

Fall 2011 IceBridge DC-8 Flight Plans  
19 August 2011 Draft

*compiled by*

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# Introduction to Flight Plans

This document is a translation of the NASA Operation IceBridge (OIB) scientific objectives articulated in the Level 1 OIB Science Requirements, at the June IceBridge Antarctic planning meeting held at the University of California at Irvine, through official science team telecons and through e-mail communication and iterations into a series of operationally realistic flight plans, intended to be flown by NASA's DC-8 aircraft, beginning in mid-October and ending in late November 2011. The material is shown on the following pages in the distilled form of a map and brief text description of each science flight. Google Earth (KML) versions of these flight plans are available via anonymous FTP at the following address: <ftp://atm.wff.nasa.gov/outgoing/oibscienceteam/>. Note that some users have reported problems connecting to this address with certain browsers. Command-line FTP and software tools such as Filezilla may be of help in such situations.

For each planned mission, we give a map and brief text description for the mission. All of the missions are planned to be flown from Punta Arenas, Chile. At the end of the document we add an appendix of supplementary information, such as more detailed maps of certain missions and composite maps where several missions are designed to work together. On the maps for the land ice missions, the background image is from the Rignot et. al. 1-km InSAR-based ice velocity map. 2009 and 2010 OIB flight lines are depicted in yellow. A careful reader may notice that some of the mission maps in the main part of the document highlight flightlines in green, yellow, and red colors, while other only show the black lines. The colors are a refinement added to the flight plans at a late stage of design which help the field team navigate the aircraft properly to achieve specific science goals. The colors represent the degree of “straightness” of each flight segment, where straight segments are steered using an automated technique and curved sections using a specialized manual method. Not all of the flight plans shown here have reached that mature stage of design.

In fact, as a general rule the flight plans depicted here are all at varying stages of completeness. For each mission we note “Remaining Design Issues” to be resolved, if any exist. In most cases these are minor. CryoSat underflights are a major exception, since these have to be re-planned for each potential flight day (for sea ice) or within a window of several potential flight days (for land ice).

Note that this document shows 32 planned land and sea ice missions totaling 352 flight hours, which is more than we expect to fly this year. The extra flight plans give us operational flexibility to fly as much as possible, and scientifically productive, while we are in the field.

This document does not include the flight plans for the OIB high-altitude flights to be conducted with the Land, Vegetation and Ice Sensor (LVIS) using the NCAR Gulfstream-V aircraft. Those missions are being designed under a separate effort.

## **IceBridge Mission Statement**

Operation IceBridge will employ aircraft to monitor the most sensitive and critical areas of sea ice, ice sheets and glaciers during the gap in satellite coverage caused by the failure of ICESat-1, in 2009, and the launch of ICESat-2, planned for late 2015. Sensitive and critical areas include coastal Greenland and especially its outlet glaciers, costal Antarctica including the Antarctic Peninsula and ice shelves, the sea ice of the Arctic and Antarctic and the southeast Alaskan glaciers. Data collected by IceBridge will improve our knowledge of the contribution of the Greenland and Antarctic ice sheets to sea level rise and will make fundamental contributions to the understanding of changes occurring in the extent and thickness of the polar sea ice cover. Given the societal importance of understanding changes in sea

level rise and sea ice extent, IceBridge data will monitor and improve modeling efforts for sea ice, ice sheet and glaciers. IceBridge will also prepare for the future of airborne monitoring efforts of the cryosphere by adapting existing instruments for high altitude unmanned aerial systems such as the NASA Global Hawk.

### **IceBridge Science Objectives**

The following are the major science objectives of Operation IceBridge in priority order and are met by the following flight plans:

- 1) Make airborne laser altimetry measurements over the ice sheets and sea ice to fill in the data gap between the failure of ICESat-1 in 2009 and the launch of ICESat-2 planned for 2015.
- 2) Link measurements made by ICESat, ICESat-2, and CryoSat-2 to allow their comparison and the production of a long-term, ice sheet altimetry record.
- 3) Use airborne altimetry and radar to monitor key, rapidly changing areas of ice, including sea ice, ice sheets and glaciers, in the Arctic and Antarctic to maintain a long term observation record, improve understanding of glacial dynamics, and augment predictive models of sea level rise and sea ice cover.
- 4) In conjunction with altimetry measurements, collect other remotely sensed data to improve predictive models of sea level rise and sea ice cover, especially the following:
  - Ice sheet and sea ice thickness, structure and extent;
  - Bed topography underlying land-based ice;
  - Bathymetry beneath floating ice shelves;
  - Snow accumulation and firn structure; and
  - Other geophysical constraints that will improve estimates of the geothermal and oceanic heat flux
- 5) Adapt existing instruments for airborne remote sensing of ice by high altitude unmanned aerial systems such as the NASA Global Hawk.

