1/27/2010 18:52:51. The receiver anomaly was not noticed prior to this test and there were no useful data from the GLAS receiver for these tests. It was suspected that the Laser 1 had a short circuit when the laser first developed the problem and ceased to fire and re-applying electrical power to it caused a glitch in the electrical ground to the entire instrument. It appeared the RF switch that select and connect the detectors and digitizers failed to close, or the gain of the detector stuck at zero. The receiver remained silent since until we switched to different combinations of detectors, digitizers, and oscillators on 3/26/2010.

A new set of tests were planned for April 2010 that corrected all the mistakes and oversights occurred in the earlier tests. However, the tests had to be canceled by the MESSENGER team due to higher priority activities with the MESSENGER spacecraft.

J-3 Spare 1064 nm Detector (Test 7) and Digitizer/Oscillator (Test 5) Function Tests

Initiators: Xiaoli Sun, Peggy Jester

Objectives:

- To verify the function and performance of the spare 1064 nm detector, digitizer, and clock oscillator;

Tests:

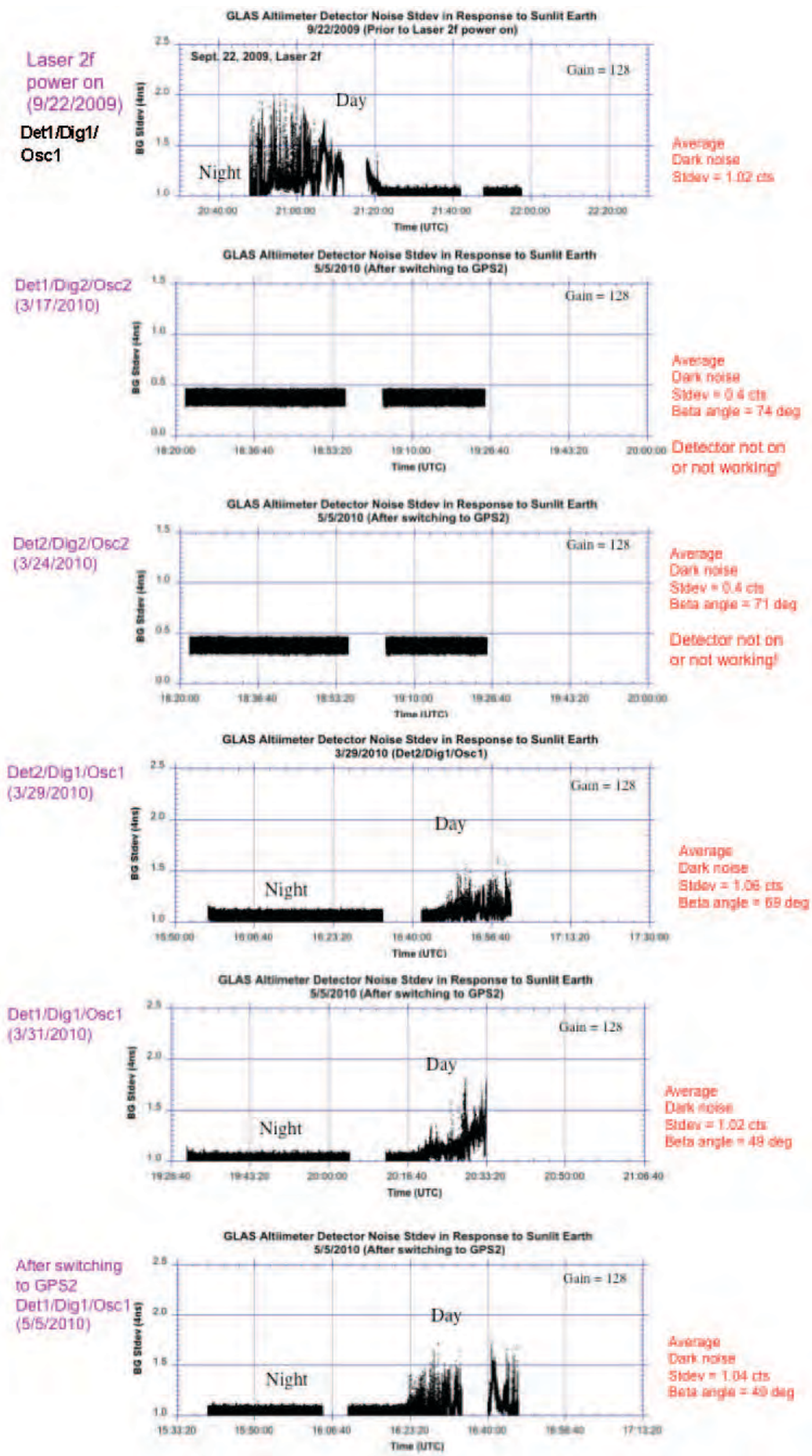
- Switch to the spare components in the order of
  Det1/Dig2/Osc2,
  Det2/Dig2/Osc2,
  Det2/Dig1/Osc1,
  Det1/Dig1/Osc1,
  and then switch to GPS Receiver #2 and repeat the test with Det1/Dig1/Osc1.
- Conduct a self diagnosis test in each case using the on board optical test source (OTS) to verify the detector responsivity to the sunlit earth, the pulse amplitude and ranging precision to a set preprogrammed OTS pulses.

Test Timeline:

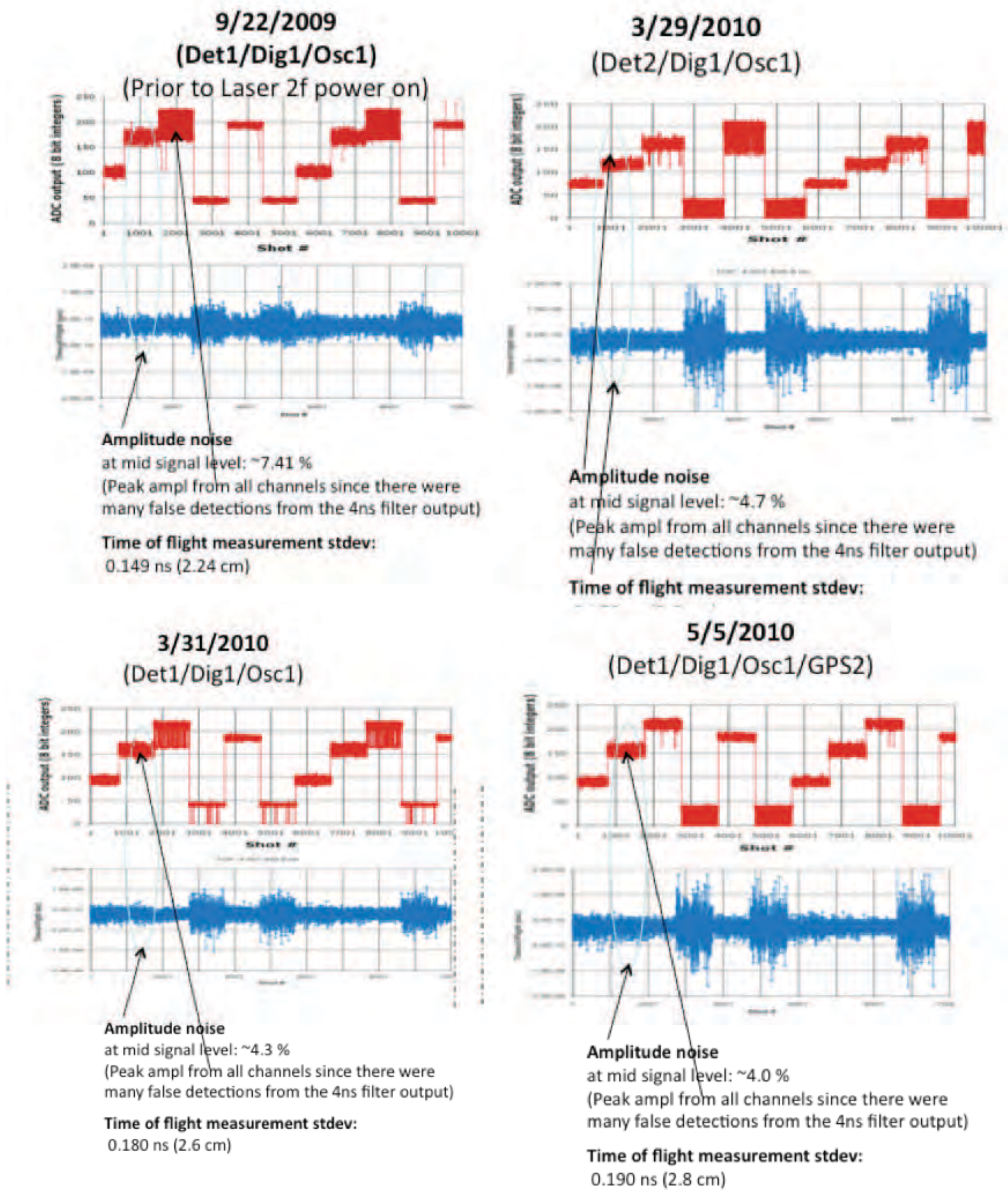
2010/076-20:18:58	2010/03/17	execute OTS tests for osc2/dig2/det1
2010/083-15:02:04	2010/03/24	switch to det2
2010/083-19:50:19	2010/03/24	execute OTS tests for osc2/dig2/det2
2010/085-17:06:34	2010/03/26	switch to osc1/dig1
2010/088-22:20:07	2010/03/29	execute OTS tests for osc1/dig1/det2
2010/089-22:32:27	2010/03/30	switch to det1
2010/090-21:00:43	2010/03/31	execute OTS tests for osc1/dig1/det1
2010/120-14:33:02	2010/04/30	switch to GPS Receiver 2
2010/125-15:34:10	2010/05/05	execute OTS tests for osc1/dig1/det1/GPS2

Test Results:

There was an anomaly in the GLAS receiver that the detectors stopped responding to the sunlit earth with a rms noise level at half of the nominal dark noise level (1.1 LSB of the digitizer output) when Laser 1 was first repowered on 1/27/2010. The detectors started to respond to sunlit earth on 3/26/2010 when we switched from Osc2/Det2/Dig2 to Osc1/Det2/Dig1, but the gain of the variable gain amplifier stuck at a constant value and not responding to ground command. It was believed that Laser 1 had a short circuit that re-applying electrical power caused a glitch in the electrical ground of the entire instrument. The symptoms pointed to the digital to analog converter that controlled the detector gain setting and the MOSFET switches that connected the detectors and oscillators to the Digitizers. As a result, there was no useful data for the cases of Det1/Dig2/Osc2 and Det2/Dig2/Osc2. The amplifier gain stuck at 128 till the end when we finally turned off the instrument. Detectors 1&2, Digitizer 1, and Oscillators 1 were shown all functional with nominal performances. Oscillator 2 performed well according to other data. It was difficult to evaluate whether Digitizer 2 was functional because of the anomaly.



GLAS 1064 nm detector output noise in response to the night and day side of the earth. The noise level stayed at ~1 on the night side of the earth and rose to ~2 at noon. The receiver malfunctioned with a noise level of <0.5 for the cases of Det1/Dig2/Osc2 and Det2/Dig2/Osc2. The detector output prior to Laser 2f science measurement campaign with OSC1/Det1/Dig1 is also included as a base line.



GLAS 1064 nm receiver output pulse amplitude and time-of-flight measurement error under various OTS test signal levels and combinations of detectors, digitizers, oscillators and GPS receivers. It shows the amplitude fluctuation was <5% and the range measurement error was 2-3 cm at mid signal levels. The results from Det1/Dig2/Osc2 and Det2/Dig2/Osc2 are not shown because the receiver malfunctioned when attempting to power on Laser 1 on 1/27/2010, until a reset occurred while switching to Dig1/Osc1 on 3/26/2010.

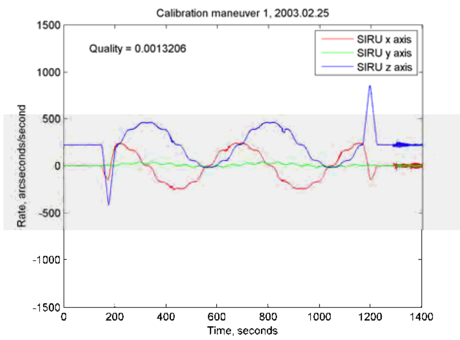
J-4 SIRU Calibration (Test 6)

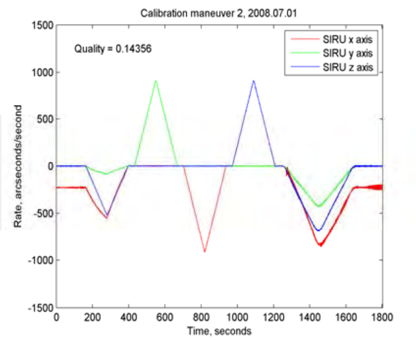
ICESat SIRU Calibration

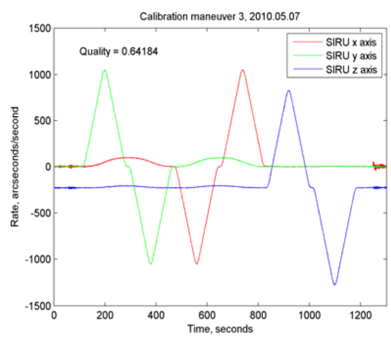
University of Texas at Austin ICESat Team

September 21, 2010

The objective of the end of mission SIRU calibration maneuver was final SIRU calibration parameters for comparison with those from the beginning of the mission. This helps quantify SIRU performance and aging effects. The three figures below show the three calibration maneuvers performed during the mission and their dates. The end of mission calibration maneuver was processed at CSR to estimate the final SIRU calibration parameters, as described below. The result was a set of calibration parameters for comparison with those from the beginning of the mission.







SIRU calibration parameter estimation for the 2010.05.07 SIRU calibration maneuver

The SIRU measures angles about non-orthogonal sense-axes and is capable of four active sense-axes. A matrix *G* is used to transform measurements about the SIRU sense-axes to measurements about an orthogonal spacecraft body frame.

$$\omega_{body} = G^{-1}\left(\omega_{meas} + b_{bias}\right) \tag{1.1}$$

If there are three active sense-axes then the measurement and bias rate vectors are three by one, *G* is a three by three matrix, and its inverse is used in equation 1.1. If there are four active sense-axes then the measurement and rate bias vectors are four by one, *G* is a three by four matrix, and its pseudo-inverse is used in equation 1.1.

The simplest definition of *G* assumes there are no sense-axes misalignment errors and no measurement scale factor errors. A more realistic definition includes these errors.

$$G = \left(I - \Lambda - M\right)\left(W - U\Delta_v - V\Delta_u\right)^T \tag{1.2}$$

W, U, V are geometry matrices defining the sense-axes. $\Lambda, M, \Delta_u, \Delta_v$ are symmetric scale factor, asymmetric scale factor, *u* sense-axis misalignment, and *v* sense-axis misalignment matrices. Parameter estimates for $\Lambda, M, \Delta_u, \Delta_v$ during the 2010.05.07 calibration maneuver are described below, followed by the resulting *G* matrix. Sense-axes measured rates and estimated body rates during the calibration maneuver are shown in Figures 1 and 2.

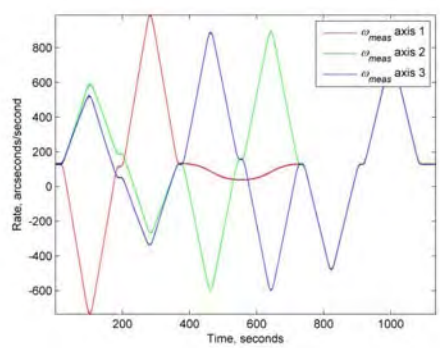


Figure 1 Sense-axes measured rates for the 2010.05.07 SIRU calibration maneuver

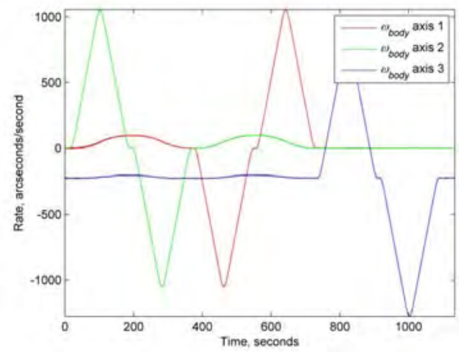


Figure 2 Estimated body rates for the 2010.05.07 SIRU calibration maneuver

Symmetric and asymmetric scale factor parameters

The Λ, M symmetric and asymmetric scale factor matrices are related to estimated calibration parameters by

$$\begin{aligned} \Lambda &= diag\left(\lambda_i\right) \\ M &= diag\left(sign\left(\omega_{meas}\right)m_i\right) \end{aligned} \tag{1.3}$$

The asymmetric scale factor matrix is a function of the measured rate so is not constant. Figure 3 below shows the parameter estimates during the calibration maneuver.

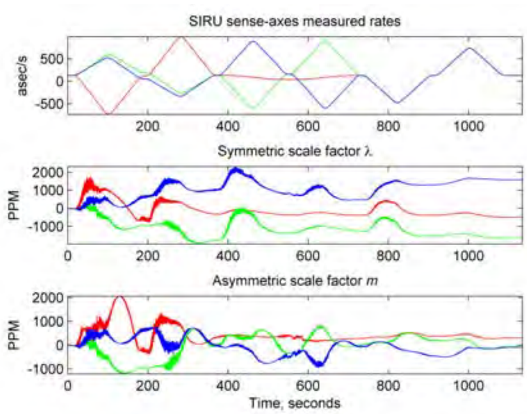


Figure 3 Scale factor parameter estimates during the calibration maneuver

Sense-axes misalignment parameters

The Δ_u, Δ_v sense-axes misalignment matrices are related to estimated calibration parameters by

$$\begin{aligned} \Delta_u &= diag(u_i) \\ \Delta_v &= diag(v_i) \end{aligned} \tag{1.4}$$

Figure 4 below shows the parameter estimates during the calibration maneuver.

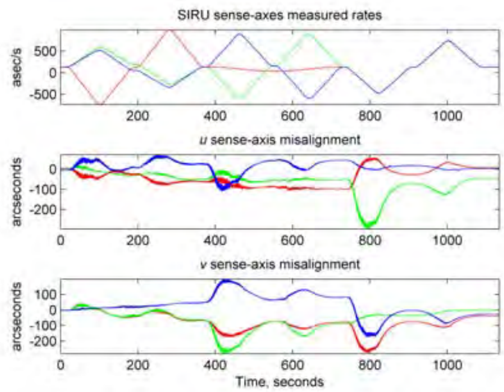


Figure 4 Sense-axes misalignment estimates during the maneuver

G matrix results

The resulting matrix for use in equation 1.1 is

$$G_{CSR}^{-1} = \begin{bmatrix} .0001 & .7058 & -.7081 \\ -.8162 & .4074 & .4088 \\ -.5774 & -.5765 & -.5783 \end{bmatrix} \tag{1.5}$$

Because of asymmetric scale factors, CSR values are a function of the measured rates. The values shown are for positive measured rates.

The ideal matrix with zero scale factor and misalignment errors is

$$G_{ideal}^{-1} = \begin{bmatrix} 0 & .7071 & -.7071 \\ -.8165 & .4082 & .4082 \\ -.5774 & -.5774 & -.5774 \end{bmatrix} \tag{1.6}$$

The matrix estimated by Ball for the 2008.07.01 calibration maneuver is

$$G_{Ball}^{-1} = \begin{bmatrix} -.0002 & .7056 & -.7081 \\ -.8189 & .4085 & .4071 \\ -.5739 & -.5790 & -.5770 \end{bmatrix} \tag{1.7}$$

The Ball values are constant so can not include asymmetric scale factors.

