LVIS –OIB 2012 Antarctica Grid Mapping and Flights

The following document presents LVIS flight lines and sample plans to be considered for the Fall 2012 Antarctica G-V OIB deployment.

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**Introduction**

These flight lines continue the grid sampling approach using the LVIS high altitude laser altimeter system begun in Antarctica in 2011 as well as specific target lines requested by the Science team including high-priority ICESat tracks and OIB repeat observations. The grid sampling approach is intended to address the OIB science requirements, while maximizing spatial coverage in constructing a datum to link ICESat-1, ICESat-2 and GRACE. The priority areas for the grid sampling approach have been chosen based on coverage obtained in 2011, persistent weather problem areas, and the latest results from GRACE “global-ice” mascons. As with previous LVIS high-altitude deployments, it is expected that the final flight planning of grid lines will be made in the field and be based on science team priorities and weather.

**Direct connection to OIB Baseline Science Requirements:**

IS1: Measure surface elevation with a vertical accuracy of 0.5m or better.

IS2: Measure annual changes in ice sheet surface elevation sufficiently accurate to detect 0.15m changes in uncrevassed and 1.0m changes in crevassed regions along sampled profiles over distances of 500m. We are repeating existing altimetry lines flown by LVIS in 2009 and 2011, as well as crossing lines laid down by ATM and LVIS 2009-2011.

IS7: Collect elevation data so that the combined ICESAT-1-OIB sampling provides an elevation measurement within 10km for 90% of the area within 100km of the edge of the ice sheet. Each area has a densification of flight lines within 100-km of the edge of the continuous ice sheet.

IS6: Remeasure surface elevation along established airborne altimeter and ICESat lines that extend from near the glacier margin to near the ice divide. Several candidate ICESat-1 tracks selected based on their temporal and along-track sampling between the glacier margin and divide. In addition, the LVIS swath mapping provides an abundance of ICESat-1 and future mission (ICESat-2) underflight data.

IS9: Measure once surface elevation across flow transects at 3km and 8km upstream of the terminus. Flight lines provide the opportunity to acquire the across flow transects.

IS11: Measure elevation over 15 Antarctic glaciers that are rapidly changing or likely to change in next 10 years. The Peninsula area has a densification of flight lines to provide the basis of 5-km grid sampling with 10km or 20km grids elsewhere on the WAIS.

Note: In the following images, the full suite of LVIS grid lines is shown in black with those flown in 2011 in yellow. Lines selected for the currently-depicted 2012 plans are shown in red. The background image for many of the plans is the 1-km InSAR-based ice velocity map by Rignot et al.
Overview of Priority Box Locations
Peninsula: Priority 1
Flight: Pen Tip

5km spaced lines
Repeat of Icesat-1 track: 0367 and 1342
Peninsula: Priority 1
Flight: Crane Repeat

100% mapping of 250x 30km area.
Captures numerous Icesat-1 lines
Peninsula: Priority 1
Flight: Crane Sandwich

5km line spacing to E and W of Crane mapping flight
Repeat of Icesat-1 track: 0010
Peninsula: Priority 1
Flight: North Larsen
5km line spacing
Repeat of Icesat-1 track: none
Also overflight of several ~2km wide sections of Icesat tracks as part of grid
Shown including possible transit over Upper Peninsula (little impact on flight time).
Peninsula: Priority 1
Flight: Larsen Base
5km line spacing
Repeat of Icesat-1 track: 0263
Also overflight of several ~2km wide sections of Icesat tracks as part of grid.
Dyer: Priority 4
Flight: W Dyer
Within P4 Area: High?
10km line spacing at coast, 20km inland
Repeat of Icesat-1 track: none
Also overflight of several ~2km wide sections of Icesat tracks as part of grid
Shown including transit over Peninsula (little impact on flight time).
Dyer: Priority 4
Flight: E Dyer
Within P4 Area: Lower?
10km line spacing
Repeat of Icesat-1 track: none
Also overflight of several ~2km wide sections of Icesat tracks as part of grid