# Sea Ice – Bellingshausen 1

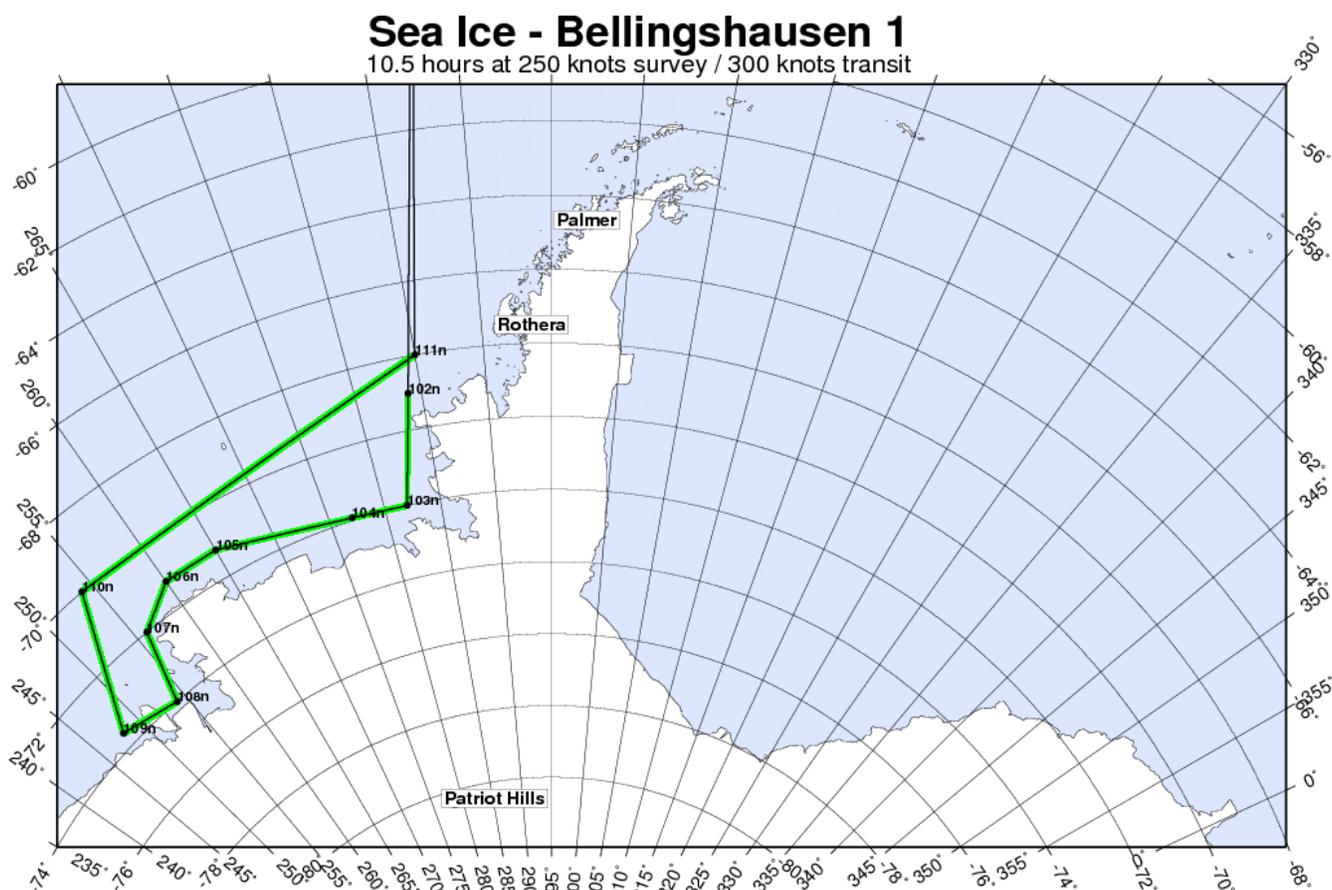
This mission represents a continuation of the IceBridge time series, repeating much of the 091021 and 101030 Sea Ice 01 flights. The northern portion of this flight (i.e. between WP110n and 111n) may be adjusted according to sea ice coverage reports obtained just prior to (or during) the deployment, specifically the location of the ice edge. Also note that that segment of the flight may have to be flown at high altitude, depending on fuel constraints. The 2011 mission has been modified from previous mission plans by removal of the PIG area flight lines, and addition of coverage in the Bellingshausen Sea region. This mission should be flown as early as possible, preferably before mid-Oct, because of the relatively early onset of melt of in this region.

**Flight Priority:** High

**Instrument Priority:** ATM, snow radar, DMS, Ku-band radar, gravimeter

**ICESat Tracks:** none

**Remaining Design Issues:** none



# Sea Ice – Bellingshausen 2

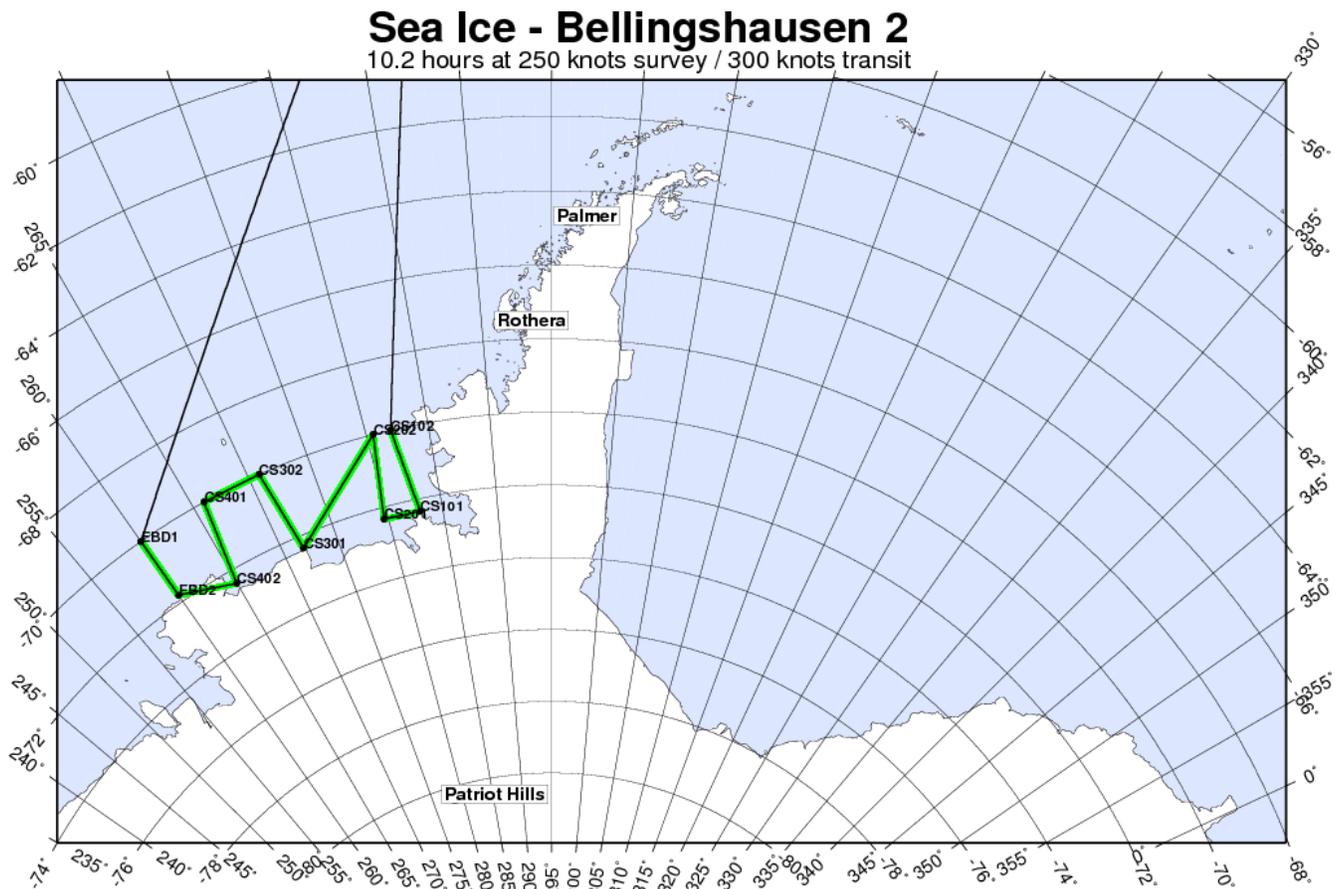
This mission represents a modification of Bellingshausen 1, to be flown in its place in the event that the ice edge in this region has retreated far southward. Adapting to “moderate ice” sea ice condition, the flight pattern is modified to (a) provide denser coverage (i.e. multiple north-south legs) over the smaller expanse of sea ice and (b) the opportunity to make multiple passes over the ice edge. The specific location of the waypoints should be reviewed before the flight and adjusted based on the sea ice coverage reports obtained just prior to (or during) the deployment, specifically the location of the ice edge. Of medium priority on this mission is the opportunity for a coordinated under flight of a CryoSat2 or Envisat orbit (in that preferred order) along one of the north-south legs. This opportunity should not dictate the decision to fly the mission. Instead, the coordinated under flight should only be flown if, on the day selected for the mission, there is a CryoSat2 or (absent CryoSat2 tracks) an Envisat ground-track that is well-located relative to one of the planned grid lines and well-timed (plus or minus 2 days). If there is a time offset greater than 2 hours, the flight line needn't be an exact replication of the CryoSat2 or Envisat ground-track. This mission should be flown as early as possible, preferably before mid-Oct, because of the relatively early onset of melt of in this region.