J-5 Laser Loop Heat Pipe (LLHP) and Component Loop Heat Pipe (CLHP) Engineering Tests (Tests 8 and 9)

Initiators: Dan Butler, Charles Baker, Eric Grob, Jentung Ku, Laura Ottenstein

Purpose:

Approximately 7 months after launch, the CLHP experienced an anomaly shortly after a Spacecraft yaw maneuver, when it was no longer pumping correctly and could not properly control the temperatures of the GLAS instrument components. This was exhibited as a multi-orbit warmup of the GLAS electronics until the instrument safed itself. As a result, an investigation was initiated, and a Tiger Team was formed. The CLHP operating temperature was effectively lowered by the instrument safing (instrument was turned off.) Restarts of the LHP were unsuccessful. But when the LHP was allowed to have its compensation chamber cycle cool to the point where the survival heater turned on, a "flushing action" occurred, which forces colder liquid from the compensation chamber in the evaporator core pump to displace any vapor or Non-Condensable Gas (NCG) bubbles that may have caused the pump to stop operating properly. The CLHP was then successfully restarted and procedures were established to resume operations with the CLHP. In investigating the anomaly, it was noticed that prior to the runaway condition, the evaporator temperature had small anomalous temperature spikes in prior orbits. Subsequently, when pre-cursors spikes occurred during later operations, typically at the end of the eclipse period of the orbit, the set point temperature was dropped 5 degrees to re-condition or flush the LHP with positive results (pre-cursor spikes are no longer indicated.). The temperature blips were again seen on several occasions, and the set point temperature was reduced each time, to create the flushing action, mitigating the temperature blips and keeping the CLHP in operation. With these procedures in place, the CLHP was successfully operated for the remainder of the mission. It should be noted that the LLHP worked fine throughout the mission without any problems, and we have not seen this type of problem on several other missions that have used Loop Heat Pipes (LHP's)

After the anomaly the GLAS Tiger Team reviewed the data, developed a fault tree, and consulted with various experts. However, no definitive cause(s) of the anomaly was determined. The loss of temperature control and run away condition could only have been caused by vapor penetration between the vapor (or evaporating side) of the primary wick into the liquid core side of the primary wick. This may have been a result of a slow fluid leak or the presence of Non-Condensable Gas (NCG) or vapor bubble at the end of the evaporator core (where the bayonet liquid line exits) all of which allow the primary wick to have a localized depriming. This depriming is typically prevented by adequate secondary wick design which does not allow the primary wick to go dry by pumping fluid from the compensation chamber into the area near the end of the bayonet (the permeability of the primary wick limits its ability to pump significant distances.) Propylene is particularly sensitive to this since it has a lower (~1/3) static wicking height versus ammonia LHPs. Other propylene LHPs have not exhibited this anomaly. Subsequently, the major US LHP manufacturers have improved the secondary wick design.

Fortunately, the loop continued to operate successfully throughout the mission, thus negating the slow leak hypothesis, leaving NCG or a vapor bubble as the likely secondary wick stressor. The CLHP loop reservoir had been extensively reworked under very tight schedule pressure during instrument Integration and Test, and it's possible that not all of the time consuming cleaning procedures and bake-outs were performed to the "letter of the law" that would reduce the amount of NCG in the loop. Nonetheless, both the CLHP and LLHP operated properly during ground testing (after the rework), although the CLHP did have one minor anomaly during thermal vacuum testing when the evaporator would not restart until its temperature was lowered. Curiously, the LHP only had anomaly pre-cursors in the vicinity of the Yaw maneuver where the sink environment for the CLHP Radiator was the largest (suggesting the small 'g' loads of the propulsive maneuver may aggravate the situation.)

When the GLAS Laser campaign was completed, an opportunity to conduct engineering tests of both LHP's was made available. Both loops were tested to "stress" their operation and see if anything had changed between launch in 2003 and 2010, seven years later. The LLHP was tested first, since a problem with the CLHP might require shutdown of the instrument. During the testing that was just completed, only when the yaw flip occurred was there any sign of the anomaly pre-cursors.

Test Approach (LLHP):

Setup: Laser warm-up heaters on, LLHP starter heater on, Laser power on.

Test 1: Warm the LLHP Radiator; LLHP setpoint=6.1C

Roll the LLHP radiator to point at Earth for 30 minutes.

Test 2: Rapid LLHP Setpoint Increase - Raise the LLHP setpoint at the rate of 1 count per 3.5 minutes spread over 3 days.

Day 1: start at 54 counts (6.2C) and end at 124 counts (14C)

Day 2: start at 125 counts (14.1C) and end at 189 counts (21.5C)

Day 3: start at 190 counts (21.6C) and end at 250 counts (29C)

Test 3: Large LLHP Setpoint Increase - Raise the LLHP setpoint in large steps (5C).

Lower setpoint to 177 counts (20C). Then raise the setpoint to 218 counts (25C) in one step.

Results and Lessons Learned (LLHP):

All tests were conducted successfully and the LLHP continued to operate nominally, demonstrating over 7 years of successful on-orbit operations.

Test Approach (CLHP):

Setup: CLHP start heater on

Test 1: Warm the CLHP Radiator; CLHP Setpoint = 15C

Roll the CLHP radiator to point at Earth for 30 minutes.

Test 2: Warm the CLHP Radiator; CLHP Setpoint = 0C

Lower the CLHP setpoint to 0C in one step.

Roll the CLHP radiator to point at Earth for 30 minutes.

Test 3: Rapid CLHP Setpoint Increase - Raise the CLHP setpoint at the rate of 1 count per 5 minutes spread over 3 days.

Day 1: start at 73 counts (0.1C) and end at 165 counts (10C)

Day 2: start at 166 counts (10.1C) and end at 210 counts (15C)

Day 3: start at 211 counts (15.1C) and end at 252 counts (20C)

Results and Lessons Learned (CLHP):

During these initial Engineering tests of the CLHP, no anomalies or severe temperature blips were noted, which was puzzling since problems had been seen in the past. However, it was observed that the original anomaly occurred shortly after a Spacecraft yaw maneuver, which was perhaps the cause of a problem (movement of an NCG bubble or the generation of a vapor bubble in the evaporator core). When a Spacecraft yaw maneuver was again planned after completion of the initial series of CLHP tests, Test 3 was then repeated shortly after the maneuver. When the loop set point temperature was increased to 20 C, severe evaporator temperature blips (greater than 5 C) were observed in the loop. The set point temperature was then lowered to 15 C and the loop recovered normal operation. This test showed that the CLHP was performing as before, with NCG or vapor bubble stressing the secondary wick as a possible cause of the anomaly. The yaw maneuver produced small G forces, which can cause repositioning of vapor or NCG bubbles within the LHP reservoir and evaporator core, especially in micro-gravity. The set point temperature increase "stresses" the secondary wick of the loop, and if there is a sufficient amount of NCG or vapor in the evaporator core, then the secondary wick may not be able to provide adequate liquid flow to the prime wick to carry the heat away from the evaporator resulting in a localized vapor penetration. This test provided us with an opportunity to complete tests in microgravity that showed possible LHP sensitivity to NCG. This effect may be more pronounced in microgravity, since one-g operation can mask or compensate for NCG sensitivity due to a different distribution of liquid and vapor within the reservoir and evaporator core due to gravitational effects. This reinforces the need to be particularly diligent in the manufacture of LHP's to maximize internal cleanliness and minimize the amount of NCG that can be present in the loop and design a robust secondary wick. Fortunately, numerous other LHP's have been operating successfully on many other missions for a number of years (SWIFT, AURA, GOES, Comsats), so this is not a cause for undue concern. The secondary wicks have also been improved at both the two major LHP vendors also mitigating the sensitivity.

J-6 GLAS Clock Oscillator/GPS Receiver Timing Performance Test (Test 12)

Initiators: Xiaoli Sun, Peggy Jester

Objectives:

- To verify the performance of the GLAS spare clock oscillator function and performance;
- To verify the timing performance of the spare GPS receiver

Tests:

- Switch to the spare clock oscillator, monitor its frequency against the GPS 1 pps ticks, and determine the frequency change from before launch;
- Switch to the spare GPS receiver and measure its 1 pps tick times against the spacecraft clock oscillator to determine its time bias and stability assuming the spacecraft clock stayed stable during the transition period.

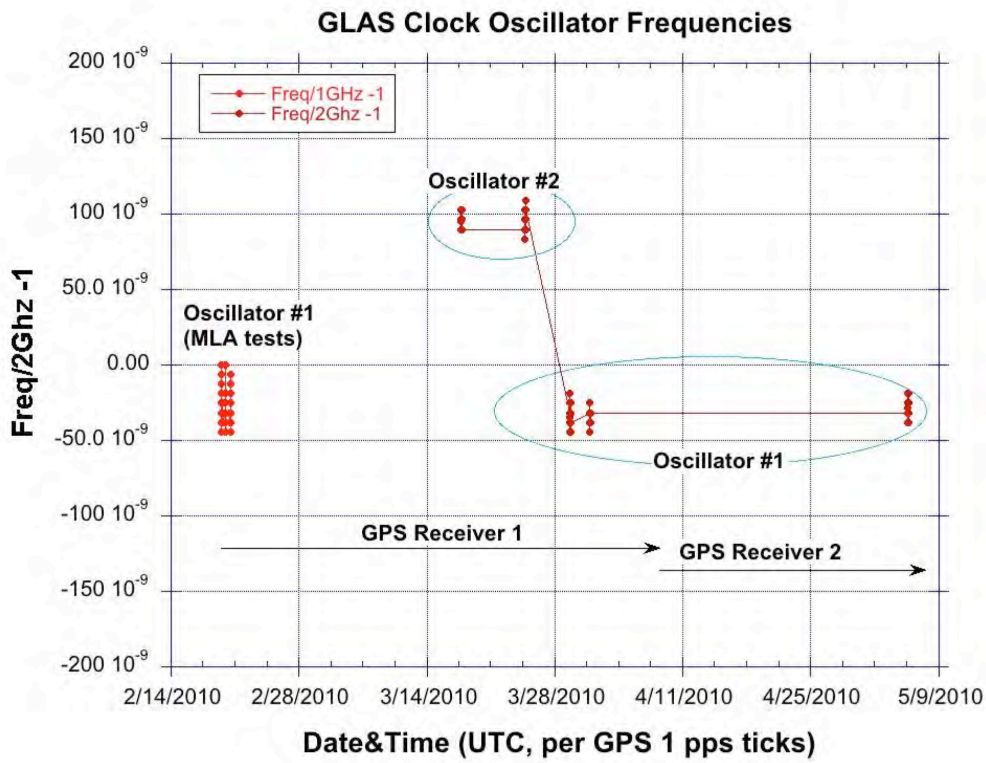
Test Timeline:

- The spare clock oscillator was switched on and the prime oscillator was switched off on 3/3/2010 18:06:17. They were switched back on 3/26/2010 17:06:34 after a series of self diagnosis and calibration tests. The spare GPS receiver was powered on 04/30/2010 14:33:02.

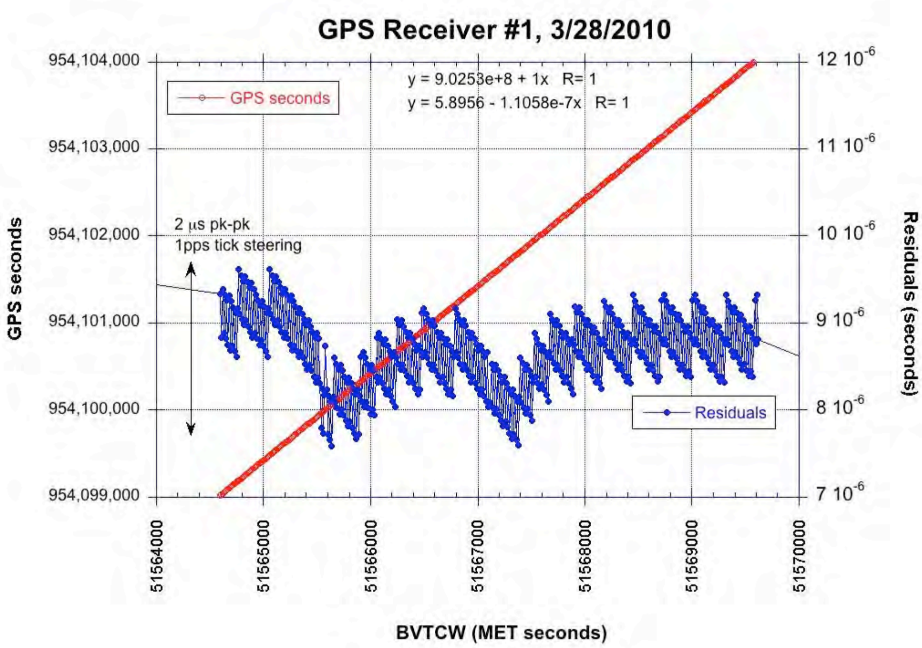
Test results:

The spare clock oscillator frequency was stable and changed by -40 parts per billion (ppb) compared to its frequency since Feb. 2001 (normalized frequency offset changed from 1.4e-7 to 1.0e-7). The prime clock oscillator frequency came back within 10 ppb to the previous value after switching. Its frequency changed by a total of +50 ppb since Feb. 2001.

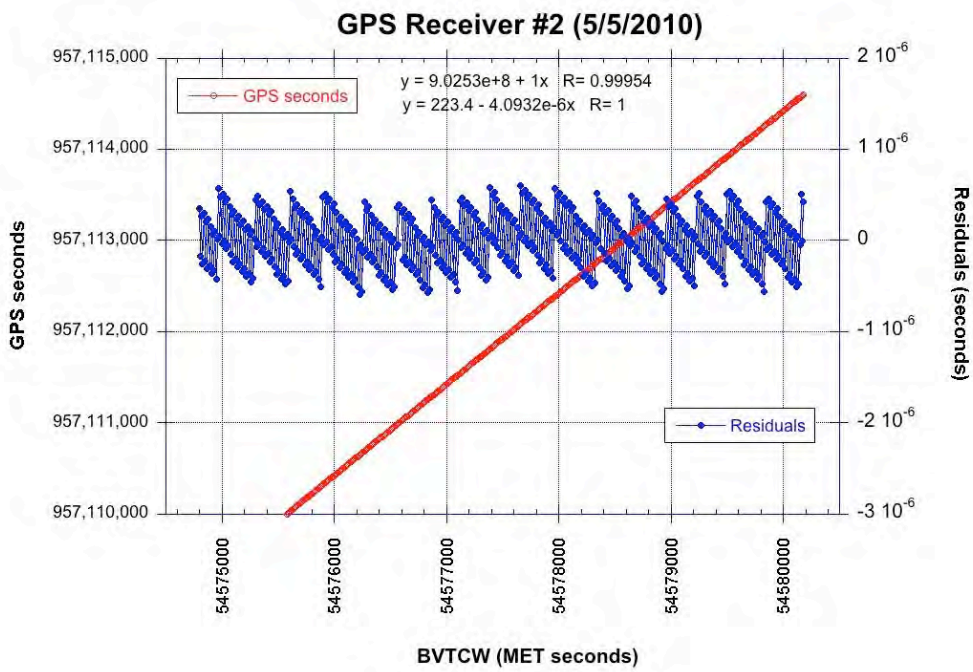
The GPS Receiver #2 performed well in terms of time keeping. It had a 9 microseconds time offset compared to GPS Receiver #1. GPS Receiver #2 also appeared to have a smaller jitter (or steering) in its 1 pps tick, 1 us peak to peak and about half that of GPS receiver #1. They were both within pre-flight specification.



GLAS clock frequency based on the on board GPS receiver 1 pps ticks. Switching the GPS receiver did not affect the frequency measurement, which indicated the GPS receivers performed identically during this period. As a comparison, the preflight frequency in Feb 2001 was 1.4e-7 for Oscillator #2 and -2.5e-7 for Oscillator #1.



Timing jitter of the 1 pps ticks of GPS Receiver #1 measured against the bus vehicle time code word (BVTCW) mission elapse time (MET).The BVTCW time and consequently the MET should be stable (constant frequency) to <<1 ppb over the time period the GPS receiver was switched over.



Same as above with GPS Receiver #2, which had a different time offset and time walk (1 pps tick steering to stay within the band of UTC time).

J-7 ICESat/GLAS Boresight Calibration with Venus (Test 15)

Initiators: Xiaoli Sun, Gregory Neumann, Peggy Jester, David Hancock, Charles Baker, NASA GSFC

Bob Schutz, Sungkoo Bae, Center for Space Research, University of Texas

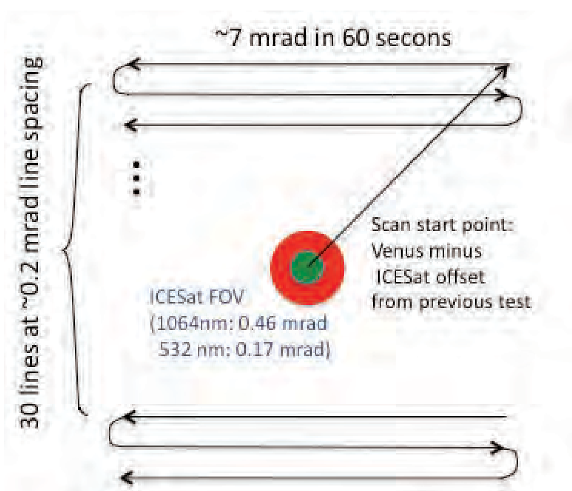
ICESat Mission Operation team, Ball Aerospace and Technology Corp.

Objectives:

- Measure the angular offset between the spacecraft star tracker, the instrument star tracker, and GLAS receiver FOV
- Demonstrate ICESat bus pointing capability

Test Plan and Execution:

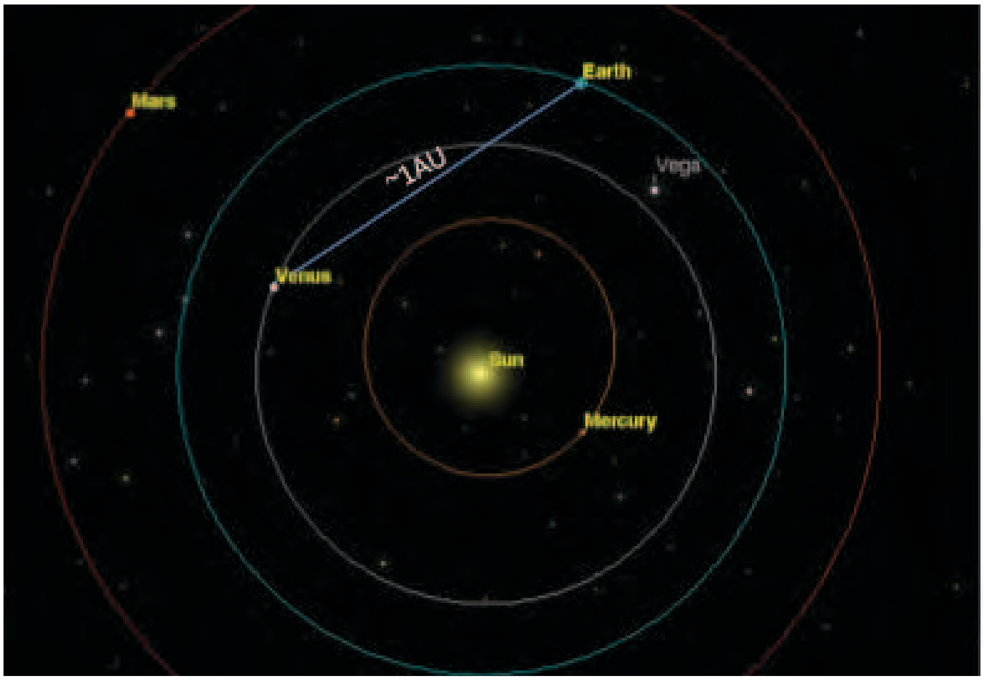
- Venus is expected to generate ~0.01 nW cw light (25e6 photons/s or 1/3 that of peak count rate from sunlit earth) on 532 nm channel detectors (SPCMs) and expected to be easily detectable
- Venus is expected to generate ~0.1 nW light onto the 1064 nm detector and will be difficult to be detected
- Scan area has to be larger than the GLAS pointing uncertainty discovered from the MESSENGER pointing test (0.4 mrad +/-2 mrad)
- Both 532 nm and 1064 nm detector on
- Test pattern design: (a) scan area to cover the ICESat pointing control uncertainties; (b) line spacing less than half the GLAS receiver FOV; (c) scan rate sufficient slow that Venus cross the receiver FOV in 3-4 seconds; (d) entire maneuver time less than 45 minutes when ICESat and Venus had direct line of sight.