Shown including transit over Peninsula (little impact on flight time).
Palmer: Priority 5
Flight: E Palmer

20km line spacing
Repeat of Icesat-1 track: none
Also overflight of several ~2km wide sections of Icesat tracks as part of grid

Within P5 Area: Lower?
Palmer: Priority 5
Flight: W Palmer
Within P5 Area: High?
10km line spacing, 20km spacing inland
Repeat of Icesat-1 track: none
Also overflight of several ~2km wide sections of Icesat tracks as part of grid
Ellsworth: Priority 3  
**Flight: N Ellsworth**  
*Within P3 Area: High*

20km line spacing  
Repeat of Icesat-1 track: still to be selected at lower end (on transit in)  
Also overflight of several ~2km wide sections of Icesat tracks as part of grid
Ellsworth: Priority 3
Flight: S Ellsworth
Within P3 Area: Medium

20km line spacing
Repeat of Icesat-1 track: 1320
Also overflight of several ~2km wide sections of Icesat tracks as part of grid
Evans: Priority 3
Flight: Evans Fill

*Within P3 Area: Lowest*
20km line spacing. With 2011 data, completes establishment of 10km grid in the region
Repeat of Icesat-1 track: still to be selected at upper end (on transit in)
Also overflight of several ~2km wide sections of Icesat tracks as part of grid
Institute Moller Flight: Priority 2  

Moved from DC8 plans.
Issues remaining: need clarification on which of lines are data (ie flown exactly) vs which can be approximated during transit.
PIG Area: Priority 2
Flight: Abbot Coast

Within P2 Area: Medium

10km line spacing at coast, 20km inland
Repeat of Icesat-1 track: still to be selected at upper end (on transit in)
Also overflight of several ~2km wide sections of Icesat tracks as part of grid
PIG Area: Priority 2
Flight: PIG 20

20km line spacing
Repeat of Icesat-1 track: still to be selected at upper end (on transit in)
Also overflight of several ~2km wide sections of Icesat tracks as part of grid

Within P2 Area: Low?
PIG Area: Priority 2
Flight: PIG Offset Repeat

Within P2 Area: High?

Repeats 2009, 2011 flights but has each pass offset by 900m to the (image) right (tracks still spaced by 1.8km track). Expected location of 2012 data swaths shown in orange, 2011 elevation data shown colored.

Flight can repeat 900m of 9 out of total 11 of the 2011, 2009 data swaths.
Repeat of Icesat-1 track: still to be selected at upper end (on transit in)
Also overflight of several ~2km wide sections of Icesat tracks as part of grid
PIG Area: Priority 2  
Flight: PIG Fill  
Within P2 Area: Low?
20km spacing inland + completes 10km grid closer to PIG begun in 2011
Repeat of Icesat-1 track: still to be selected at upper end (on transit in)
Also overflight of several ~2km wide sections of Icesat tracks as part of grid
Thwaites-Pope Area: Priority 2

Flight: Pope Coast

Completess coastal grid started in 2011
Repeats line on Crosson Ice Shelf and Smith Glacier
Repeat of Icesat-1 track: 0056
Also overflight of several ~2km wide sections of Icesat tracks as part of grid
Thwaites-Pope Area: Priority 2
Flight: Pope Icesat

Within P2 Area: High?

Repeat of Icesat-1 track: 0288, 0220, 0190, 1291
Thwaites-Pope Area: Priority 2
Flight: Inland Thwaites
Within P2 Area: Low?
Completes 20km grid started in 2011
Repeat of Icesat-1 track: 0056
Also overflight of several ~2km wide sections of Icesat tracks as part of grid
Getz Area: Priority 6  
Flight: Upper Getz  
Enhances 10km coastal grid over Marie Byrd land begun in 2011

Repeat of Icesat-1 track: TBD  
Also overflight of several ~2km wide sections of Icesat tracks as part of grid
PoleHole: Priority 2

~90deg arcs around 86S or 88S. TBD.
Sea Ice: LVIS Endurance

Repeats portion of DC8 2009, 2010 flight tracks