**Flight Priority:** High if Bellingshausen 1 is impractical because of light ice, otherwise medium

**Instrument Priority:** ATM, snow radar, DMS, Ku-band radar, gravimeter

**ICESat Tracks:** none

**Remaining Design Issues:** replace NS leg(s) with contemporaneous CryoSat ground track



# Sea Ice – Endurance

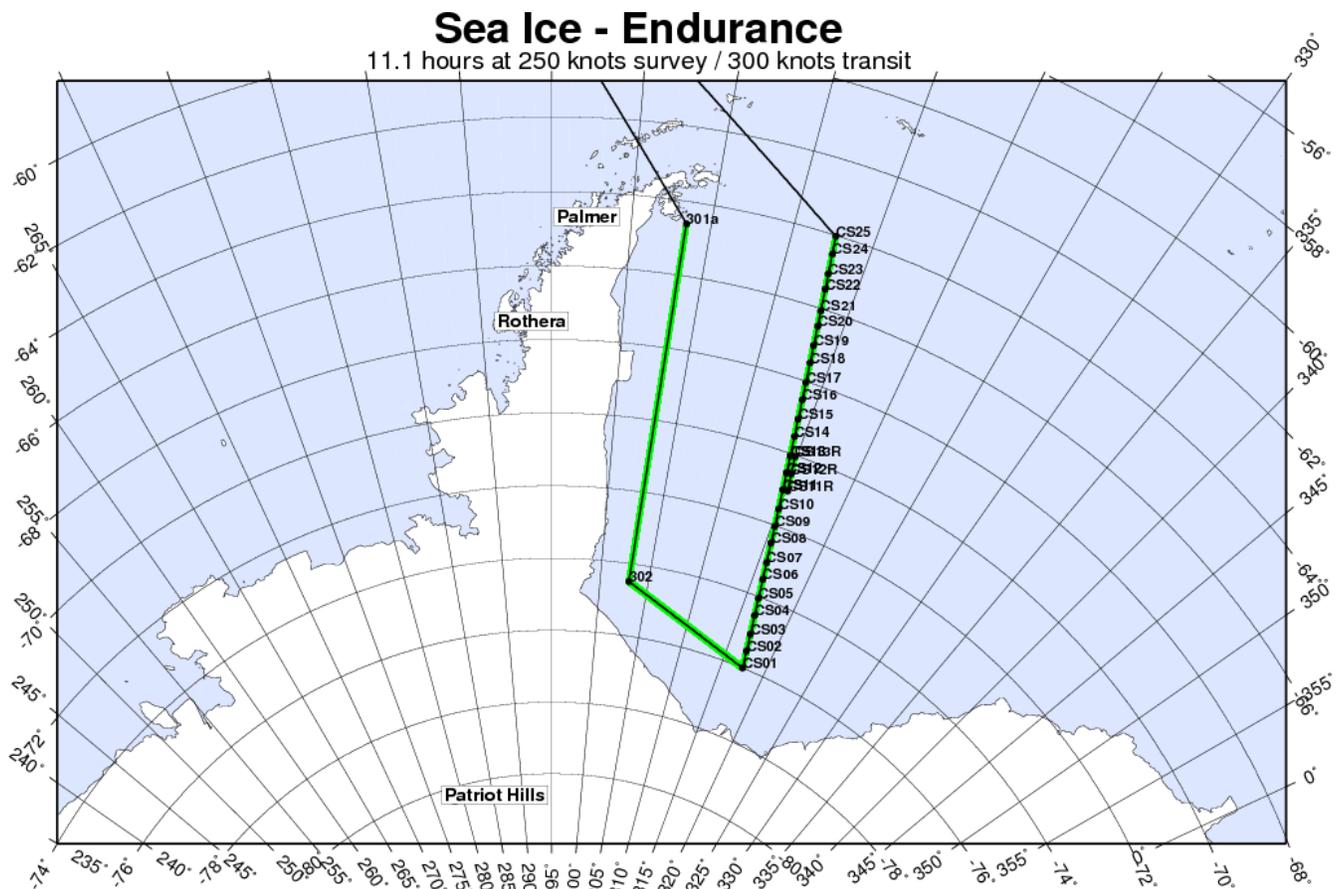
This mission represents a continuation of the IceBridge time series, repeating the “along shore” flight line (i.e. WP301a to WP302) flown in 2009 and October 28, 2010. It typically crosses rough sea ice. The eastern flight line (i.e. WPCS22 to CS01) is a repeat of a segment flown in October 28, 2010. The eastern flight line (i.e. WPCS22 to CS01) will be adjusted to occupy a contemporaneous CryoSat2 orbit. On the day of the mission, the eastern flight line (i.e. WPCS22 to CS01) will be adjusted as necessary to allow a 30 minute backtrack loop along the line, repeating a portion of the track to aid in the determination of drift rate. If logistically possible, it is recommended that this mission be coordinated with a Gulfstream V LVIS mission with the aircraft occupying the eastern CryoSat orbit line at about the same time, and with the Gulfstream flying a 30 minute “double back” loop when the Gulfstream pulls ahead of the DC-8 by 30 minutes.