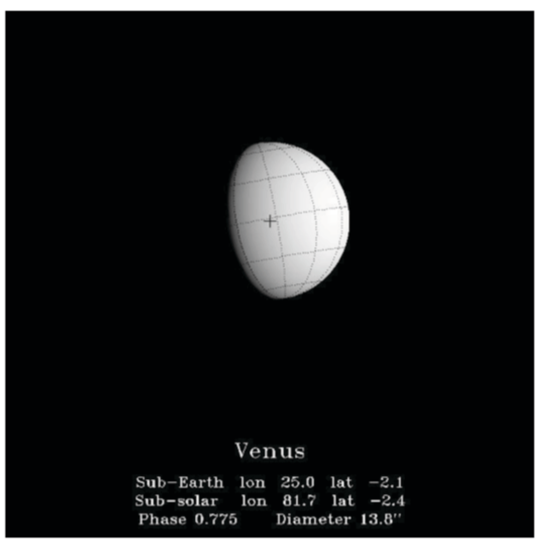
ICESat to Venus scan pattern design

Test Timeline:

- 6/7/2010: GLAS instrument configuration and receiver performance verifications
- 6/15/2010 14:17:00: Start of Venus Scan #1
- 6/15/2010 23:56:00: Start of Venus Scan #2



Planetary lineup during the tests



Venus at 6/15/2010

Test results:

1. ICESat Spacecraft Maneuver Results

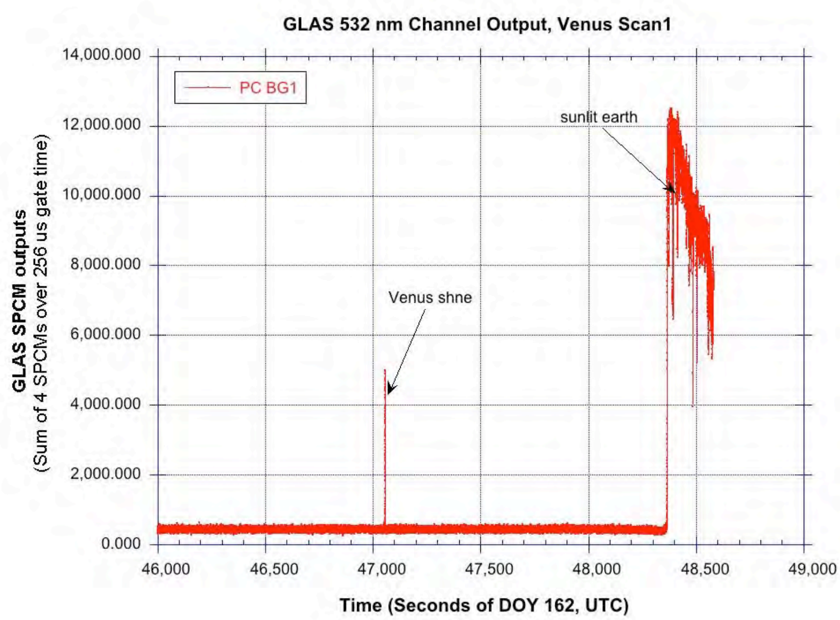
The ICESat spacecraft maneuvers were executed as planned. Two Venus scans were executed with first one offset by -2.5 mrad in both IST-X and IST-Y direction and the second one offset by -2.5 mrad in IST-Y direction only to account for the possible pointing biases discovered during the MESSENGER pointing tests. ICESat spacecraft again successfully executed the scan maneuvers. All the telemetry data were within the limit except for the OMNI antenna on the nadir panel that the temperature rose to above the yellow limit near the end of the maneuver. The fields of views of the star trackers were blocked by earth during a big fraction of the time of the scans, which could affect the accuracy of the precision altitude determination.

2. GLAS Receiver Responses

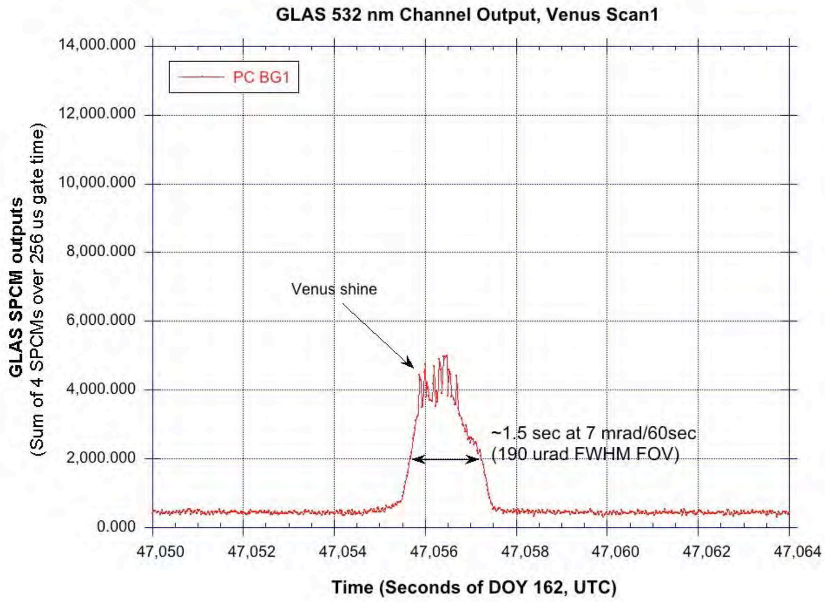
GLAS 532 nm channel successfully acquired Venus shine during both of the scans, with the photon count rate about on half of those from sunlit earth at local noon, which was very close to what we calculated. The signal was at least 20 times of the background noise count and the duration of the signal corresponded to the GLAS 532 nm channel FOV (170 urad).

GLAS 1064 nm channel appeared to have detected Venus shine though the signals were weak and hardly discernable from the noise floor. However, the noise level did rise slightly around the time of 532 nm channel outputs, as shown in the plots below. The weak response from the 1064 nm was expected based on the receiver model.

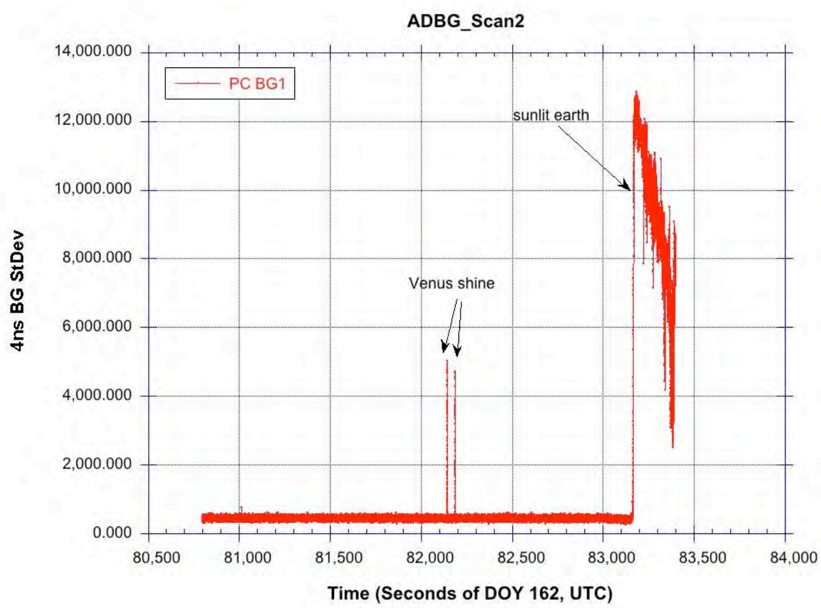
We should be able to measure the boresight of both channels to a fraction of the receiver field of view if we could repeat the test with a smaller scanning area and denser line spacing. The signal from the 1064 nm channel should also be much more evident with a denser scan line spacing.



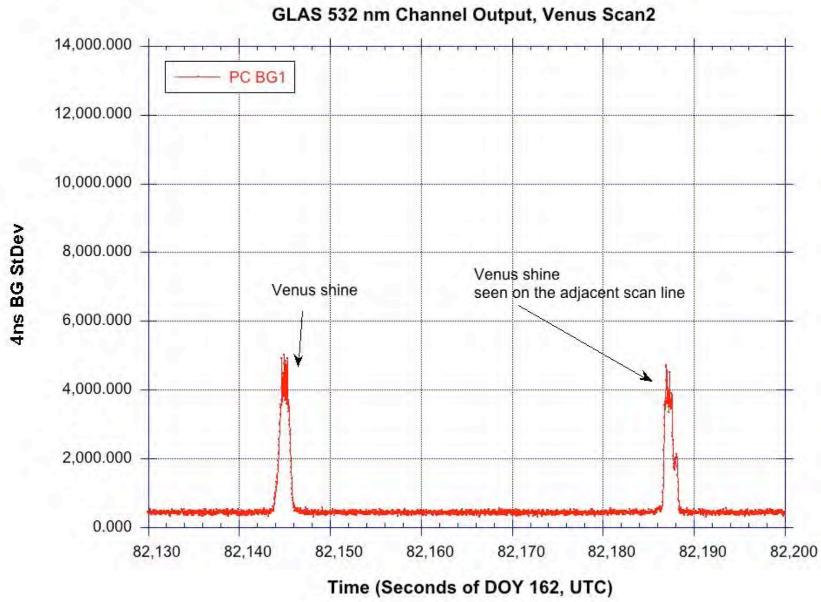
GLAS 532 nm channel outputs during the first Venus scan on 6/15/2010.



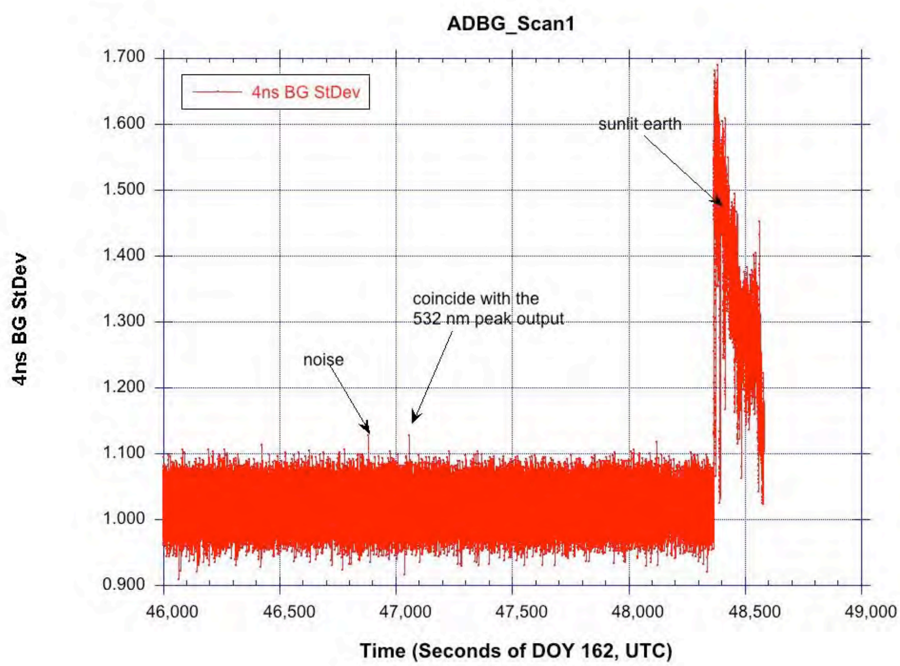
Same as above but zoomed in on the Venus shine response.



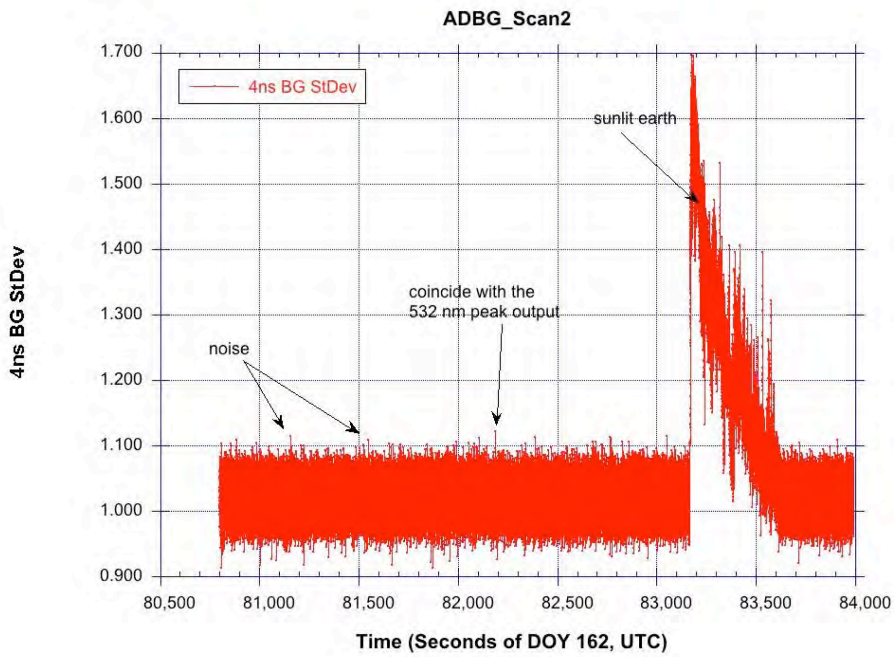
GLAS 532 nm channel outputs during the second Venus scan on 6/15/2010.



Same as above but zoomed in on the Venus shine response.



GLAS 1064 nm channel outputs during the first Venus scan on 6/15/2010.



GLAS 1064 nm channel outputs during the second Venus scan on 6/15/2010.

3. ICESat Precision Altitude Determination (PAD)

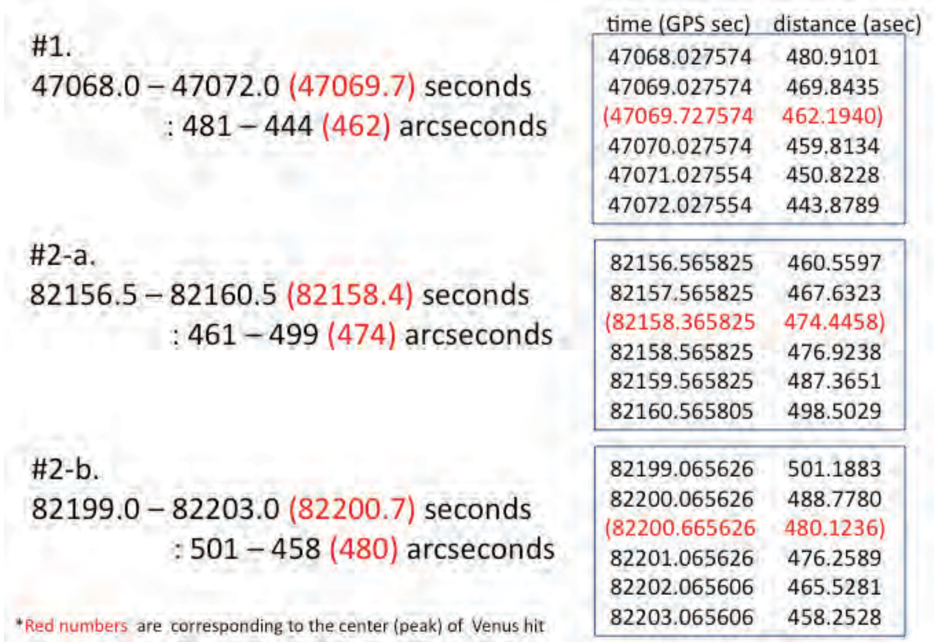
ICESat orientated with GLAS boresight direction (BD) directed toward Venus. Earth blocked all star tracker FOVs for most of the scans and hence no IST, BST1 or BST2 data during these time. There were 2300 second data gaps in each star tracker, mostly same gap period in each star tracker. SIRU was the only attitude data source during Venus pointing maneuvers and the accuracy of the precision attitude determinations were degraded (accuracy ~50 arcsec). The star tracker data were available before and after data gaps and they were used in the calculations.

Assumptions:

- Venus direction obtained from JPL Planetary Ephemeris DE-405
- The angle between IST BD and Venus was exactly180°
- The angle between GLAS BD and IST BD was exactly180°

Factors that could influence the altitude determination accuracy

- IST is known to exhibit variations of ~20 arcsec during an nominal orbit caused by thermal variations around the orbit
- There were 2300 seconds data gaps in all star tracker data. SIRU data had to be used during these periods to give an effective start track data for the attitude determinations.
- The star tracker data was available before and after data gaps and they were used in the solutions.
- Venus was not a point source but subtended ~15 arcsec when viewed from earth



#1.
47068.0 – 47072.0 (47069.7) seconds
: 481 – 444 (462) arcseconds

time (GPS sec)	distance (asec)
47068.027574	480.9101
47069.027574	469.8435
(47069.727574	462.1940)
47070.027574	459.8134
47071.027554	450.8228
47072.027554	443.8789

#2-a.
82156.5 – 82160.5 (82158.4) seconds
: 461 – 499 (474) arcseconds

time (GPS sec)	distance (asec)
82156.565825	460.5597
82157.565825	467.6323
(82158.365825	474.4458)
82158.565825	476.9238
82159.565825	487.3651
82160.565805	498.5029

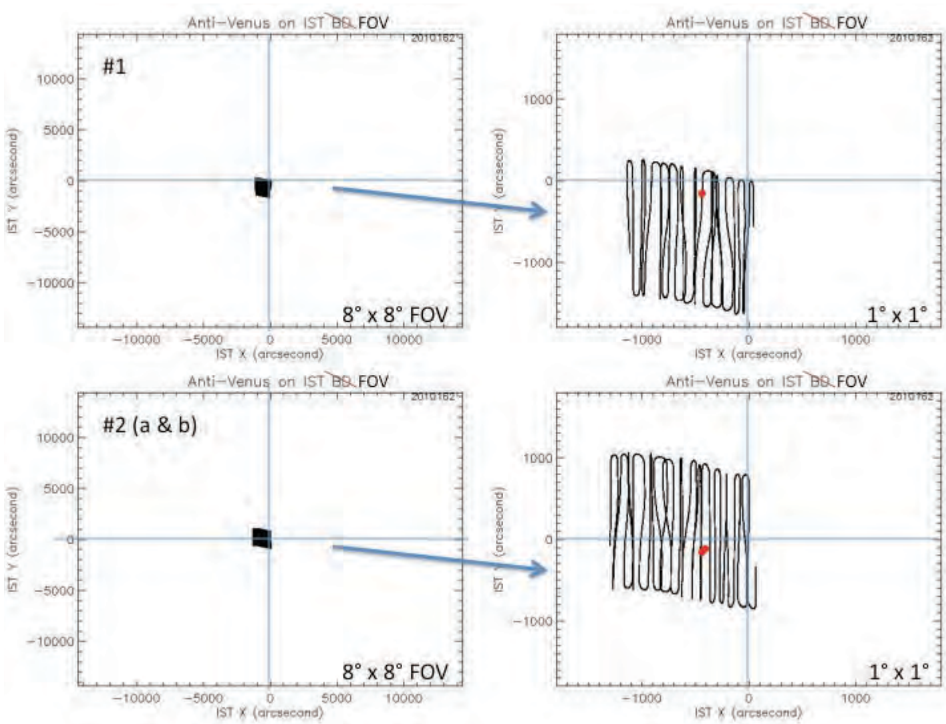
#2-b.
82199.0 – 82203.0 (82200.7) seconds
: 501 – 458 (480) arcseconds

time (GPS sec)	distance (asec)
82199.065626	501.1883
82200.065626	488.7780
(82200.665626	480.1236)
82201.065626	476.2589
82202.065606	465.5281
82203.065606	458.2528

*Red numbers are corresponding to the center (peak) of Venus hit

Angular offsets of ICESat/GLAS boresight solved from the times of GLAS 532 nm channel outputs and ICESat pointing angles from precision altitude determination solutions.

The precision altitude determination data were replotted in the GLAS instrument body frame, namely, IST-X and IST-Y axes, which were used routinely in determining the GLAS laser beam pointing angles for the GLAS altimetry data since the beginning of the mission and the results are shown below.



ICESat/GLAS to Venus scanning angles in IST-X and IST-Y axes for both scans. The red dots are where GLAS 532 nm channel responded to Venus shine. The centers of the two scans were deliberately offset to account for the possible pointing biases discovered during the MESSENGER pointing tests.