**Flight Priority:** High

**Instrument Priority:** ATM, snow radar, DMS, Ku-band radar, gravimeter

**ICESat Tracks:** none

**Remaining Design Issues:** replace eastern leg with contemporaneous CryoSat ground track



# Sea Ice – Seelye Loop

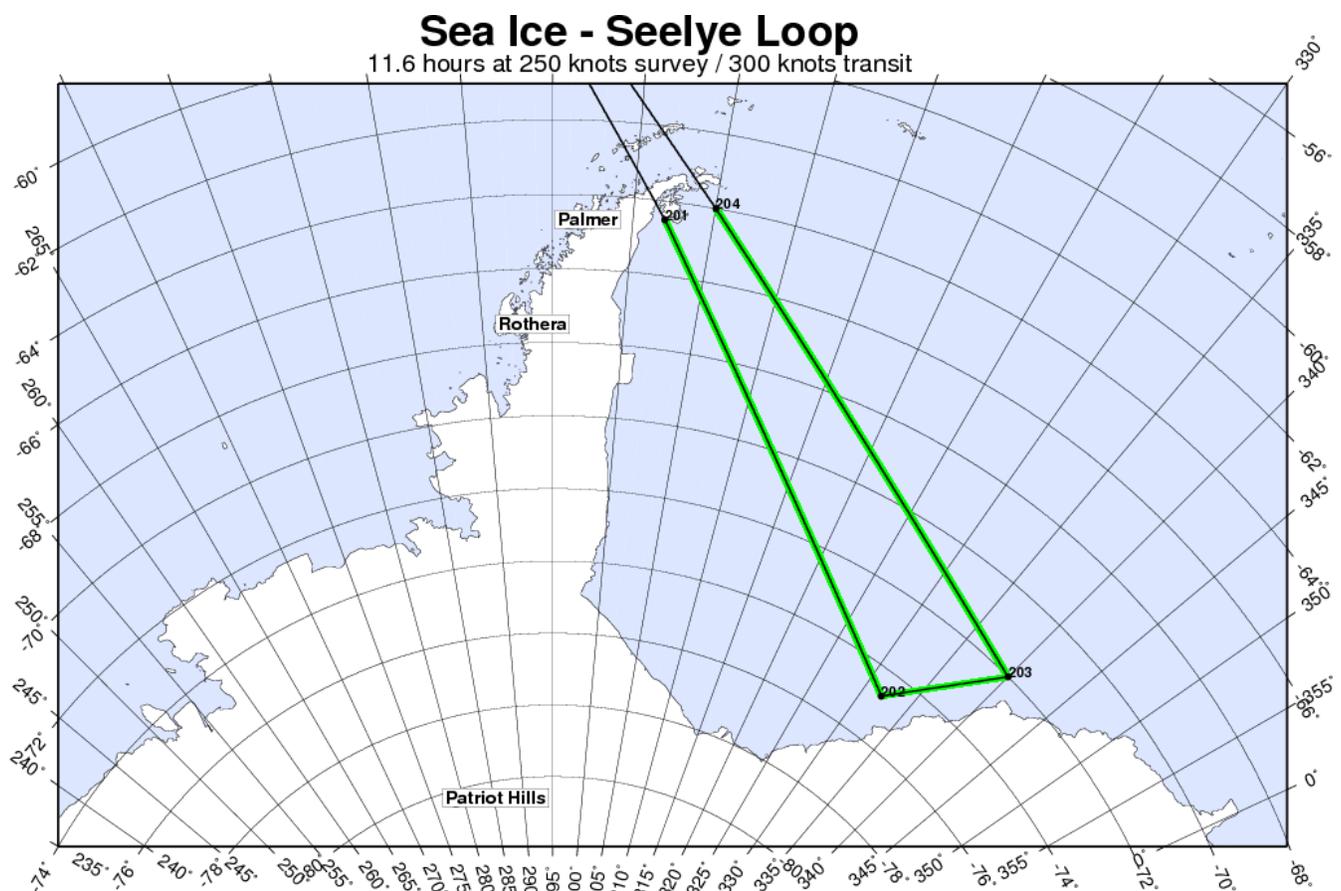
This mission represents a continuation of the IceBridge time series, repeating of the 091024 and 101026 missions. It targets gradients in sea ice freeboard and thickness along the “gate” connecting the tip of the Antarctic Peninsula with Cape Norvegia. Time permitting, a 30 minute backtrack loop could be included on the flight line to repeat a portion of the track to aid in the determination of sea ice drift rate. However note that this mission is probably too long even without the backtrack, and may have to be shortened if dictated by fuel constraints.

**Flight Priority:** High

**Instrument Priority:** ATM, snow radar, DMS, Ku-band radar, gravimeter

**ICESat Tracks:** none

**Remaining Design Issues:** none



# Sea Ice – Seelye Prime

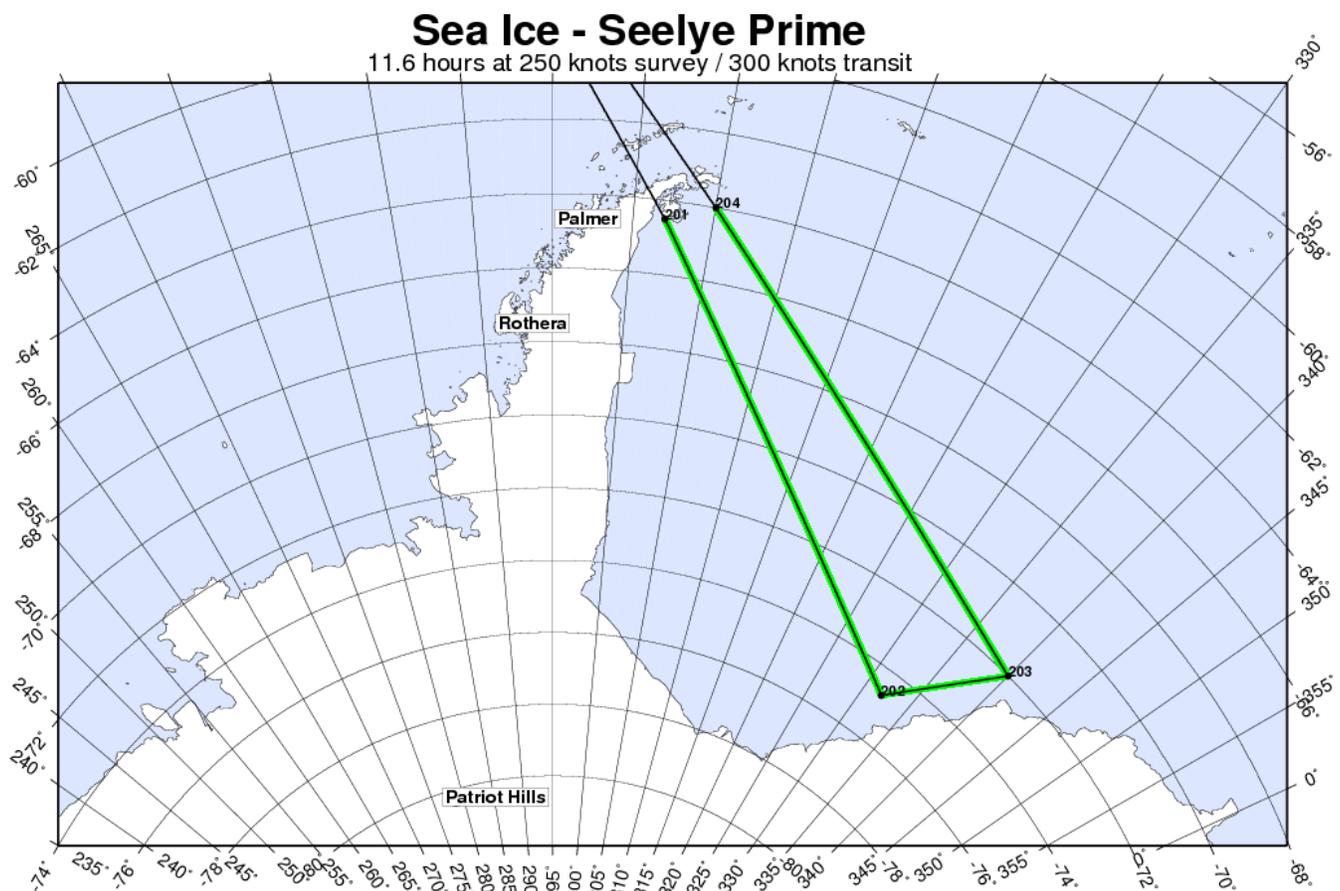
This mission would repeat the Seelye Loop above, but following at least two weeks after the first flight. This time period (in the Antarctic Spring) would allow a significant amount of snowmelt to occur and permit validation of the snow radar results. Note that as is the case with the Seelye Loop mission, this mission is also probably too long even without the backtrack, and may have to be shortened if dictated by fuel constraints.

**Flight Priority:** Medium

**Instrument Priority:** ATM, snow radar, DMS, Ku-band radar, gravimeter

**ICESat Tracks:** none

**Remaining Design Issues:** none



# Sea Ice – Twisted

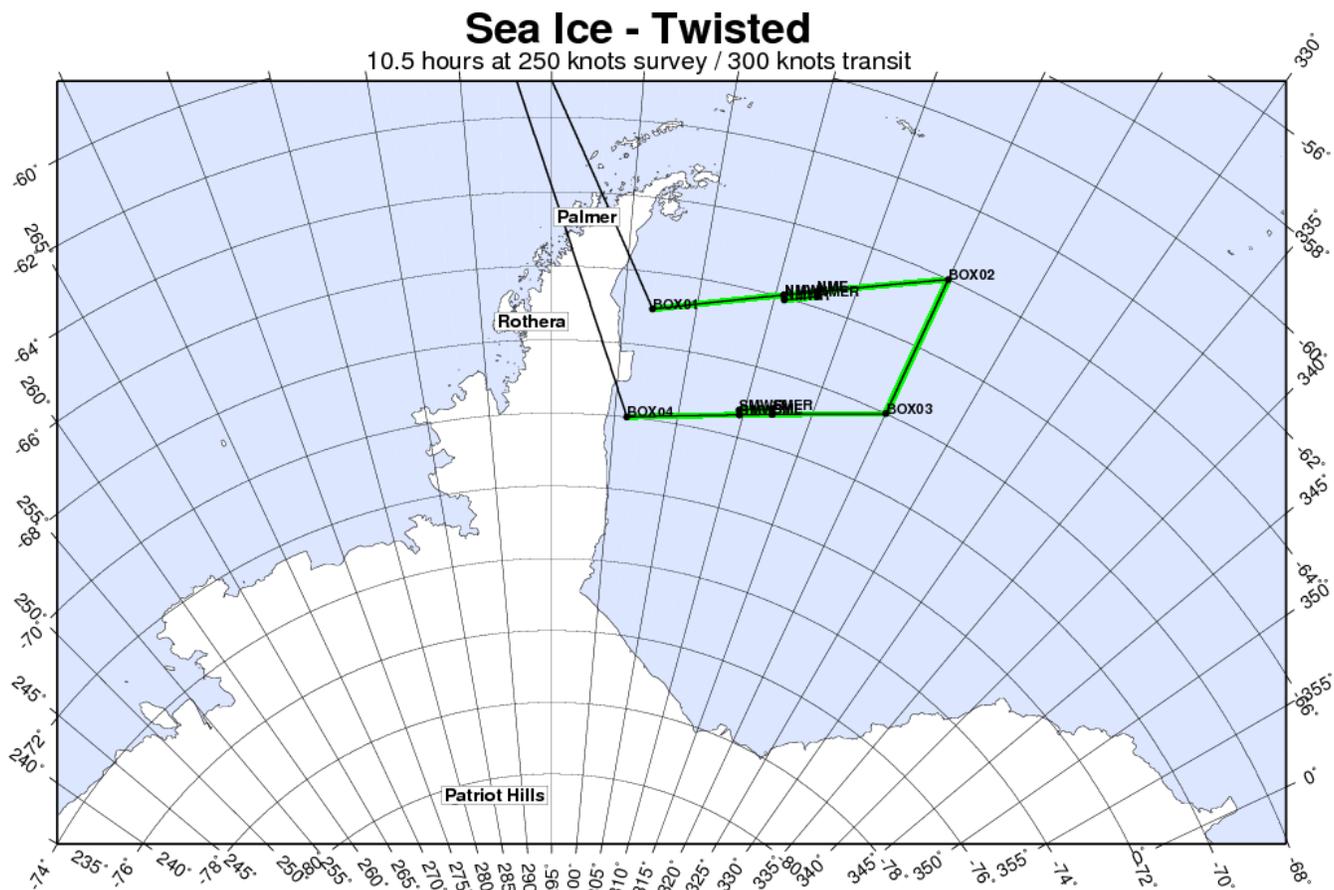
This mission represents an alternative pattern over the Weddell, generally rotating (aka ‘twisting’) the Seelye Loop pattern northward, closer to ice edge. We also include two 30 minute backtrack loops, in order to repeat portions of the track to aid in the determination of sea ice drift rate. This is a medium priority mission to be considered in the event of poor weather at other sea ice mission sites.