Location of Anti-Venus in IST Field of View

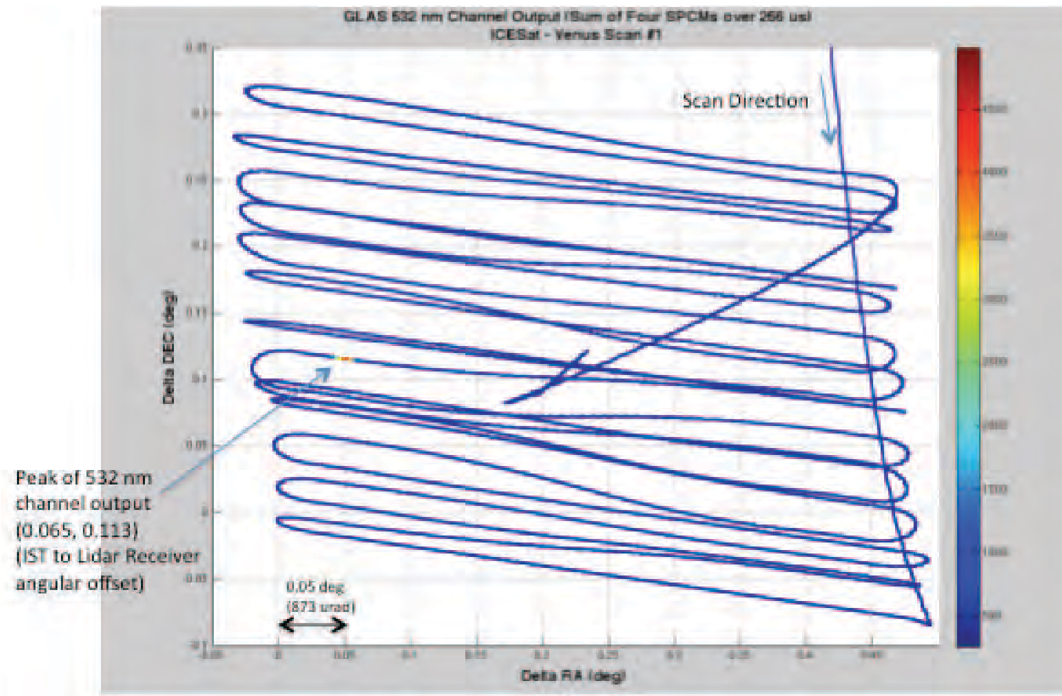
	time (GPS sec)	X (asec)	Y (asec)
#1. 47068.0 – 47072.0 (47069.7) seconds	47068.027574	-436.89	-201.43
	47069.027574	-436.83	-173.42
	(47069.727574	-436.29	-152.96)
	47070.027574	-436.70	-144.37
	47071.027554	-436.25	-114.10
	47072.027554	-436.02	-83.53
#2-a. 82156.5 – 82160.5 (82158.4) seconds	82156.565825	-448.60	-104.93
	82157.565825	-448.81	-132.03
	(82158.365825	-448.48	-155.52)
	82158.565825	-449.63	-159.74
	82159.565825	-450.18	-187.43
	82160.565805	-450.26	-214.69
#2-b. 82199.0 – 82203.0 (82200.7) seconds	82199.065626	-453.32	-214.48
	82200.065626	-453.60	-182.79
	(82200.665626	-451.44	-164.19)
	82201.065626	-452.90	-148.02
	82202.065606	-451.46	-114.25
	82203.065606	-450.50	-84.56

*Red numbers are corresponding to the center (peak) of Venus hit

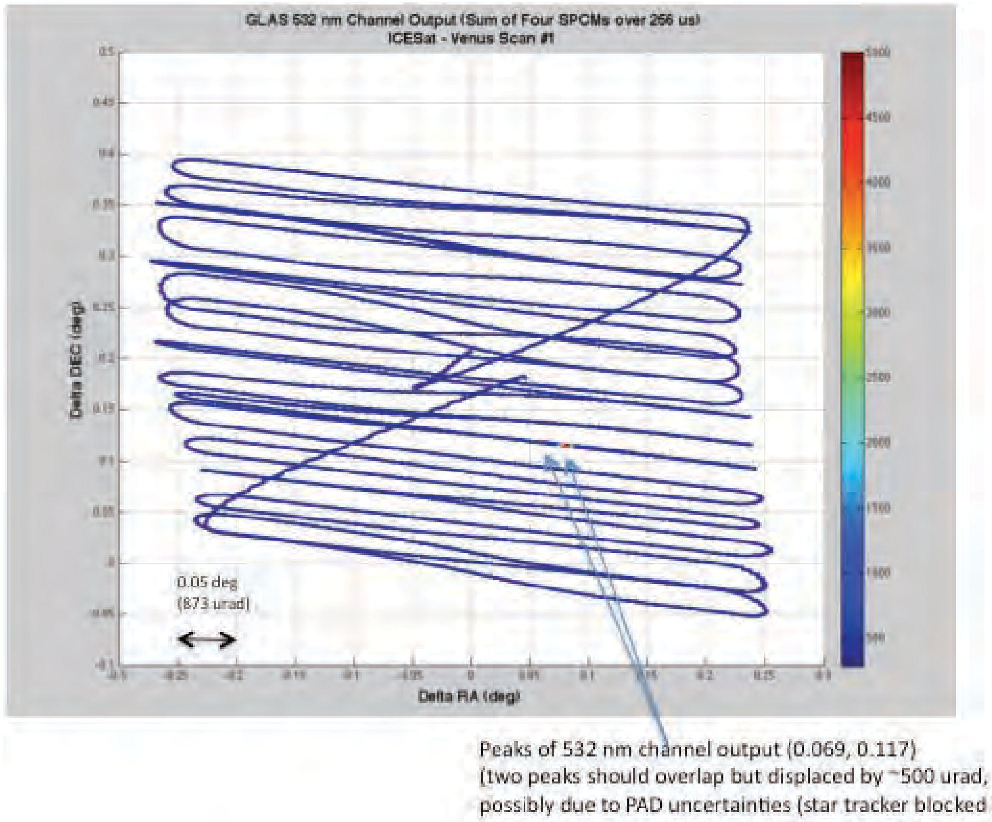
4. Combining GLAS receiver output with the PAD data

The GLAS receiver outputs from both 532 and 1064 nm channels were plotted vs. pointing angles determined from PAD solutions. They gave a more apparent view of the GLAS response to Venus shine and ICESat/GLAS pointing offsets.

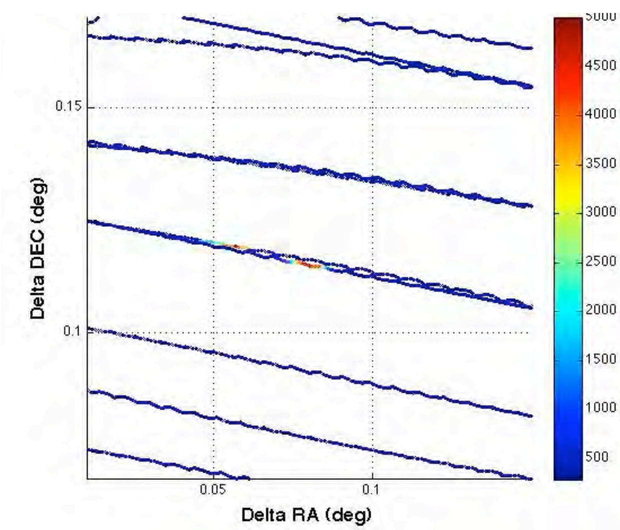
The GLAS boresight appeared to be offset from the IST by 0.05 deg (0.87 mrad) in RA direction and 0.12 deg (2.1 mrad) in DEC direction, which gave a total offset of 0.13 deg (2.3 mrad or 470 arcsec).



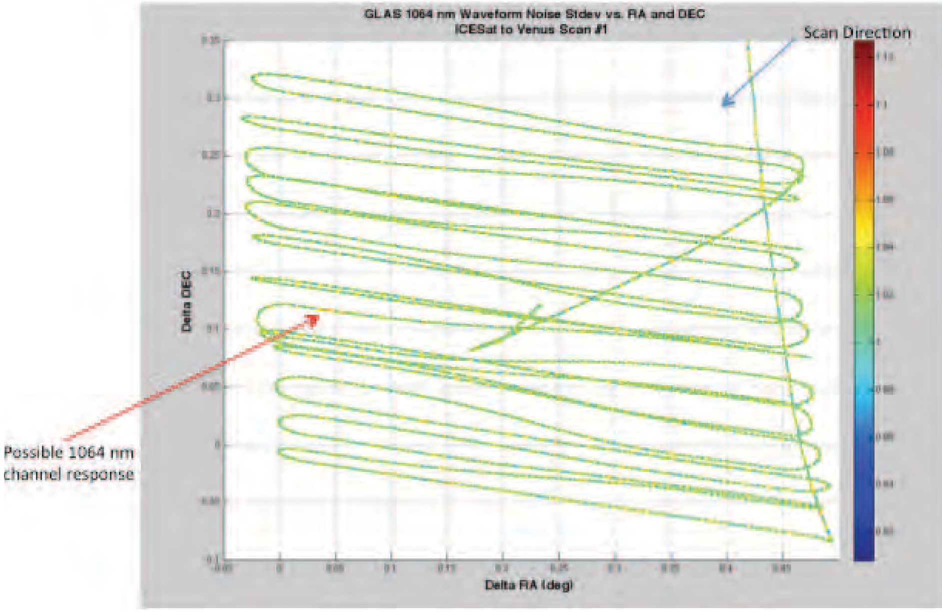
GLAS 532 nm Channel Output, DOY 162, Scan #1 - Photon count rate vs. RA and DEC along the opposite direction of the Star Tracker. It showed a pointing offset of 0.05 deg in the RA direction and 0.12 deg in the DEC direction. The entire scan pattern was shifted (i.e., not centered at (0,0)) to account for a known GLAS boresight offset.



GLAS 532 nm Channel Output, DOY 162, Scan #2 - Photon count rate vs. RA and DEC along the opposite direction of the Star Tracker. It showed a pointing offset of 0.06 deg in the RA direction and 0.12 deg in the DEC direction. The entire scan pattern was shifted differently from Scan #1 to account for the uncertainty in GLAS boresight offset.

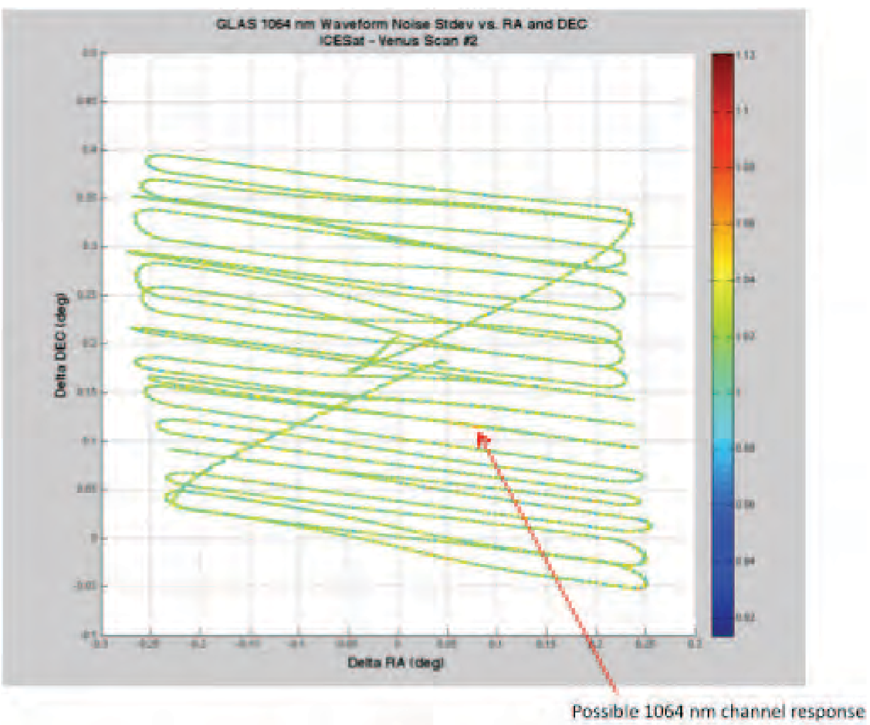


Same as above but zoomed into the region of GLAS responses. The difference in the locations of Venus shine responses gives an indication of the PAD accuracy (0.025 deg, or 90 arcsec, sum of errors from two solutions).



GLAS 1064 nm Channel Output, DOY 162, Scan #1 – Waveform Noise standard deviation vs. RA and DEC GLAS 1064 nm Channel Output, DOY 162, Scan #1 – Waveform Noise standard deviation vs. RA and DEC along the opposite direction of the Star Tracker. It showed a possible response to Venus shine at about the same position where 532 nm channel had a distinct response.

GLAS 1064 nm Channel Output, DOY 162, Scan #2 – Waveform noise standard deviation vs. RA and



DEC along the opposite direction of the Star Tracker. It showed a possible response to Venus shine at about the same position where 532 nm channel had a distinct response.

The IST boresight offset discovered during the Venus scan agreed with those from pre-launch measurements, batch-EKF correction, and ocean scans maneuvers. The plots below show the GLAS boresight used in Release 53x elevation products and Venus position in IST reference frame from the recent scans. It is shown that the Venus scans provided an independent verification of ICESat/GLAS PAD results used in the ground data processing.

Appendix K: GLAS Instrument Operations Change Requests

GLAS Instrument Operations Change Request Form

ID # GLAS-CR-001	Status CLOSED
Approved by: Email signatures are attached for: Eleanor, Peggy	Assigned To: Peter/Kris/Peggy
Initiated by: Steve Palm	Resolution Date: 1/16/03
Initiated Date: 1/7/2003	Implementation Date: 04/11/2003

Category (check all that apply)						
		Parameter	X	GLAS Flight Software		Ground Software
		Procedure		Documentation		GPS
		SRS		Other	X	Operations

Priority						
		Low (Desirable)	X	High		Critical (Emergency)

Title:

532 nm boresite algorithm modification

Description/Justification:

Because it is planned to operate only 2 SPCMs at one time on-orbit, the 532nm boresite calibration procedure (as planned and operated during I&T) will take too long to complete. We intended to do a 5x5 (coarse) scan followed by a 15x15 (fine) scan. With just 2 SPCMs, the dwell time at each position would be 8-10 seconds. This means that the fine scan would take too long. So, as an alternative, we would like to do two 5x5 scans in succession, with the first one at a large x/y increment and the second with a finer increment. This sequence would approximate the coarse/fine scan sequence as originally conceived. The coarse and fine scans need to be executed over the ocean and in the dark. Also the scans should be done relatively close together in time (no more than an orbit apart).

Since there are several constraints on the scheduling of the scans (dark, over ocean, within an orbit or two of each other) it was determined that the best way to run the scans would be out of stored memory. Therefore, patching the flight software so that scans could follow each other automatically rather than pausing between the 2 scans to analyze

data and uplink values was a more logical way to implement the desired change.
Area Affected*: 532 boresite code, procedure to run 532nm boresite scan
Impact*: There is minimal impact to the flight software: 2 data values are changed and the software is tested. There is no impact to the instrument. There is no impact to the flight procedures.
Implementation*: Patch the fine scan number of positions to integrate. The number of X and Y positions is located in the data area of the Photon Counter task software. This way a fine calibration could be run automatically after the coarse to achieve the desired results. Steve Palm, in a 1/16/03 email, stated the new fine boresite calibration x & y number of positions should be 5 for both. The software was updated by the GLAS Flight Software Maintenance Team (code 582) under their GLAS-CCR#009 which was closed on 02/11/2004. The GLAS Flight Software Maintenance Team has provided the load and procedures to patch the software. The team has also provided the load and procedures to back out the update if there is a problem with the patch. The fine boresite scan can also be executed in the proposed manner using commands from the ground if there is a problem with the software patch. The planning and execution is more complicated if the ground commands are used.
CCB Members: Abshire, Ketchum, Hancock (for Science and Science Ops), Jester

Attach additional pages as necessary

*Initiator completes as able; CCB will get additional input as needed

GLAS Instrument Operations Change Request Form

ID # GLAS-CR-0002	Status CLOSED
Approved by: See attached email signatures for Ketchum, Hancock, Baker (concurs), Abshire, Jester. Need Zwally or Schutz and Sirota (concur)	Assigned To: Peggy Jester
Initiated By: Peggy L Jester / Eleanor Ketchum	Resolution Date: 04/02/03
Initiated Date: 4/2/03	Implementation Date: 04/03/03

Category (check all that apply)		Parameter		GLAS Flight Software		Ground Software
		Procedure		Documentation		GPS
		SRS	X	Other Limits	X	Operations

Priority		Low (Desirable)	X	High		Critical (Emergency)

Title:

Raise the SPCM Temperatures

Description/Justification:

Raise the SPCM temperature 3 degrees to 22.5 degrees, by raising the component loop heat pipe **3 degrees** in order to decrease the outgassing time. This will enable us to get the SPCMs powered on sooner. Since we are between lasers and not in a calibration mode changing the thermal environment will not effect current operations. This temp will be lowered to the current setting prior to laser turn on or SPCM turn-on, which ever comes first. Temperatures should be set back to current value (CLHP setpoint at 17.58 degrees) before the sun beta angle reaches 0.0.

By raising the SPCMs 3 degrees the outgassing time is reduced by 20-25% or about 2 weeks which allows us to turn them on sooner and possibly in conjunction with Laser 2.

Area Affected*:

SPCMs, thermal environment of GLAS/SRS/Telescope Bench

Impact*:

Raising the CLHP will change

1) the SRS cameras temp an expected **3 degrees**. This is not expected to be an issue since a laser change is expected and we are not in a calibration mode. However, the yellow high limit should be changed to 32 degrees for the duration of this operation.
2) the bench temp an expected 1.5 – 3 degs. This may or may not affect bench alignment. Thermal vacuum testing showed elastic behavior, so that the return to current setting is expected to correct any induced misalignment.
3) The EBox temperature will also come close to its yellow high limit of 30 degrees.
4) The oscillator frequency will change; this is not a big impact since we are not attempting to do range data during this time period.

Implementation*:

Change the LRS Temperature yellow high limit to 32 degrees and the EBOX temperature yellow high limit to 30.5 degrees.

Raise the CLHP set point to **20.36 degrees** at a rate of 2 counts per 5 minutes using the ICESat flight procedure. This will be done out of the spacecraft stored memory (CSM).

The LRS and EBox temperatures should be closely monitored during this operation. Trend plots/tables should be produced/updated and evaluated. Using TCAD post-pass after the setpoint change plot the LRS and Ebox temperatures to dertermine trends. Continue to update plots after each day time pass during the week and once per day on the week-end/holiday.

Note: As we get closer to the sun beta angle of 0.0 degrees (early June) the bench and other temperature s will slightly warm up 0.5 to 1.0 degrees.

Attach additional pages as necessary

*Initiator completes as able; CCB will get input as needed

GLAS Instrument Operations Change Request Form

(Initiator completes shaded areas)

ID # GLAS-CR-003	Status CLOSED
Approved by: E-mail approvals attached for : Schutx, Sun, Ketchum, Hancock, Jester	Assigned To: Peggy Jester
Initiated by: David Hancock	Resolution Date: 4/16/03
Initiated Date: 4/10/2003	Implementation Date: 04/21/2003

Category (check all that apply)		Parameter		GLAS Flight Software		Ground Software
		Procedure		Documentation		GPS
		SRS	X	Other Update GLAS MET	X	Operations

Priority	X	Low (Desirable)		High		Critical (Emergency)

Title: Jam GLAS MET to spacecraft's VTCW
Description/Justification: Jam the GLAS MET to the time of the bus VTCW before a laser is powered on. This will cause EDOS's Production Data Sets (PDS) to contain nearly the same span of data across the different packet types. Some packets are time-stamped by the spacecraft and some by GLAS. Before launch we had thought the GLAS MET and the s/c VTCW would both be kept near the correct time of day, however VTCW is maintained as a continuous count from Jan 1, 2000 using bias and frequency slope parameters to correct it to the time of day. It is better for the science data processing if the GLAS MET is maintained in the same manner.