**Flight Priority:** Medium

**Instrument Priority:** ATM, snow radar, DMS, Ku-band radar, gravimeter

**ICESat Tracks:** none

**Remaining Design Issues:** none



# Land Ice – Getz 3

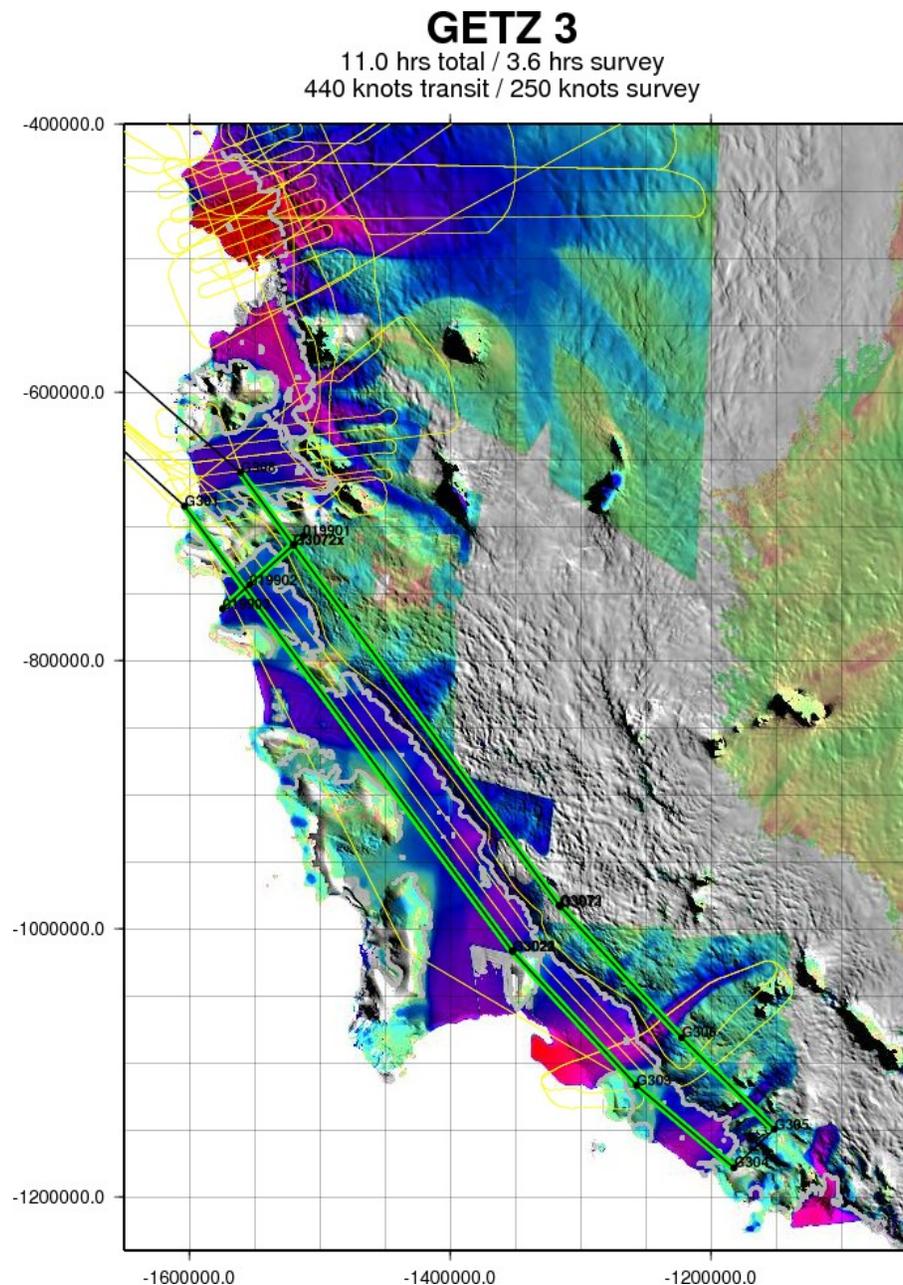
This is a new mission, designed to supplement the 2009 Getz 1 and 2010 Getz 2 flights. The twofold purpose is to continue mapping the sub ice-shelf bathymetry using the gravimeter, and to continue mapping the ice surface and bedrock upstream of the grounding line. Coverage extends west of the previous OIB Getz surveys, and also occupies an ICESat line crossing all of the flown and planned Getz OIB flight lines. See the Appendix for a composite map of all Getz missions.