Area Affected*: Time of GLAS packets. Science data processing
Impact*: The user may notice a jump in time in either direction of the GLAS housekeeping packets. Since laser is not on and we are not collecting science data will only see in the housekeeping packets. Need to check impact of data in the database on the IST.
Implementation*: Request the IMOC to jam the GLAS MET with the spacecraft VTCW. GLAS IOT to track the offset between the GLAS MET and spacecraft VTCW. When the offset is greater than 2.0 seconds, the GLAS IOT shall request that the GLAS MET be jammed with VTCW.
Board members: Bob Schutz, Eleanor Ketchum, Xiaoli Sun, David Hancock, Peggy Jester

Attach additional pages as necessary

GLAS Instrument Operations Change Request Form

(Initiator completes shaded areas)

ID # GLAS-CR-004	Status CLOSED
Approved by: Eleanor Ketchum, Xiaoli Sun (for JBA), Peggy Jester, David Hancock, Bob Schutz	Assigned To: GLAS FSW maint
Initiated by: Redgie Lancaster	Resolution Date: 04/03/2003
Initiated Date: 4/3/2003	Implementation Date: 05/07/2003

Category (check all that apply)	X	Parameter	X	GLAS Flight Software		Ground Software
		Procedure	x	Documentation		GPS
		SRS		Other		Operations

Priority		Low (Desirable)	X	High		Critical (Emergency)

Title:

Etalon closed-loop control algorithm modifications

Description/Justification:

Two parameter values in the current etalon control loop software must be manually updated whenever the laser reference temperature changes by more than a few degrees. Failure to update these parameters can result in the control loop going to its default state and partial losses of the science data.

We propose to add a software patch in the flight software to automatically update these parameter values according to the laser reference temperature to make the control loop operation maintenance free and robust.

The following changes to the closed-loop control algorithm are requested:

1.) The parameter "tset_off" should be updated with a value calculated from measurements of the laser reference temperature according to the relation:

tset_off = (ct_etalon_openloop_tbl.ola0) + (ct_etalon_openloop_tbl.ola1)*(ct_etalon.tlaser_new)

where: ct_etalon_openloop_tbl.ola0 = 64.46

ct_etalon_openloop_tbl.ola1 =0.462.

Note:

- The parameter ct_etalon.tlaser_new represents the most recent measure of reference temperature in ADC units for the currently operating laser.
- The parameter tset_off represents the best guess for the etalon temperature setting in the corresponding D to A converter units.
- The coefficients ct_etalon_openloop_tbl.ola0 and ct_etalon_openloop_tbl.ola1 provide linear scaling between these two temperatures.
- The value of tset_off is updated every 2 minutes.

2.) The parameter "tset_fail" which is the default temperature setting in D to A converter units should the control loop failed the tracking test (average etalon transmission falls below a predetermined value). We propose to let tset_fail = tset_off, i.e., to let the default temperature setting equal the best guess based on the laser reference temperature.

Area Affected*:

Etalon throughput

Impact*:

Jim Spinherne had no concerns with this change in the etalalon tracking algorithm.

Barring any hardware failures these code modifications will make closed-loop tracking

more robust. In the event that the value in ct_etalon.tlaser_new is not useful (due to failure of the laser thermistors) the tracking algorithm will fail. Depending upon the failure the etalon temperature will be set to either preset limits, tset_min or tset_max, which are currently set to 100 (38.72 deg C) and 195 (48.42 deg C), respectively. One can also disable this linkage between the laser reference temperature and the etalon control loop by parameter change within the existing code and the proposed patch. This is accomplished by letting: ct_etalon_openloop_tbl.ola0 = desired value (e.g., 148) and ct_etalon_openloop_tbl.ola1 = 0.
Implementation*: GLAS FSW implemented FSW, IPS version 4.3 under FSW CCR 014, closed on 02/11/2004 See attached pages
CCB members: Eleanor Ketchum, Xiaoli Sun (for JBA), Peggy Jester, David Hancock, Bob Schutz

Attach additional pages as necessary

*Initiator completes as able; CCB will get additional input as needed

Attachment:

Modified Etalon Closed-Loop Tracking Mode #2 (Flight S/W CCR-014)

P. Kutt / CSC — 4/16/03, draft #2

Summary

The modified etalon closed-loop mode is a new tracking mode for the etalon temperature, which has been added to the existing control modes. This mode is similar to the original tracking mode, but avoids using the E532 reference energy measurement since it is not digitized correctly. In addition, all three terms of the loop filter (not just the integral term) are limited to specified ranges.

The first implementation of the modified closed-loop mode (CCR-003) was uplinked as a software patch after launch. Two problems were subsequently noted:

- If the tracking algorithm is unsuccessful, the etalon temperature setting reverts to a default table value. However, the default temperature setting varies with the temperature of the laser, requiring updates to the table value.
- If a warm restart were to occur while the software patch is loaded in RAM, the etalon tracking mode would be left in an invalid state, and no control of the etalon temperature would take place until etalon tracking is reset by a ground command.

This document describes a new version of the modified closed-loop mode that fixes both of these problems. The new version essentially combines the modified closed-loop mode and open-loop mode by calculating the temperature outputs for both modes simultaneously. As long as tracking is successful, the closed-loop temperature output is used for setting the etalon temperature. However, if tracking fails, the open-loop temperature output is used instead of a fixed default value. In addition, if a warm restart occurs while the patch is running, the etalon control mode will switch over to open-loop mode.

Commands

The modified closed-loop mode is enabled with the same command that is used to control the other etalon tracking modes. As before, the command has the following options:

`/GCTETTRACK START`	— start etalon tracking (in the original closed-loop mode)
`/GCTETTRACK STOP`	— stop etalon tracking
`/GCTETTRACK OPENLOOP`	— start etalon tracking in open-loop mode
`/GCTETTRACK MODIFIED`	— start etalon tracking in modified closed-loop mode

The STOP option will stop tracking in any mode.

The format of the `/GCTETTRACK` command is:

Name	Size in Bytes	Data Type	Description
(CCSDS header)	6	header	apid = 20
(function code)	1	u_byte	function = 30
(checksum)	1	u_byte	
Etalon tracking mode	2	u_word	0 = STOP = stop tracking in any mode 1 = START = start tracking in original closed-loop mode 2 = OPENLOOP = start tracking in open-loop mode 3 = MODIFIED = start tracking in modified closed-loop mode

Telemetry

The new control mode uses the same telemetry variables as the original closed-loop mode. These variables all appear in ancillary telemetry.

Name	Size in Bytes	Data Type	Description
Etalon Mode	1	u_byte	Indicates the mode of Etalon processing: 0 = OFF 1 = ACQUIRE (calibration) 2 = TRACKING
Etalon State	1	u_byte	Indicates the state of Etalon processing: 0 = IDLE (not processing) 1 = INIT (initializing) 2 = SET_TEMP (setting Etalon temperature) 3 = SETTLE (waiting for temperature to settle) 4 = AVERAGE (averaging transmission ratios) 5 = OPENLOOP (open-loop mode: averaging temperature data) 6 = MODIFIED (modified closed-loop mode: averaging pin data) ACQUIRE mode uses states 1, 2, 3, and 4. Original closed-loop TRACKING mode only uses state 4. Open-loop TRACKING mode only uses state 5. Modified closed-loop TRACKING mode only uses state 6.
Etalon Temperature Setting (= **set_temp**)	1	u_byte	Indicates the latest Etalon temperature setting that was commanded by the CT software (for all modes).
Etalon Status Flags	1	u_byte	bit 0: Etalon Tracking Low Transmission Flag (= **low_tr_on**)

Name	Size in Bytes	Data Type	Description
			0 = GOOD (on-axis transmission is above limit) 1 = LOW (on-axis transmission is below limit) bit 1: Etalon Tracking Active Flag (= **track_ok**) 0 = PAUSED (tracking is paused) 1 = ACTIVE (tracking is active) bit 2: Etalon Test Mode Flag 0 = NORMAL (reading data from LMB sensors) 1 = TEST (using test data values) bit 3: Etalon Nonstandard Tracking Mode Flag 0 = ORIGINAL (original tracking mode) 1 = MODIFIED (open-loop or modified closed-loop mode) bit 4: Etalon Open-Loop Cycle Update Flag (= **ol_updates**) 0,1 = toggles each time an open-loop cycle starts
Etalon Averaged On-Axis Transmission (= **tr_on**)	4	float	Indicates the latest averaged on-axis transmission (for ACQUIRE mode and closed-loop TRACKING modes).
Etalon Averaged Off-Axis Transmission (= **tr_off**)	4	float	Indicates the latest averaged off-axis transmission (for ACQUIRE mode and closed-loop TRACKING modes).
Etalon Temperature Error (= **delta_temp**)	4	float	Indicates the temperature error (for closed-loop TRACKING modes). In the original closed-loop mode, the value is in degrees. In the modified closed-loop mode, the value is in unknown units.
Etalon Tracking Loop Filter Output (= **y**)	4	float	Indicates the output of the Etalon loop filter (for closed-loop TRACKING modes)
Etalon Tracking Failure Average (= **fail_avg**)	4	float	Indicates the fraction of recent measurements in which the on-axis transmission is low (for closed-loop TRACKING modes).
Etalon Start Temperature for Acquire Command	1	u_byte	Indicates the Start Temperature parameter in the most recent Etalon calibration command (for ACQUIRE mode).
Etalon Stop Temperature for Acquire Command	1	u_byte	Indicates the Stop Temperature parameter in the most recent Etalon calibration command (for ACQUIRE mode).
Etalon Temperature Step for Acquire Command	1	u_byte	Indicates the Temperature Step parameter in the most recent Etalon calibration command (for ACQUIRE mode).
Etalon Averaging Time for Acquire Command	1	u_byte	Indicates the Averaging Time parameter in the most recent Etalon calibration command (for ACQUIRE mode).
Etalon Temperature Settle Time for Acquire Command	2	u_word	Indicates the Settle Time parameter in the most recent Etalon calibration command (for ACQUIRE mode).
Etalon Averaging Update Counter (= **tr_updates**)	1	u_byte	Counter that increments each time a new pair of averaged transmissions are calculated (for ACQUIRE mode and closed-loop TRACKING modes).
Spare	1	u_byte	

Table Parameters

The modified closed-loop mode requires several new parameters that are not present in the original closed-loop mode. The new parameters are specified in Table #26 (the next section describes how these parameters are used).

Closed-Loop Tracking Parameters (Table #26)

Name	Size in Bytes	Data Type	Description
fixed_pin_e	4	float	Fixed value of E532 energy (in counts) to use in place of the measured E532 energy. • default value = 250.0
min_tr_off	4	float	Minimum value of tr_off which can be used to calculate the ratio tr_on/tr_off. • default value = 0.02
a_thresh	4	float	Parameter used for calculation of delta_temp. • default value = 0.30
aob_max	4	float	Parameter used for calculation of delta_temp. • default value = 2.57
aob_min	4	float	Parameter used for calculation of delta_temp. • default value = 1.00
aob_setpt	4	float	Parameter used for calculation of delta_temp. • default value = 2.30
dt_off	4	float	Constant offset added to delta_temp for the input of the loop filter. • default value = 0.0
a1	4	float	Gain for proportional term of loop filter. • default value = 1.0
a2	4	float	Gain for integral term of loop filter. • default value = 0.0033
a3	4	float	Gain for differential term of loop filter. • default value = 0.0
b2	4	float	Time constant used for integral term of loop filter. • default value = 1.0
y2_min	4	float	Minimum limit for integral term of loop filter. • default value = -1541.0
y2_max	4	float	Maximum limit for integral term of loop filter. • default value = 1541.0
lx_min	4	float	Minimum limit for linear term of loop filter. • default value = -0.15

Name	Size in Bytes	Data Type	Description
lx_max	4	float	Maximum limit for linear term of loop filter. • default value = 0.15
dx_min	4	float	Minimum limit for differential term of loop filter. • default value = -0.0013
dx_max	4	float	Maximum limit for differential term of loop filter. • default value = 0.0013

The modified closed-loop control mode uses several parameters from the original etalon parameter table (Table #13), as indicated by the unshaded entries below. The shaded entries belong to the original closed-loop mode and are not used by the modified mode.

Etalon Tracking Parameters (Table #13)

Name	Size in Bytes	Data Type	Description
cycle_time	2	u_word	The cycle time for collecting and averaging data for tracking, in shots. • default value = 400 = 10 sec
min_pin_e	1	u_byte	Minimum valid value for 532 energy readings.
lookup_len	1	u_byte	Number of entries in the lookup table. The maximum length is 80.
tr_off_ref	4	float	The off-axis transmission at delta_temp=0.
dt_off	4	float	A constant offset added to delta_temp for the input of the loop filter.
a1	4	float	Gain for proportional term of loop filter.
a2	4	float	Gain for integral term of loop filter.
a3	4	float	Gain for differential term of loop filter.
b2	4	float	Time constant used for integral term of loop filter.
y2_min	4	float	Minimum limit for integral term of loop filter.
y2_max	4	float	Maximum limit for integral term of loop filter.
tset_scale	4	float	Scale of temperature setting, in deg/count. • default value = 0.1082
tset_off	4	float	Offset for temp setting, in counts. This is only used as the initial value, before the open-loop output is available. • default value = 148.0
tset_min	1	u_byte	Minimum temperature setting, in counts.

Name	Size in Bytes	Data Type	Description
			• default value = 100
tset_max	1	u_byte	Maximum temperature setting, in counts. • default value = 195
td_interval	2	u_word	Length of interval used for calculating the failure average, in cycle_time intervals. • default value = 180
track_thr	4	float	Minimum threshold in on-axis transmission. • default value = 0.3
td_fail_thr	4	float	Maximum threshold in failure average for failure of tracking detection. • default value = 0.50
tset_fail	1	u_byte	Default temperature setting to use if tracking detection fails.
(spare)	1	u_byte	• (unused)

The modified closed-loop control mode uses most of the open-loop parameters in Table #25. Note that these parameters depend on the laser in use and must be modified if the laser is changed.

Open-Loop Tracking Parameters (Table #25)

Name	Size in Bytes	Data Type	Description
ol_sample_time	2	u_word	Number of shots between temperature readings. This should be a multiple of 40 since the temperatures are read out every 40 shots. • default value = 40 = 1 second
ol_cycle_time	2	u_word	Number of temperature readings to average during each cycle. • default value = 120 = 2 minutes
tlaser_index	2	u_word	Indicates which item in the CT telemetry current value table should be used for the 'laser temperature'. This value must be modified if the laser is changed. The expected selections are: • 1 = GLM1REFT = Laser #1 reference temperature (LMB ch 1) • 24 = GLM2REFT = Laser #2 reference temperature (LMB ch 24) • 28 = GLM3REFT = Laser #3 reference temperature (LMB ch 28) Other CT telemetry values are also allowed. The index is calculated as (base + channel), where the base index for each board is: LMB=0, TCM=43, HVPS=120, PDU=160, HK=200, and HK(submux)=240. • default value = 24 = GLM2REFT
tbench_index	2	u_word	Indicates which item in the CT telemetry current value table should be used for the 'bench temperature'. The expected selection is:

Name	Size in Bytes	Data Type	Description
			• 228 = GHK1FOLDT = Fold Temperature, PRT (HK ch 28) Other CT telemetry values are also allowed, as for **tlaser_index**. • default value = 228 = GHK1FOLDT??
ola0	4	float	Constant term (in counts) in the expression for the etalon temperature setting. • default value = 64.46
ola1	4	float	Coefficient (in counts/count) of the 'current laser temperature' term in the expression for the etalon temperature setting. Note that for this and the following coefficients, all temperatures are in raw counts. • default value = 0.462
ola2	4	float	Coefficient (in counts/count) of the 'change in laser temperature' term in the expression for the etalon temperature setting. • default value = 0.0
ola3	4	float	Coefficient (in counts/count) of the 'current bench temperature' term in the expression for the etalon temperature setting. • default value = 0.0
ola4	4	float	Coefficient (in counts/count) of the 'change in bench temperature' term in the expression for the etalon temperature setting. • default value = 0.0
ol_min	1	u_byte	Minimum value (in counts) for the etalon temperature setting.
ol_max	1	u_byte	Maximum value (in counts) for the etalon temperature setting.
(spare)	2		(unused)

Description of Algorithm

Note: The open-loop and closed-loop calculations are performed in parallel during each laser shot.

I. Initialization

`ol_init = 0` (used for open-loop calculation)

`filter_init = 0` (used for closed-loop calculation)

`ol_output =` **`tset_off`** (initial value of open-loop output)

II. Open-loop Calculation (in parallel with closed-loop)

repeat while tracking:

Average the laser and bench temperatures over the open-loop cycle period.

```
ol_avg_ctr = 0                  (number of samples)
tlaser_sum = 0                  (sum of laser temperatures)
tbench_sum = 0                  (sum of bench temperatures)

repeat while ol_avg_ctr < ol_cycle_time:

    wait for ol_sample_time laser shots

    if CT telemetry is being processed then
        tlaser = telemetry item at tlaser_index in Current Value Table (in counts)
        tbench = telemetry item at tbench_index in Current Value Table (in counts)
        ol_avg_ctr = ol_avg_ctr + 1
        tlaser_sum = tlaser_sum + tlaser
        tbench_sum = tbench_sum + tbench
    end if

end repeat

if ol_avg_ctr > 0 then
    tlaser_new = tlaser_sum / ol_avg_ctr  (new averaged laser temperature)
    tbench_new = tbench_sum / ol_avg_ctr  (new averaged bench temperature)
else (protect against division by 0)
    tlaser_new = 0                        (this should never happen)
    tbench_new = 0
end if
```

Calculate the open-loop temperature setting (ol_output). If this is the first cycle, initialize the previous temperatures.

```
if ol_init = 0 then
   ol_init = 1
   tlaser_prev = tlaser_new
   tbench_prev = tbench_new
end if

ol_output = ola0
        + ola1*tlaser_new + ola2*(tlaser_new – tlaser_prev)
        + ola3*tbench_new + ola4*(tbench_new – tbench_prev)

tlaser_prev = tlaser_new
tbench_prev = tbench_new
```

end repeat

III. Closed-loop Calculation (in parallel with open-loop)

repeat while tracking:

Average the pin-A and pin-B readings over the closed-loop cycle period.

```
avg_ctr = 0            (number of samples)
tpa_sum = 0            (sum of pin-A readings)
tpb_sum = 0            (sum of pin-B readings)
```

repeat while avg_ctr < **cycle_time**:

```
    wait for next laser shot

    pin_a = on-axis throughput sensor (integer in range 0 – 255)
    pin_b = off-axis throughput sensor (integer in range 0 – 255)

    tpa = pin_a / fixed_pin_e      (normalized pin-A reading)
    tpb = pin_b / fixed_pin_e      (normalized pin-B reading)

    avg_ctr = avg_ctr + 1
    tpa_sum = tpa_sum + tpa
    tpb_sum = tpa_sum + tpb

end repeat

if avg_ctr > 0 then
    tr_on  = tpa_sum / avg_ctr     (averaged on-axis transmission)
    tr_off = tpb_sum / avg_ctr     (averaged off-axis transmission)
else
    tr_on  = 0
    tr_off = 0
end if

tr_updates = tr_updates + 1        (update counter in telemetry)
```

Calculate the temperature error (**delta_temp**) using the new algorithm.

```
if tr_off ≥ min_tr_off then
    aob = tr_on / tr_off           (pin-A / pin-B ratio)
    if aob < aob_max and aob > aob_min and tr_on < a_thresh then
        delta_temp = aob_max – aob_setpt
```

```
    else
        delta_temp = aob − aob_setpt
    end if
else
    delta_temp = 0
end if
```

Iterate the loop filter. Apply limits to each term. On the first cycle, initialize the integral and differential terms to zero.

```
x = delta_temp + dt_off          (input to loop filter)

if filter_init = 0 then
    filter_init = 1
    x_prev = x
    y2_prev = 0
end if

lx = x                           (linear term)
if lx > lx_max then
    lx = lx_max
else if lx < lx_min then
    lx = lx_min
end if

y2 = b2 · y2_prev + x            (integral term)
if y2 > y2_max then
    y2 = y2_max
else if y2 < y2_min then
    y2 = y2_min
end if
```

```
dx = x − x_prev                    (differential term)
if dx > dx_max then
   dx = dx_max
else if dx < dx_min then
   dx = dx_min
end if

y = a1 · lx + a2 · y2 + a3 · dx    (output of filter)

x_prev = x
y2_prev = y2
```

Check if tracking is successful (tracking detection).

```
if tr_on ≥ track_thr then
   low_tr_on = 0                   (low-transmission flag)
else
   low_tr_on = 1
end if

fail_sum = sum of low_tr_on over the last td_interval cycles

fail_avg = fail_sum / td_interval (failure average)

if fail_avg < td_fail_thr then
   track_ok = 1                    (tracking status flag)
else
   track_ok = 0
end if
```

if the state of **`track_ok`** *changed from* 1 *to* 0 *then*

send event message: **GCT140 Etalon tracking suspended, failure rate = %.3f.**

else if the state of **`track_ok`** *changed from* 0 *to* 1 *then*

send event message: **GCT004 Etalon tracking resumed.**

end if

Calculate the new temperature setting and set the etalon temperature. *Use the open-loop output temperature as the zero offset in the temperature setting. If tracking has failed, use the open-loop output temperature as the temperature setting.*

if **`track_ok`** = 1 *then*

`set_temp` = round ((**`y`** / **`tset_scale`**) + `ol_output`)

else

`set_temp` = round (`ol_output`)

end if

if **`set_temp`** ≤ **`tset_min`** *then*

`set_temp` = **`tset_min`**

else if **`set_temp`** ≥ **`tset_max`** *then*

`set_temp` = **`tset_max`**

end if

set etalon temperature to **`set_temp`** (in counts)

end repeat

GLAS Instrument Operations Change Request Form

(Initiator completes shaded areas)

ID # GLAS-CR-005	Status CLOSED
Approved by:	Assigned To: GLAS FSW Maintenance / GLAS Ops
Initiated by: Peggy Jester	Resolution Date: 05/19/2003
Initiated Date: 5/19/2003	Implementation Date: 07/01/2003

Category (check all that apply)		Parameter	X	GLAS Flight Software		Ground Software
		Procedure		Documentation		GPS
		SRS		Other	X	Operations

Priority		Low (Desirable)	X	High		Critical (Emergency)

Title: Implement a counter in the housekeeping telemetry to monitor laser drive pulse width at the 40 per second rate.
Description/Justification: The laser drive pulse width is reported in housekeeping at the once per 4 second rate. This is not a fine enough sampling to catch the early indications of laser problems. In order to prevent a potential laser failure we should be able to monitor the laser drive pulse width more closely. Since we do not have enough bandwidth to report the laser drive pulse width at the 40 per second rate then we can report the number of times the value is outside the normal range. We would like to have 1) a cumulative counter for the number of times the laser drive pulse width is out of range (cleared from the ground), 2) a counter indicating the number of times the laser drive pulse width is lower than the normal minimum (cleared every 4 seconds) and

3) a counter indicating the number of times the laser drive pulse width is above the maximum (cleared every 4 seconds).
Area Affected*: GLAS Flight software CD task The CD housekeeping packet spares will be used. Operations – the IMOC telemetry data base will need to be modified to include the new counters and their limits. If the limits are exceeded then GLAS support will need to be paged.
Impact*:
Implementation*: GAS FSW implemented IPS verison 4.4, under FSW CCR 015, closed on 02/11/2004. Update code in the CD task. Request update of the telemetry database. Need the limits on the laser drive pulse width.
Board members:

Attach additional pages as necessary

GLAS Instrument Operations Change Request Form

(Initiator completes shaded areas)

ID # GLAS-CR-006	Status CLOSED
Approved by: Eleanor, Xiaoli, Bob, David, Peggy	Assigned To: GFSW Maintenance
Initiated by: Jan McGarry	Resolution Date: 06/21/2003
Initiated Date: June 21, 2003	Implementation Date: 01/14/2004

Category (check all that apply)		Parameter	x	GLAS Flight Software		Ground Software
		Procedure		Documentation		GPS
		SRS		Other		Operations

Priority		Low (Desirable)	X	High		Critical (Emergency)

Title:	Gain / Cloud interaction software patch

Description/Justification:

The Instrument Algorithm Team propose to (1) use the raw peak as input to the gain (replacing the 8ns filter peak), and (2) to jump around (not call) the gain loop when certain conditions indicate the presence of clouds. See attached documentation. Detailed description in attached write up by Jan McGarry dated July 15, 2003, “GLAS GAIN/CLOUD Interaction Software CCR-006 (FSW CCR-016).

Area Affected*:

Flight software – requires patch. Currently in testing.

ICESat CT Database will need updating for new telemetry/commands.

Science data processing software will need updates for new telemetry. May impact waveform processing (GSAS project bug#000534).

Impact*: Peter Kutt (582/CSC) indicates this patch is relatively easy to implement. There is a chance that the new algorithm could get stuck in the "jump around gain loop". To avoid the CB requested a time-out and go to fixed gain branch be added to that section of code.
Implementation*: GLAS FSW implemented IPS version 4.5, under FSW CCR 016 closed on 02/11/2004. The Science Team wants this change in place before the laser is turned on. Peter Kutt has given an indication that it could be complete and tested by end of July 2003. Details of the code implementation will be provided in the code/test review package. E-mail exchanges between Jan and Peter refining the detailed description by Jan will be included with this CCR. Initial value for the raw peak limit is 35 and for the weight limit is 150. The CCB has requested/approved testing the weight limit with the values: 100, 150, 200, 250 after the patch is operating (after a laser is powered) for a short period.
Board Members: Eleanor, Xiaoli, Bob, David, Peggy

Attach additional pages as necessary.

*Initiator completes as able; CCB will get additional input as needed.

GLAS Instrument Operations Change Request Form

ID # GLAS-CR-007	Status CLOSED
Approved by: Eleanor, Xiaoli, Bob, David, Peggy	Assigned To: Operations
Initiated by: Jan McGarry	Resolution Date: 08/15/2003
Initiated Date: August 15, 2003	Implementation Date: 09/01/2003

Category (check all that apply)		Parameter		GLAS Flight Software		Ground Software
		Procedure		Documentation		GPS
		SRS		Other	X	Operations

Priority		Low (Desirable)	X	High		Critical (Emergency)

Title:	Altimeter Algorithm Parameter Updates through August 2003

Description/Justification:

Various Altimeter Algorithm parameters have been changed over the course of instrument checkout after launch to optimize the algorithm performance. Several of these are permanent parameter changes that need to uplinked after every CPU reset (Vref, Gmin, Wmin, Noise Search Offset). There is also one other parameter change that goes along with CCR-006, but is not explicitly stated in that CCR. It is the initial gain setting (Ginit). See the attached notes (GLAS Altimeter Algorithm Parameter Changes through August 2003).

Area Affected*:

Flight software – requires 2 table loads to change the parameter limits for Gmin and the Noise Search Offset. These load have been previously uplinked and used, and need to be reloaded after every CPU reset.

Impact*: All of these changes were done during the months of February and March 2003, with the exception of the Ginit parameter change, which is part of CCR-006.
Implementation*: The Science Team wants these parameters in place when the laser is turned on.
Board Members: Eleanor, Xiaoli, Bob, David, Peggy

Additional pages attached.

*Initiator completes as able; CCB will get additional input as needed

The following parameters were changed during the instrument verification phase of GLAS after launch. These parameters were changed to optimize the algorithm and are intended to be permanent changes – they should be re-installed after CPU resets.

1- Change gain parameter **Vref** to 150 (originally changed 2/28/03).

   The parameter Vref determines the amplitude of the echo waveform peak. It was determined that the launch value of 180 was contributing to the waveforms being saturated. So this value was reduced.

2- Change the gain parameter **Gmin** to 13 (originally changed 3/13/03).

   Gmin is the minimum limit on the gain setting (in hardware units). At launch the minimum gain had been set at 4 (< 1 in absolute units), but it was determined that in the region below 13, the behavior of the gain response was nonlinear, so the minimum gain value was raised to keep the gain out of the nonlinear region. The value 13 in hardware units corresponds to an absolute gain value (units the software calculates in) of 2.8.

   It was also necessary to change the limits on the Gmin value for uplink. These values had been 3 – 10, but were changed (via table upload) to 3 - 250.

3- Change the minimum range window width (**Wmin**) to 1 km (originally changed 3/18/03).

   The onboard DEM minimum and maximum heights in the 1 x 1 degree grids appear to be very accurate – accurate enough to be able to reduce the minimum window size to 1 km. To reduce the effect of clouds in the range window, it was decided to take advantage of the accuracy of the onboard DEM and reduce the minimum size of the range window from the launch value of 2 km to 1 km.

4- Change the start of the noise region (**Background Noise Search Offset Start**) to -667000 ns (originally changed 3/28/03).

   The launch value of the noise region was 6671 ns (1 km) beyond the end of the range window. It was determined that ringing from saturated pulses could continue well beyond the end of the range window (for several kilometers), so it was decided to move the calculation of the noise to 100 km in front of the range window – in space, above any possible return from the atmosphere.

   It was also necessary to change the limits of this parameter for uplink. These values had been 0 – 200,000, but were changed (via table load) to –2,000,000 - +1,000,000 nanoseconds.

The following parameter change goes along with CCR-006 (Gain Patches) and should also be reloaded after every CPU reset.

5- Change the initial value of the gain (**Ginit**) to 80.

   The launch value of Ginit was 21 (in hardware units). With CCR-006 Ginit will become not only the initial value of the gain, but also the reset value of the gain, when the gain loop times out. A value of 80 was chosen to be mid-range in the gain region.

GLAS Instrument Operations Change Request Form

(Initiator completes shaded areas)

ID # GLAS-CR-008	Status CLOSED
Approved by: Bob Schutz, Jay Zwally, Jim Abshire, David Hancock, Peggy Jester	Assigned To: Operations
Initiated by: Jan McGarry	Resolution Date: 02/11/2004
Initiated Date: February 11, 2004	Implementation Date: 02/13/2004

Category (check all that apply)	x	Parameter	x	GLAS Flight Software		Ground Software
		Procedure		Documentation		GPS
		SRS		Other	X	Operations

Priority		Low (Desirable)	x	High		Critical (Emergency)

Title:

Change of Npq compression parameters for land surface type

Description/Justification:

Broad surface topography is getting clipped because all of the information in the surface echo cannot fit into 544 nanoseconds. This occurs most often for land surface types. The following compression is therefore requested for land surface type only:

Compression according to p = 1, q = 4, N = 392 which will cause the following to occur:

Bins 1 to 392 - No compression 15 cm sampling 0 to 58.8 m above ref range
Bins 393 to 544 - Compression x4 60 cm sampling 58.8 to 150 m above ref range.

See attached notes from Dave Harding for detailed justification of the change..

Area Affected*: Flight software land compression parameters will be updated in the working table of parameters. Operations will be required to review procedure and monitor that update was successful.
Impact*: Minimal to the flight software/operations but a significant impact to the science if these values are not changed.
Implementation*: Parameter load via a single comamnd. If the GLAS MEU is reset then the parameters will have to be re-loaded.
Board Members: Bob Schutz, Jay Zwally, Jim Abshire, David Hancock, Peggy Jester

Attach additional pages as necessary

*Initiator completes as able; CCB will get additional input as needed

Rationale for Implementing GLAS Waveform Compression for Land Regions
David Harding
February 11, 2004

Implementation of waveform compression, using the pqn compression parameters in the GLAS waveform acquisition software, is requested for cells designated as land in the on-board surface type mask. On-board compression is achieved by reporting a waveform signal amplitude that is an average of adjacent digitizer bins.

Compression according to p = 1, q = 4, n = 392 corresponding to the following is requested:

Bins 1 to 392   No compression 15 cm sampling 0 to 58.8 m above ref range
Bins 393 to 544 Compression x4 60 cm sampling 58.8 to 150 m above ref range

With no compression, the 544 land waveform bins acquired with 1 GHz digitization (15 cm per bin) provide a waveform extent of 81.6 m. In areas of steep topography or tall vegetation on sloped topography, the height distribution of within-footprint surfaces can exceed this 81.6 m waveform extent. In those circumstances the waveform is truncated, with the upper portion of the backscatter signal extending beyond the limits of the telemetered waveform. In areas of mountainous topography, truncation occurs for about 10% of the waveforms. Truncated waveforms invalidate computation of a number of land surface parameters, including the elevation of the highest detected surface (signal start), mean elevation (centroid between signal start and end), return energy, and surface reflectance, slope, and roughness. Derived parameters such as vegetation height and biomass can thus also not be properly computed.

A variety of compression approaches were considered to overcome waveform truncation. In the on-board waveform acquisition algorithm, 150 m of the 1064 nm channel digitizer record can be accessed, establishing an upper limit on waveform extent. The proposed compression approach accomplishes two objectives. The lower portion of the telemetered waveform, up to 58.8 m, is uncompressed providing full 1 GHz sampling of narrow to moderately broad waveforms suitable for full-resolution analysis of those waveforms. For very broad signals, extending beyond 58.8 m, compression by a factor of 4 for the upper portion of the waveform will enable the maximum 150 m extent to be observed in the telemetered waveform, minimizing occurrences of truncation.

Prior to ICESat launch, ISIPS waveform processing algorithms were tested and reportedly properly handle waveforms compressed using the pqn parameters. Processing outputs for land waveforms will be assessed immediately after Laser 2 turn on to ensure proper processing is occurring.

GLAS Instrument Operations Change Request Form

(Initiator completes shaded areas)

ID # GLAS-CR-009	Status CLOSED
Approved by: Bob Schutz, Jay Zwally, Jim Abshire, David Hancock, Peggy Jester	Assigned To: Operations
Initiated by: Science Team, D Hancock	Resolution Date: 10/17/2005
Initiated Date: October 17, 2005	Implementation Date:10/21/2005

Category (check all that apply)	x	Parameter	x	GLAS Flight Software		Ground Software
		Procedure		Documentation		GPS
		SRS		Other	X	Operations

Priority		Low (Desirable)	x	High		Critical (Emergency)

Title:

Change of Npq compression parameters for ice sheet (land ice) surface type

Description/Justification:

Broad surface topography is getting clipped because all of the information in the surface echo cannot fit into 544 nanoseconds. The following compression is therefore requested for ice sheet (land ice) surface type only:

Compression according to p = 1, q = 4, N = 392 which will cause the following to occur:

Bins 1 to 392 - No compression 15 cm sampling 0 to 58.8 m above ref range
Bins 393 to 544 - Compression x4 60 cm sampling 58.8 to 150 m above ref range.

This was already done for surface type = land; see GLAS-CR-008 and attachment

Area Affected*:

Flight software ice sheet compression parameters will be updated in the working table of parameters. Operations will be required to review procedure and monitor that update was successful.
Impact*: Minimal to the flight software/operations but a significant impact to the science if these values are not changed.
Implementation*: Parameter load via a single comamnd. If the GLAS MEU is reset then the parameters will have to be re-loaded.
Board Members: Bob Schutz, Jay Zwally, Jim Abshire, David Hancock, Peggy Jester

Attach additional pages as necessary

*Initiator completes as able; CCB will get additional input as needed

Rationale for Implementing GLAS Waveform Compression for Land Regions
David Harding
February 11, 2004

Implementation of waveform compression, using the pqn compression parameters in the GLAS waveform acquisition software, is requested for cells designated as land in the on-board surface type mask. On-board compression is achieved by reporting a waveform signal amplitude that is an average of adjacent digitizer bins.

Compression according to p = 1, q = 4, n = 392 corresponding to the following is requested:

Bins 1 to 392   No compression 15 cm sampling 0 to 58.8 m above ref range
Bins 393 to 544 Compression x4 60 cm sampling 58.8 to 150 m above ref range

With no compression, the 544 land waveform bins acquired with 1 GHz digitization (15 cm per bin) provide a waveform extent of 81.6 m. In areas of steep topography or tall vegetation on sloped topography, the height distribution of within-footprint surfaces can exceed this 81.6 m waveform extent. In those circumstances the waveform is truncated, with the upper portion of the backscatter signal extending beyond the limits of the telemetered waveform. In areas of mountainous topography, truncation occurs for about 10% of the waveforms. Truncated waveforms invalidate computation of a number of land surface parameters, including the elevation of the highest detected surface (signal start), mean elevation (centroid between signal start and end), return energy, and surface reflectance, slope, and roughness. Derived parameters such as vegetation height and biomass can thus also not be properly computed.

A variety of compression approaches were considered to overcome waveform truncation. In the on-board waveform acquisition algorithm, 150 m of the 1064 nm channel digitizer record can be accessed, establishing an upper limit on waveform extent. The proposed compression approach accomplishes two objectives. The lower portion of the telemetered waveform, up to 58.8 m, is uncompressed providing full 1 GHz sampling of narrow to moderately broad waveforms suitable for full-resolution analysis of those waveforms. For very broad signals, extending beyond 58.8 m, compression by a factor of 4 for the upper portion of the waveform will enable the maximum 150 m extent to be observed in the telemetered waveform, minimizing occurrences of truncation.

Prior to ICESat launch, ISIPS waveform processing algorithms were tested and reportedly properly handle waveforms compressed using the pqn parameters. Processing outputs for land waveforms will be assessed immediately after Laser 2 turn on to ensure proper processing is occurring.

GLAS Instrument Operations Change Request Form

(Initiator completes shaded areas)

ID # GLAS-CR-010	Status CLOSED
Approved by: Schutz, Zwally, Hancock	Assigned To: GLAS Flight Software
Initiated by: David Hancock	Resolution Date: 01/07/2005
Initiated Date: 1/7/2005	Implementation Date: 04/20/2005

Category (check all that apply)	Parameter	X	GLAS Flight Software	Ground Software
	Procedure		Documentation	GPS
	SRS		Other	X Operations

Priority	Low (Desirable)	X	High	Critical (Emergency)

Title: Update Surface Type in DEM Table
Description/Justification: Some of the surface type values are incorrect in the DEM table around the coast of Greenland and Antartica. This has caused the wrong type of waveform packet to be generated for some locations and some scientific data to be lost.
Area Affected*: The DEM tables in the flight software. The surface type flag needs to be corrected for several locations.
Impact*: Because of location of the affected DEM locations, each of the 360 tables could require a

modification. Depending on the implementation this could be a lengthy process. Changing the surface type for various locations will likely change the amount of data recorded on the SSR since many ocean surfaces are being changed to land surfaces. The land waveform packet is larger than the ocean waveform packet. The IMOC will have to re-model the rate and update their SSR timing algorithm.
Implementation*: Flight software – GLAS FSW implemented IPS version 4.5, under FSW CCR 020, closed 05/10/2005 Tables will need to be updated several days before the start of the next campaign (Feb 17, 2005) to give IMOC time to model the new SSR rate.
Board Members: Schutz, Zwally, Hancock

Attach additional pages as necessary.

*Initiator completes as able; CCB will get additional input as needed.

GLAS Instrument Operations Change Request Form

(Initiator completes shaded areas)

ID # GLAS-CR-011	Status CLOSED
Approved by: Hancock, Abshire	Assigned To: GLAS Flight Software
Initiated by: Jan McGarry	Resolution Date: 02/01/2006
Initiated Date: 2/1/2006	Implementation Date: 02/21/2006 03/06/2006

Category (check all that apply)	Parameter	X	GLAS Flight Software		Ground Software
	Procedure		Documentation		GPS
	SRS		Other	X	Operations

Priority	Low (Desirable)	X	High	Critical (Emergency)

Title: Update Automatic Gain Control (AGC) Parameters
Description/Justification: Due to the lower energy of Laser 3 and to meet changing cloud conditions, update the gain latch timeout to be 30 seconds rather than 5 minutes, update GINIT to 250, and update the z_init values to 3.0, 6.5, 3.0, 3.0.
Area Affected*: The AGC parameters in the flight software.
Impact*: The gain latch timeout and z_init parameters are not commandable. Table loads and procedures will have to be developed and tested. The GINIT is commandable vis the

procedure ad_gain_param.
Implementation*: Flight software – GLAS FSW implmented, IPS verison 4.5 under FSW CCR 021 & CCR 022. Develop updated tables and procedures and test on the test bench. Test the command to change the GINIT parameter. Until the parameters are loaded to EEPROM they will have to be reloaded if the MEU is powered off or resets. To go back to the current parameter values the tables can be copied from EEPROM and GINIT can be reset to 80 using the procedure.
Board Members: Hancock, Abshire

Attach additional pages as necessary.

*Initiator completes as able; CCB will get additional input as needed.

GLAS Instrument Operations Change Request Form

(Initiator completes shaded areas)

ID # GLAS-CR-012	Status CLOSED
Approved by: Schutz, Zwally, Hancock, Abshire	Assigned To: Operations/ GLAS FSW
Initiated by: Peggy Jester	Resolution Date: 03/15/2006
Initiated Date: 3/15/2006	Implementation Date: 03/27/2006

Category (check all that apply)	Parameter	X	GLAS Flight Software		Ground Software
	Procedure		Documentation		GPS
	SRS		Other	X	Operations

Priority	Low (Desirable)	X	High		Critical (Emergency)

Title:

Perform tests in order to optimize the receiver settings for the low laser energy.