**Flight Priority:** High

**Instrument Priority:** not specified

**ICESat Track:** 0199

**Remaining Design Issues:** none





# Land Ice – Crosson 1a

This is a new mission, based on the Crosson 1 mission drafted for the 2010 OIB fall campaign but not flown then. Its primary purpose is to map the bathymetry beneath the Crosson Ice Shelf on a 10-km grid using gravimetry, supplemented by all of the other OIB sensors. A secondary purpose is to map thinning of Smith Glacier using altimetry. The grid is designed around descending ICESat orbit tracks, utilizing two of them in place of the regularly-spaced 10-km grid lines. A tie line with the 2009 Thwaites Ice Shelf survey is included, and the grid also ties into the 2010 Dotson shelf survey. It also purposely flies over areas of exposed bedrock to better constrain the gravity inversion. The grid is designed to avoid the most difficult terrain around 8000' Mount Murphy.

**Flight Priority:** High

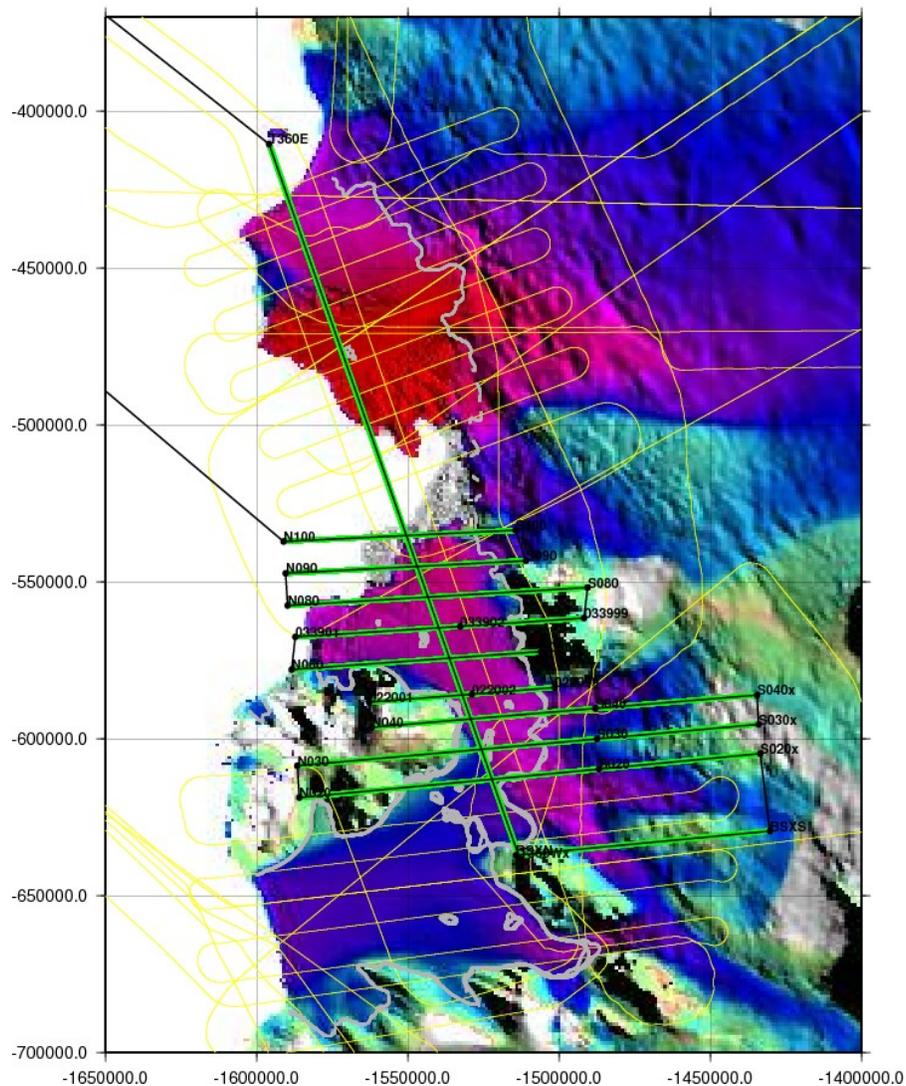
**Instrument Priority:** not specified

**ICESat Track:** 0220, 0339

**Remaining Design Issues:** none

## Crosson 1a

11.1 hrs total / 4.0 hrs survey  
440 knots transit / 250 knots survey



# Land Ice – TSK 1a

This flight is dedicated to overflying the lines over these three glaciers (plus one remaining line over Pine Island Glacier) originally flown by the NASA/CECS/Armada de Chile project in 2002. It is primarily intended to monitor changes in the surface elevation of these glaciers using the ATM, while also collecting depth, accumulation and gravity data at the same time. A change from the previous version of this mission (TSK1), which was last flown in 2009, is that the “horseshoe” portion of the Thwaites lines was widened inland from its previous position.