Description/Justification:

Due to the lower energy of Laser 3 of future science campaigns test transmit gain and receiver settings as proposed by the instrument team. The team proposes

1) to collect data for a curve fit for the transmit energy by going through a range of transmit gain settings over 1-2 orbits. The current math model for the detector gain is accurate to within +/-10%, which is adequate for estimating the transmitted and echoes

pulse energy for surface reflectance measurement but too coarse for monitoring the slow decrease in the transmitted laser pulse energy. There were small jumps in the resultant pulse energy whenever the detector gain and threshold were changed. A numerical models has been used to correct those jumps, but the model was developed based on too

few data points, as we had to keep the data continuity and minimize artificial glitches in the calculated laser pulse energy. However, as the laser ages, we will have to make more frequent adjustment of the gain and threshold for the transmitted laser pulses. We will

have to have a better model to to deal with the effects of the detector gain and threshold setting on the resultant transmitted pulse energy calculation. To collect data, the detector gain and detection threshold for the transmitted laser pulses will be varied while ICESat is in eclipse and preferably over ocean. The estimated test duration is about 500 seconds. We propose to do the test at the last few orbits of the campaign. 2) to test modified receiver settings to optimize the science data at the low energy. For one orbit the team requests that the gain algorithm's filter weight limit be modified from 150 to 60 After resetting the filter weight limit to 150, the team proposes to lower the filter thresholds from the noise mean plus 7.0 times the standard deviation to the noise mean plus 5.0 times the standard deviation. After two orbits, the value will be reset to 7.0. Lowering the thresholds will cause the system to be more sensitive to the signal (i.e. we should pick up more of the low energy surface echoes) but it will also introduce more noise. Right now we are operating at the 7*sigma level of the noise probability distribution and the change is to operate at the 5*sigma level. The test will determine the affect of lowering the threshold and the amount of noise introduced.
Area Affected*: Flight software, mission operations, and science data and processing.
Impact*: Flight software - GLAS FSW implemented IPS version 4.5 under FSW 023, closed 05/02/2006. Generate table 443 load to change the filter weight to 60; table already available to change the weight to 150; need to be available for real time monitoring during 2-3 passes. Mission operations – Planning, scheduling, and monitoring; the three extra orbits to perform the test will use up additional shots on Laser 3. Science data and processing – the modified reciever settings should not be much impact to the science data but may introduce some noise. Varying the transmit threshold and gain setting may cause some drop-outs in Tx pulse, especially at low gain and high threshold. There could also be some noise triggers when the threshold is low. The team will attempt to execute the test over a dark ocean to minimize outages in land topography measurement. Energy data will have to be tweaked due to transmit gain changes.
Implementation*: Flight software – Develop updated tables and procedures and test on the test bench. Test the command to change the filter thresholds. Mission operations – Update the filter thresholds using the command to set the background noise coefficient A1 (GADBKGNDCL); set the transmit threshold and gain as specified by the instrument team; determine whether to do during or after official campaign tracks. Note1: The transmit gain settings (1) can be executed during the same orbits that the receiver settings (2) are tested.

Note2: All updated values will be put back to their pre-test values.
Board Members: Schutz, Zwally, Hancock, Abshire

Attach additional pages as necessary.

*Initiator completes as able; CCB will get additional input as needed.

GLAS Instrument Operations Change Request Form

(Initiator completes shaded areas)

ID # GLAS-CR-013	Status CLOSED
Approved by: Hancock, Abshire, Schutz, Zwally	Assigned To: GLAS Flight Software
Initiated by: Jan McGarry	Resolution Date: 02/26/2006
Initiated Date: 2/26/2006	Implementation Date: 03/09/2007 04/14/2007

Category (check all that apply)	X	Parameter	X	GLAS Flight Software		Ground Software
		Procedure		Documentation		GPS
		SRS		Other	X	Operations

Priority	Low (Desirable)	X	High	Critical (Emergency)

Title: Test the Automatic Gain Control (AGC) Parameters Vref and the filter weight limit
Description/Justification: 1) With the lower energy of Laser 3 the return gain is adjusting between the minimum and maximum gain values but it is still causing saturation ove the ice sheets since most of the time the gain is above the minimum. Lowering the Vref parameter to 135 in the AGC algorithm will lower the amplitudes of the waveform data and reduce saturation. Vref is currently set to 150. 2) Adjusting the filter weight limit will impact how often the AGC algorithm is bypassed. The engineering team desires to test values of 80 and 0 for the filter weight.
Area Affected*: The AGC parameters in the flight software.

Impact*: 1) The Vref parameter is commandable via the procedure ad_gain_param. This procedure has been run several times - there is little impact to flight software and operations. Implementing a lower Vref will lower the amplitude of all waveforms not just those over the ice sheets. This is thought to have minimal negative impact to science since the waveforms over surfaces other than ice are not prone to saturate as much. 2) The filter weight limit is updated by a flight software table 443 load. The tables to set the filter weight to 80 and 0 will have to built and tested by the flight software maintenance team. Lowering the filter weight limit will reduce the number of times the AGC patch is bypassed due to low filter weight. With a value of 0 the the AGC algorithm will not be bypassed and therefore the patch to kickstart the gain loop during saturation will not be called.
Implementation*: 1) Set Vref as part of the campaign 3h start activities. Leave it set to 135 unless there is a negative impact to science. The procedure and its inputs are: ad_gain_params $A1 = -0.6170, $A2 = 0.6170, $A3 = 0.6090, $A4 = 0.0, $B1 = 0.0, $B2 = 0.9030, $B3 = 0.0, $B4 = 0.0, $C0 = 2.6670, $C1 = 3.7050, $VREF = 135.0, $ZMIN = -20.0, $ZMAX = 20.0, $VMIN = 2, $GINIT = 250, $GMIN = 13, $GMAX = 250 Flight software – test the procedure on the test bench. Vref = 135 will have to be reloaded if the MEU is powered off or resets. To go back to the current current Vref value (150) execute the following procedure: ad_gain_params $A1 = -0.6170, $A2 = 0.6170, $A3 = 0.6090, $A4 = 0.0, $B1 = 0.0, $B2 = 0.9030, $B3 = 0.0, $B4 = 0.0, $C0 = 2.6670, $C1 = 3.7050, $VREF = 150.0, $ZMIN = -20.0, $ZMAX = 20.0, $VMIN = 2, $GINIT = 250, $GMIN = 13, $GMAX = 250 2) Test each value of the filter weight limit, 80 and 0, for two orbits. Two table 443 loads will need to be built and tested by the flight software test team. After testing reset the filter weight to 150 using the procedure and table binary files: t443_ccr021a.prc and t443_ccr021a.bin GLAS FSW impemented under FSW CCR 024
Board Members: Hancock, Abshire, Schutz, Zwally

Attach additional pages as necessary.

*Initiator completes as able; CCB will get additional input as needed.

Appendix L: GLAS Flight Software Configuration Change Request Documentation

GLAS Flight Software Configuration Change Request Description

CCR	Problem Description	Proposed Solution	Date Closed
003	Two problems were found during testing: 1) The 532nm energy monitor on GLAS is not operating properly, and the original etalon temperature control loop software that relies on the 532nm energy monitor cannot function in closed loop operation. 2) The unexpected multimode behavior of the flight lasers also cause poor performance even the energy monitor were fixed.	1) Modify the software to use the ratio of PinA and PinB and the value of PinA without PinE to provide the necessary temperature offset signal to the existing PID controller. 2) Add upper and lower limits in each of the P, I, D, outputs that equivalently rejects outliers in the PinA and PinB outputs due to mode hopping. The Software Manager User's Guide and possibly the CT User's Guide need to reflect this change. For more details, refer to GLAS CCR #196 in the CoMITS database.	04/09/2003
009	From a GLAS Project CCR entitled "532 nm boresite algorithm modification" submitted by Steve Palm: Because we will only be operating with 2 SPCM's turned on at a (time there are only 4 left working), the way we had initially designed the boresite procedure will take too long to do on orbit. We intended to do a 5x5 (coarse) scan followed by a 15x15 (fine) scan. Unfortunately, with just 2 SPCM's we will have to use rather long dwell times at each position (8-10 seconds). This means that the fine scan is not tenable. It would simply take too long. So, as an alternative, we plan to do two 5x5 scans in succession, with the first one at a large x/y increment and the second with a finer increment. This sequence would approximate the coarse/fine scan sequence as originally conceived. The problem with doing two 5x5 scans back to back with the second one at a finer resolution is that when one uploads the command to change the x/y increment for the second scan, the software requires you to also upload a start x/y position. After the first scan completes, the mirror position is set to the position of maximum signal and is thus right where you want it to be when you begin the second scan. However, we won't know that position yet	1/15/03: Met with Peggy, Dave Hancock, Shelley, Steve Palm, and Steve Slegel. Steve S. (Photon Counter task author) suggested a patch to the fine cal number of positions to integrate located in the data area of the Photon Counter task. This way a fine calibration could be run automatically after the coarse to achieve the desired results. This patch should be developed in case frequent subsequent calibrations are needed after the first one. This patch is required to be complete before the beginning of March. Steve Palm, in a 1/16/03 email, stated the the new fine boresite calibration x & y number of positions should be 5 for both.	02/11/2004

	- as it is sent down in telemetry, and we won't get it for at least a few hours later. The solution can be implemented using the ?Set Coarse Parameters? command. Currently that command requires the start x/y position to be specified within the range [800?3200]. If the start x/y position is outside of these bounds, an error is generated. The section of code that does this test could be changed such that if the start x/y position is identically 0, then it is set to the current x/y position. An alternative approach would be to send up a command to write directly into the memory locations corresponding to the x and y increments. After the first scan is run, you send two commands that directly write the desired x/y increment values into the appropriate memory locations. Then you send another ?Start Calibration? command. This would start a scan sequence at the current location (which is the best position from the first scan) with the new x/y increments. This approach requires no software changes. The above problem was investigated under Work Request #2.		
011	The etalon control parameters need to be updated because of a change in the laser temperature. The new parameter values are specified in the file ClosedLoopParamSet3rev1.xls sent by Xiaoli Sun.	Generate and uplink new load files for table #13 (Etalon parameters) and table #26 (Etalon closed-loop parameters).	04/09/2003
012	The Auto Gain Minimum Gain (AGGMIN) parameter must be set to 13, but the AD parameter limit table (Table #441) currently restricts the value to the range 3-10.	Uplink a new version of Table #441 that increases the range of AGGMIN to 3-250.	04/09/2003
013	The AD background noise offset (NTO) parameter must be set to -667000, but the AD parameter limit table (Table #441) currently restricts the value to the range 0 to 200000. Jan McGarry requests that the range be increased to -2000000 to 1000000.	. Uplink a new version of table #441 with the modified range.	04/09/2003
014	**:** Revisions to the Automated Closed-Loop Etalon Tracking Algorithm Redgie Lancaster ? 04/01/03 The current version of the flight-software includes an automated tracking algorithm that		02/11/2004

	continuously adjusts the temperature of the Etalon using the ratio of signals (PinA and PinB) received from two photodiode detectors. These detectors are mounted to the Etalon assembly and measure the relative throughput of the Etalon for two beams (on-axis and off-axis respectively). The automated tracking algorithm is currently limited, however, by the need to specify a pair of parameters that represent the ?best guess? of the optimal temperature for the Etalon. In the event that the laser temperature is altered considerably it can become necessary to upload new ?best guess? parameters. The purpose of the two modifications detailed here is to remove the possible need for future parameter uploads by replacing these ?best guess? values with ones indexed to the reference temperature of the laser. Requested modifications to current version of flight software tracking algorithm: 1.) The parameter tset_off should be dynamically assigned the output value of the modified open-loop control code according to the equation below. tset_off = (ct_etalon_openloop_tbl.ola0) + (ct_etalon_openloop_tbl.ola1) * (ct_etalon.tlaser_new) This output value is a temperature setting that is proportional to the laser reference temperature. The required proportionality coefficients are defined in the table shown below. Revisions to the Automated Closed-Loop Etalon Tracking Algorithm Redgie Lancaster ? 04/01/03 Table Parameter Value ct_etalon_openloop_tbl.ola0 64.46 ct_etalon_openloop_tbl.ola1 0.462 ct_etalon_openloop_tbl.ola2 0. ct_etalon_openloop_tbl.ola3 0. ct_etlaon_openloop_tbl.ola4 0. 2.) The value of tset_fail should also be assigned the same value as tset_off.		
015	Analysis of playback science telemetry from before the failure of Laser #1 shows that the pulse width experienced oscillations of increasing amplitude leading up to the failure. Had this information been available in realtime housekeeping telemetry, it would have provided warning of the impending failure.	Modify the CD code to monitor the pulse width (i.e. difference between fire acknowledge and fire command times) and increment an event counter if the value falls outside of specified limits. There should be cycling counters for high and low limit violations which are	02/11/2004

		reported in housekeeping telemetry and then automatically cleared (every 4 sec). There should also be an accumulating counter that reports the total number of limit violations (high and low) and is only cleared by memory load from the ground.	
016	The instrument team has observed an unacceptable number of saturated returns. The AD gain logic needs to be modified to alleviate this problem.	1) Jump around the call to the gain routine if the Selected Filter's Weight is less than a minimum value, or if the Raw Peak is less than a minimum value. Initial values of for these minimum limits are 100 for the weight and 55 for the raw peak. 2) Change the input to the gain from the 8ns filter peak to the raw peak. Change all 8ns filter peak references to use the raw peak instead (includes input to gain, commanded uplinks, and telemetry output). The raw peak should be calculated from the 1000 raw samples used for the downlink.	02/11/2004
017	With laser #2 now operational, the pulse width monitor limits should be set to realistic operational values. The default limits are 0x0 to 0xFFFFFFFF.	Set the limits using the gswprccdpwlim procedure.	02/11/2004
018	The instrument team has determined new values of three of the etalon control parameters to improve the etalon transmission by 10-20% and ensure minimum signal loss in the event of laser or bench temperature change. The new values are: Table 25: GCTEOLA0 = 69.46 GCTEOLA1 = 0.462 Table 26 GCTECLAOBSET = 1.85	Create the updated table loads in the FSW lab and deliver them for uplink to the spacecraft.	02/11/2004
020	The Science Team has found errors in the surface type flag values for some grid elements in the GPS Digital Elevation Model tables. Some locations are flagged as SEA that should be flagged as LAND.	Load corrected flag values to DEM tables.	05/10/2005
021	The Science Team has determined that the AD gain timeout interval should be shorter. They are analyzing their data to decide what the new value should be.	Load new value to AD gain parameter table (system table 443) in RAM, and subsequently copy to EEPROM on	03/06/2006

		Instrument Team approval.	
022	Subsequent to commanded change of some of the AD parameters, the Science Team realized that parameters z1-z4 in table 443 also needed to be changed, for consistency with the commanded values.	Update the parameters in table 443 for uplink to the instrument.	03/06/2006
023	The science team would like to try a smaller value for the low weight limit parameter in the AD gain calculation, to see if this improves detector performance as the laser signal weakens.	Uplink a trial value of 60 for parameter GADAGPWGTLIM in table 443, replacing the present value of 150, and collect science data for one orbit; then restore the original value. The new value may be loaded permanently prior to the next observing campaign, if the Science Team so recommends.	05/02/2006
024	For the campaign ending approximately April 14 2007, the science team wants to run a test varying the values of the AGC weight limit. The test is expected to proceed as follows: - set the weight limit parameter to 80 (currently it is 150). - After an orbit or two like this, set the weight limit to 0 - After an orbit or two like this, set the weight limit parameter back to 150.	Prepare 2 versions of system table 443 with different values (80 and 0) of parameter GADAGPWGTLIM.	04/14/2007
025	Prepare 2 versions of system table 443 with different values (80 and 0) of parameter GADAGPWGTLIM.	Uplink test values to table 443, then restore current operational values after test is completed.	11/04/2007
026	The instrument team wishes to disable part of the AD automatic gain calculation logic to examine the effect on data quality as the remaining laser signal weakens.	The instrument team wishes to disable bypassing of the automatic gain calculation; i.e. the logical condition that determines whether the automatic gain calculation is carried out should be forced to TRUE. This can be achieved by setting the raw peak and weight limits in table 443 to zero, and patching one instruction in ad_calculate_gain() to guarantee that the selection_valid flag is always TRUE.	03/21/2008

Appendix M: Precision Range Determination (PRD) Working Group Status Report to ICESat Science Team Task I&II

Precision Range Determination (PRD) Working Group

Status Report to ICESat Science Team
Task I&II

Xiaoli Sun

Oct. 4, 2006
Scripps Institution of Oceanography
La Jolla, CA

Updated PRD Working Group Tasks & Status

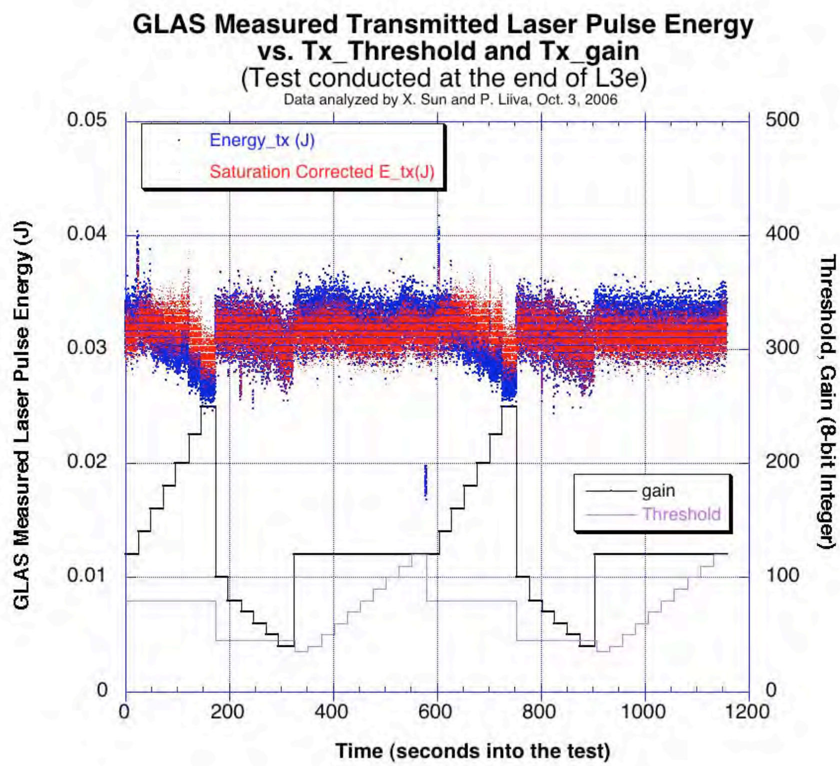
TASK	LEAD	STATUS	
1*. Transmit & Received Pulse Energy Estimation	**X. Sun**	🙂	Already included in the latest data release but needs bore sight effect correction
2*. Saturation Correction	**X. Sun**	🙂	Already included in the latest data release but still need a slope modifier & field validation for surface reflectance measurement
3. BORG Table Compilation of Ops Period Parameters	D. Harding	🙂	
4. Footprint Size, Ellipticity & Orientation Estimation	Univ. of TX	🙂	
5. 40 Hz Cloud Detection using 1064 nm Atm. Channel	S. Palm & C. Shuman	🙂	
6*. Received Waveform Alternate Gaussian Fitting	**D. Hancock**	😐	
7. Centroid vs. Gaussian Fit Range Offset	J. Dimarzio	😐	
8. 532 Forward Scattering Range Correction	S. Palm	😐	
9. Per Shot Elevation Accuracy Estimate	D. Hancock	🙁	
10*. Slope & Roughness from Waveform Broadening	**D. Harding**	⊗	

*** status report included***

Task 1 Updates
- Transmit and Received Pulse Energy Estimation

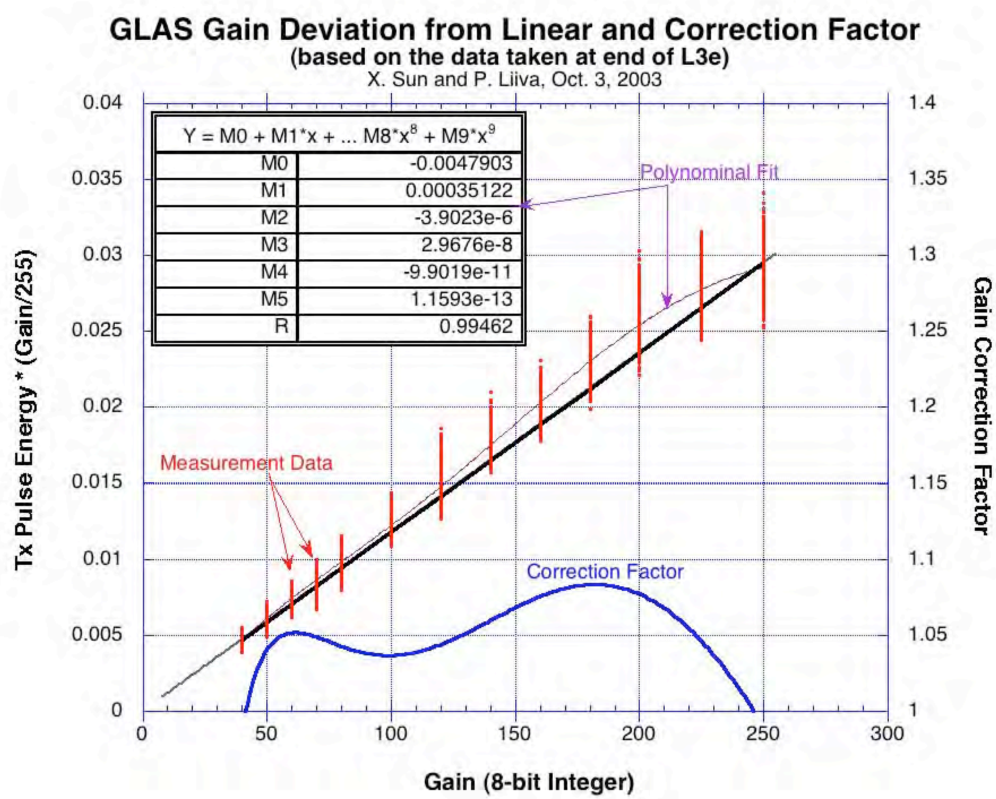
Transmitted energy:

- A test was conducted at the end of L3e to characterize the actual gain vs. the commanded value (assuming energy was constant during the test.
- The estimated Tx energy was found not depend on the Tx-threshold setting.
- The simple linear model for the gain caused up to 10% error in the estimated Tx energy.



Task 1 Updates
- Transmit and Received Pulse Energy Estimation

A gain correction function can be derived based on these test data.



Task 2 - Update
Range Bias Saturation Correction

BACKGROUND:

Reasons for saturations

- Under estimation of the signal dynamic range (~4x)
  - Partial specular reflection from semi glazed surface;
  - Opposition effects of fine snow powder;
  - Higher than expected atmosphere transmission.
- The finite response time of the automatic gain control loop causes brief saturation during transition
- Signal from near still water surface can be 50-100 times stronger than those from dry surface

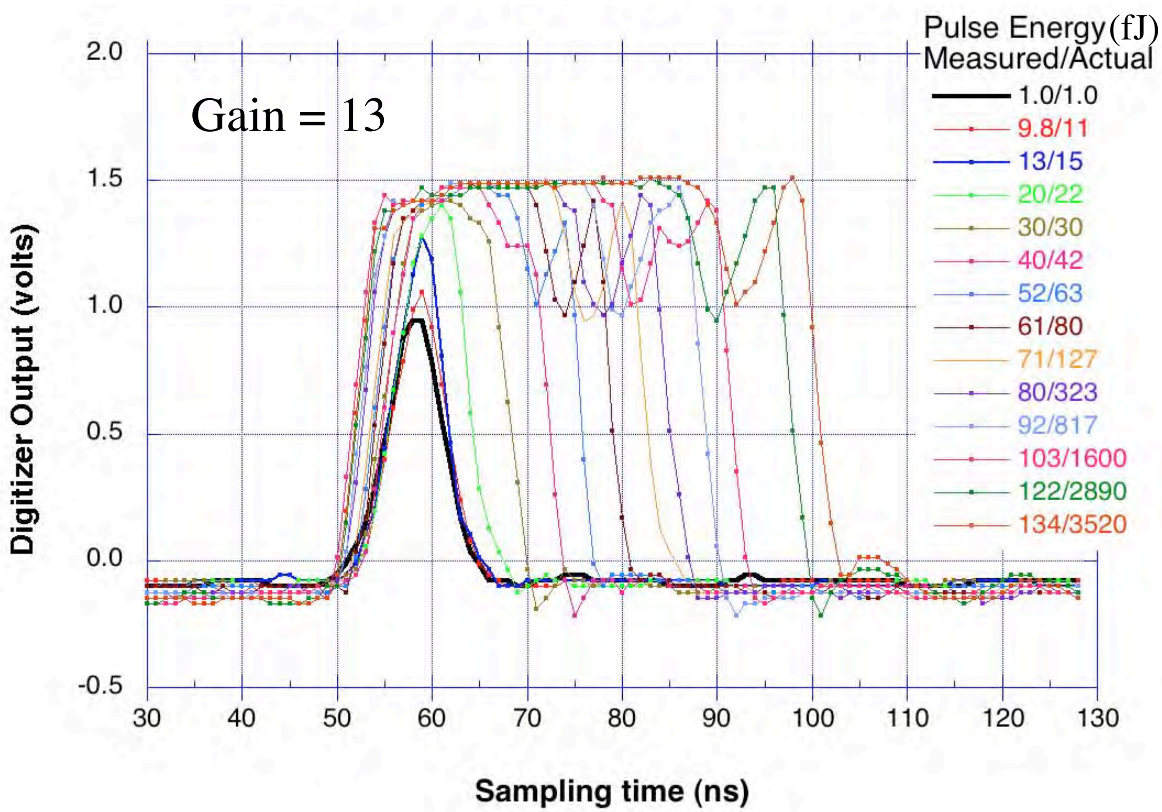
Effects of saturation

- Return pulse centroid shifting to the right (lower elevation) due to pulse broadening, up to 0.30m for icesheet and 2m for water surface
- Reduction of the return pulse area under the waveform (raw pulse energy) and underestimation of the surface reflectance

Correction of saturation

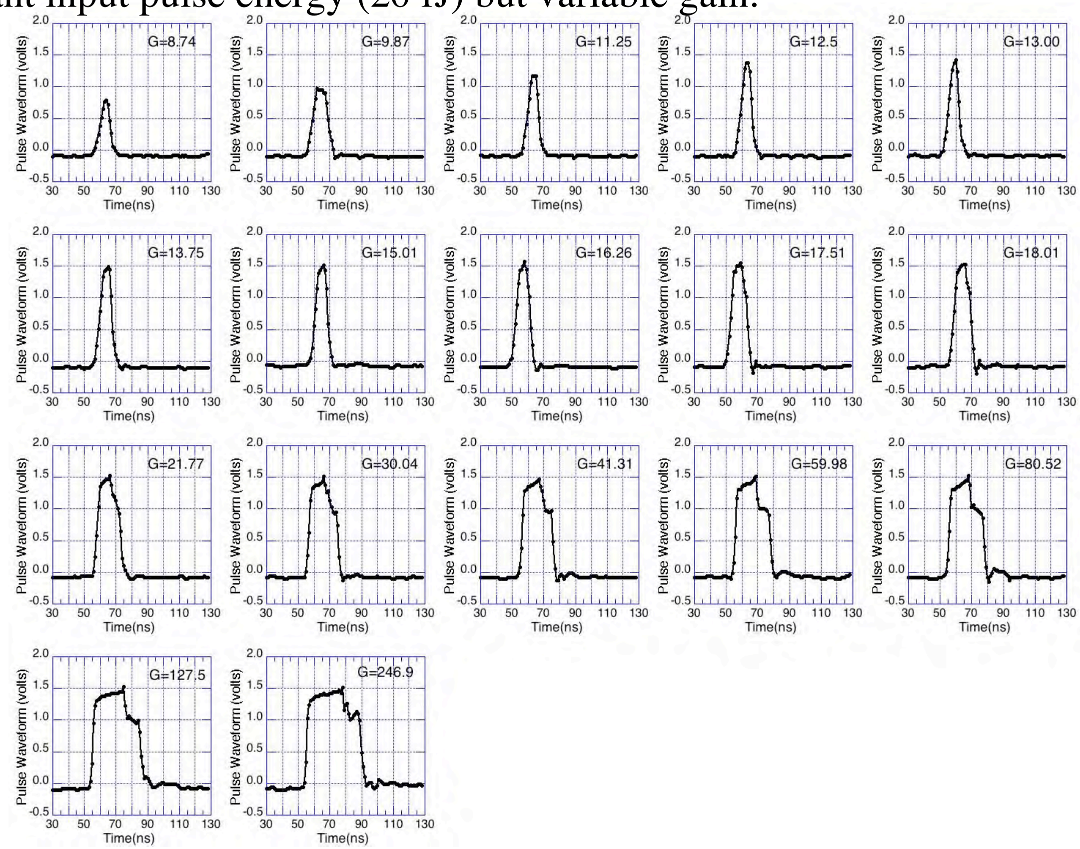
- A series of lab tests were performed using the flight spare detector to characterize the detector.
- Saturation correction algorithms for the range bias and pulse energy were developed based on the lab test data, validated in the field measurements, and included the ground data processing.

Sample Saturated Echo Pulse Waveforms
from the Lab Tests

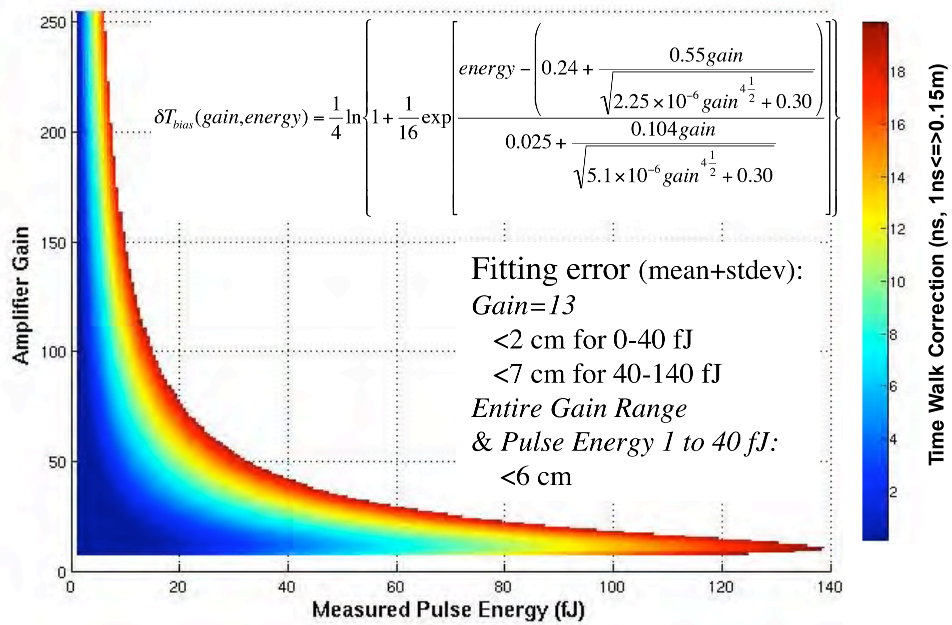


Sample Saturated Echo Pulse Waveforms
from the Lab Tests

Constant input pulse energy (20 fJ) but variable gain:



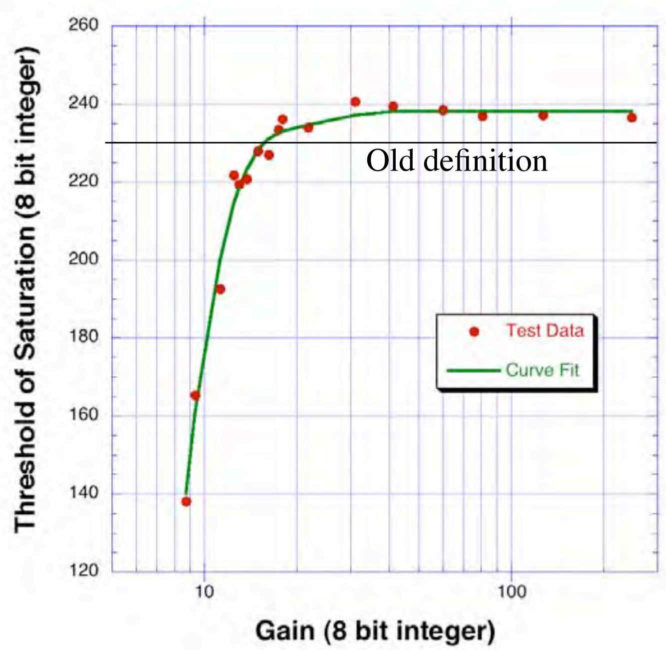
Lookup Table for the Range Bias Correction Based on the Laboratory Test Data



- Good for <0.5° slope surface and slightly over correct for up to 3° slope surfaces.
- The algorithm was applied to the entire globe during the trial runs and resulted in large errors in non flat surface elevation measurements.
- A decision tree was derived to limit the application of saturation correction algorithm to flat to low slope surfaces.

Gain Dependent Saturation Threshold

- A new set of saturation threshold is determined from lab test data where the detector output deviate from linear response by ~5%.
- A piecewise curve fit is used to give the saturation threshold as a function of the detector gain.



$$Threshold = \begin{cases} -3826.9 + 9286.1 \cdot \log(gain) - 7088.1 \cdot \log^2(gain) + 1806.0 \cdot \log^3(gain), & gain < 28 \\ 238 & gain \geq 28 \end{cases}$$

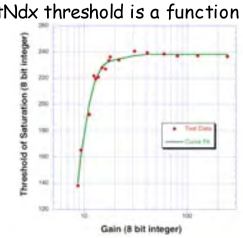
Saturation Correction Decision Tree

Signal is Above Threshold
(Std threshold for GLA06, 12, 13, 15; Alt threshold for GLA15)

No Signal Above Threshold → Invalid; 0

satNdx < 2

satNdx threshold is a function of gain:

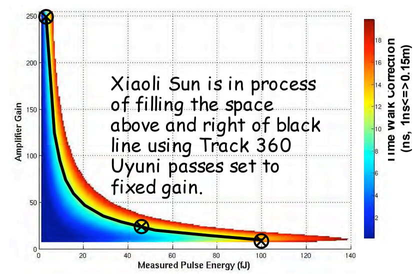


$$Threshold = \begin{cases} -3826.9 + 9286.1 \cdot \log(gain) \\ \quad - 7088.1 \cdot \log^2(gain) \\ \quad + 1806.0 \cdot \log^3(gain), & gain < 40 \\ 238 & gain \geq 40 \end{cases}$$

→ satRngCorr = 0.0; satCorrFlg = 0

satNdx ≥ 2

- Percent Saturation* < 3% (TBD can be different for Std and Alt) → 0.0; 1
- Percent Saturation* ≥ 3% (TBD can be different for Std and Alt)
  - Full Width** < 100 nsec



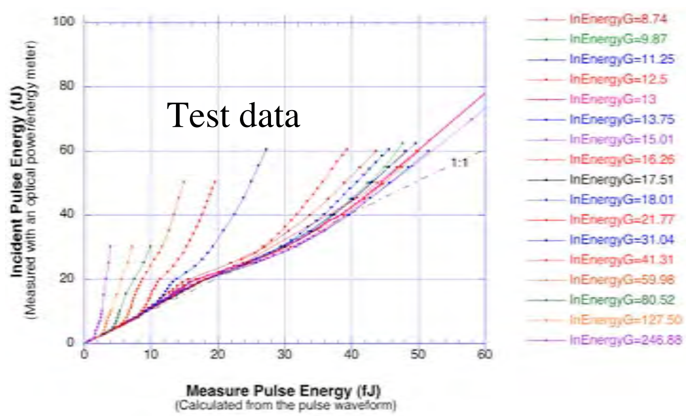
  - Computation Works → Computed Value***; 2
  - Computation Fails → Invalid; 3
  - Full Width** ≥ 100 nsec → Invalid; 4

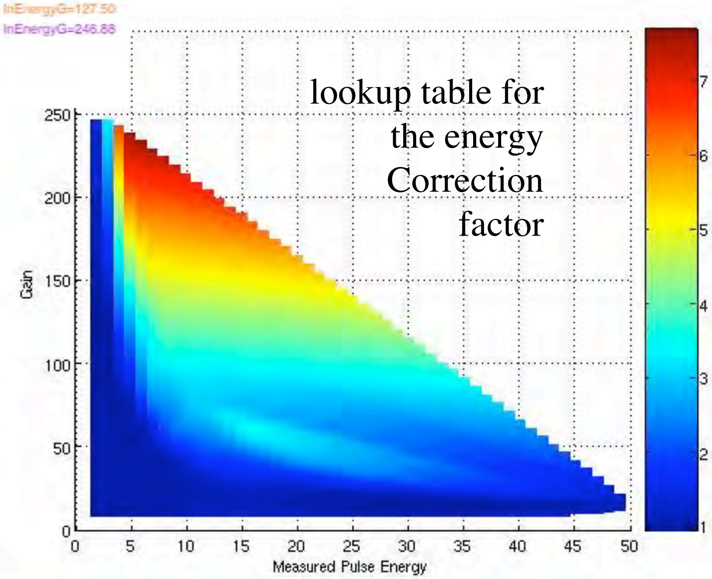
* Percent Saturation (new param to be added to GLA05, 06, 12-15) = satNdx / (Full Width);

** Full Width = SigEndOff - SigBegOff (using Std threshold for GLA06, 12, 13 and 15, and Alt threshold for GLA14)

*** Computed satRngCorr assumes slope < 0.5°; scaling formula needs to be applied to this by user if slope is larger and is known

Task 2 Update
Pulse Energy Saturation Correction





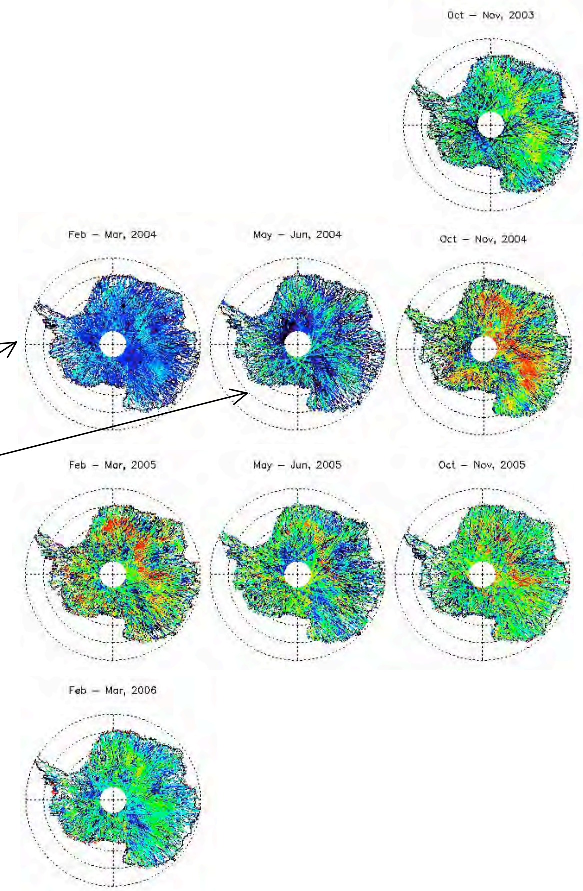
- Correction factor to be multiplied to the echo pulse energy calculated from the pulse area under the waveform.

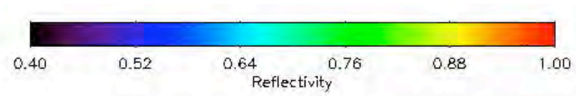
Example of Pulse Energy Saturation Correction
Antarctic Surface Reflectance - Raw data

2003		Feb L1			May-June					Oct-Nov L2a		
2004		L2b			L2c					L3a		
2005		L3b			L3c					L3d		
2006		L3e			L3f					L3g		

2007 …

Laser 2b measurement
showed a lower reflectance
than Laser 2c due to saturation effect





Example of Pulse Energy Saturation Correction
Antarctic Surface Reflectance - Saturation Corrected

	Feb	May-June	Oct-Nov
2003	L1		L2a
2004	L2b	L2c	L3a
2005	L3b	L3c	L3d
2006	L3e	L3f	L3g

2007 …

- There appears to be a trend with the Tx energy;
- Gain correction still needs to be applied;
- Bore sight correction still needs to be applied.
- The saturation correction for the pulse energy still needs to be scaled and modified based on field validation.