**Flight Priority:** High

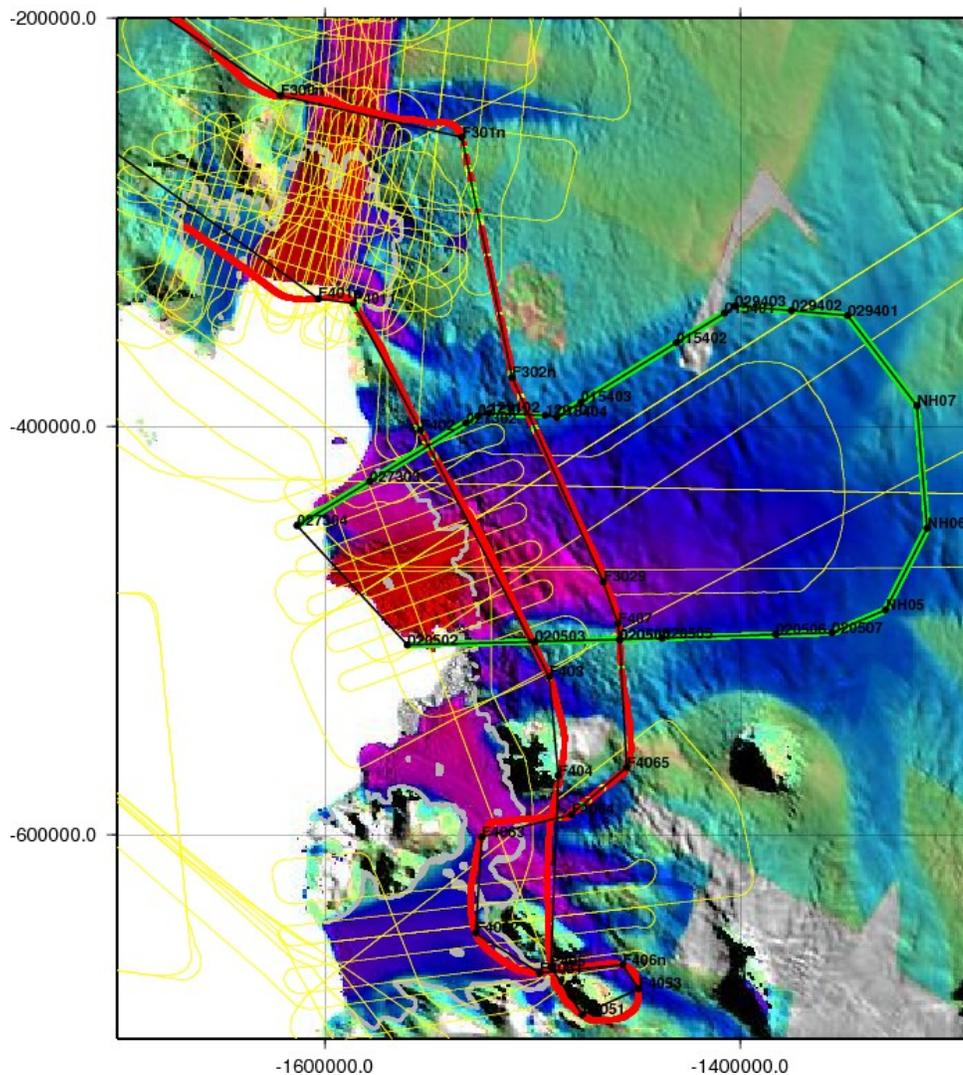
**Instrument Priority:** not specified

**ICESat Track:** 0154,0205,0273,0294,1291

**Remaining Design Issues:** none

## TSK 1a

10.8 hrs total / 4.0 hrs survey  
440 knots transit / 250 knots survey



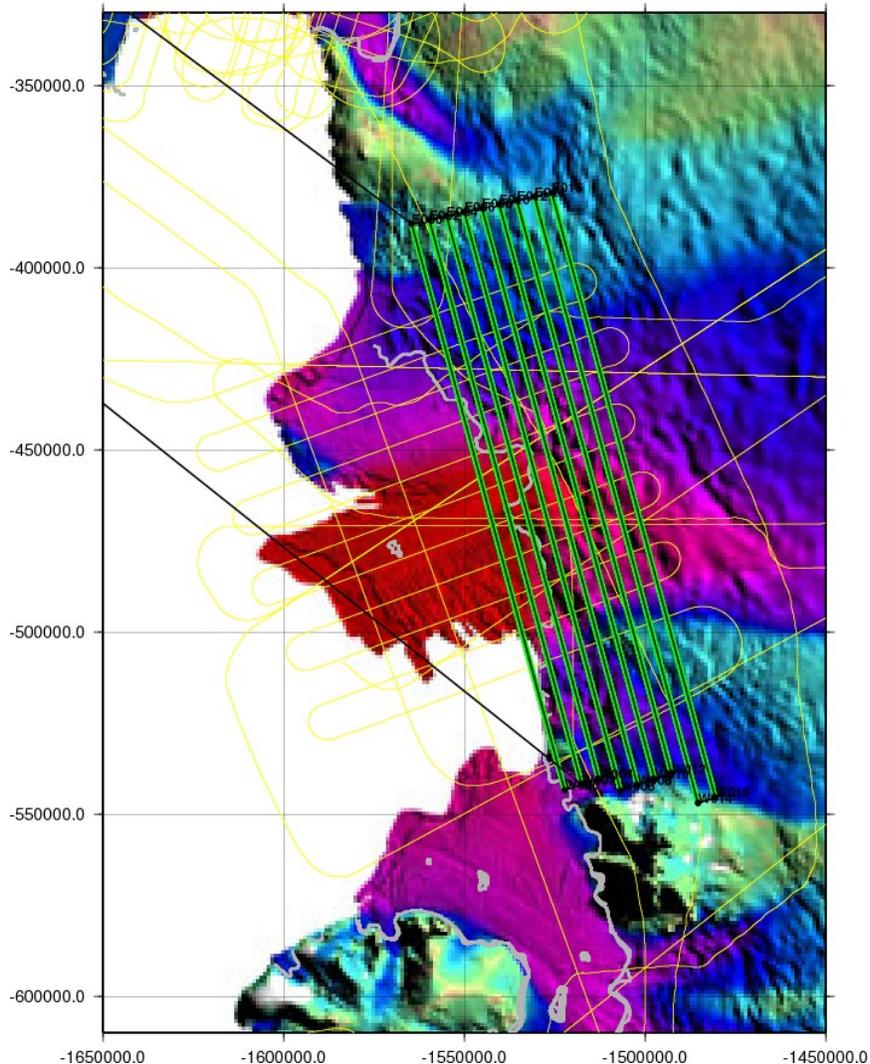
# Land Ice – Thwaites Grounding Line 1

This is a new mission, designed in conjunction with the Thwaites Grounding Line 2 mission to map in detail much of the grounding line and area upstream of it, in order to inform predictions of its potential upstream migration. The pair of missions is aligned with the UTIG AGASEA grid, and one of the lines (E05-W05 in Thwaites Grounding Line 2) is co-located with one of the UTIG cross-flow lines to facilitate intercomparison of the OIB and UTIG measurements. Each of these two missions creates a grid with 5 km spacing offset from each other by 2.5 km, so that if both missions are flown the resulting grid will be spaced at 2.5 km. See the Appendix for a composite map which shows all previous and planned OIB flight lines in this area, plus the UTIG and BBAS AGASEA lines.

- Flight Priority:** High
- Instrument Priority:** not specified
- ICESat Track:** none
- Remaining Design Issues:** none

## Thwaites Grounding Line 1

11.4 hrs total / 4.2 hrs survey  
440 knots transit / 250 knots survey



# Land Ice – Thwaites Grounding Line 2

See previous discussion included with the Thwaites Grounding Line 1 mission.

**Flight Priority:** Low

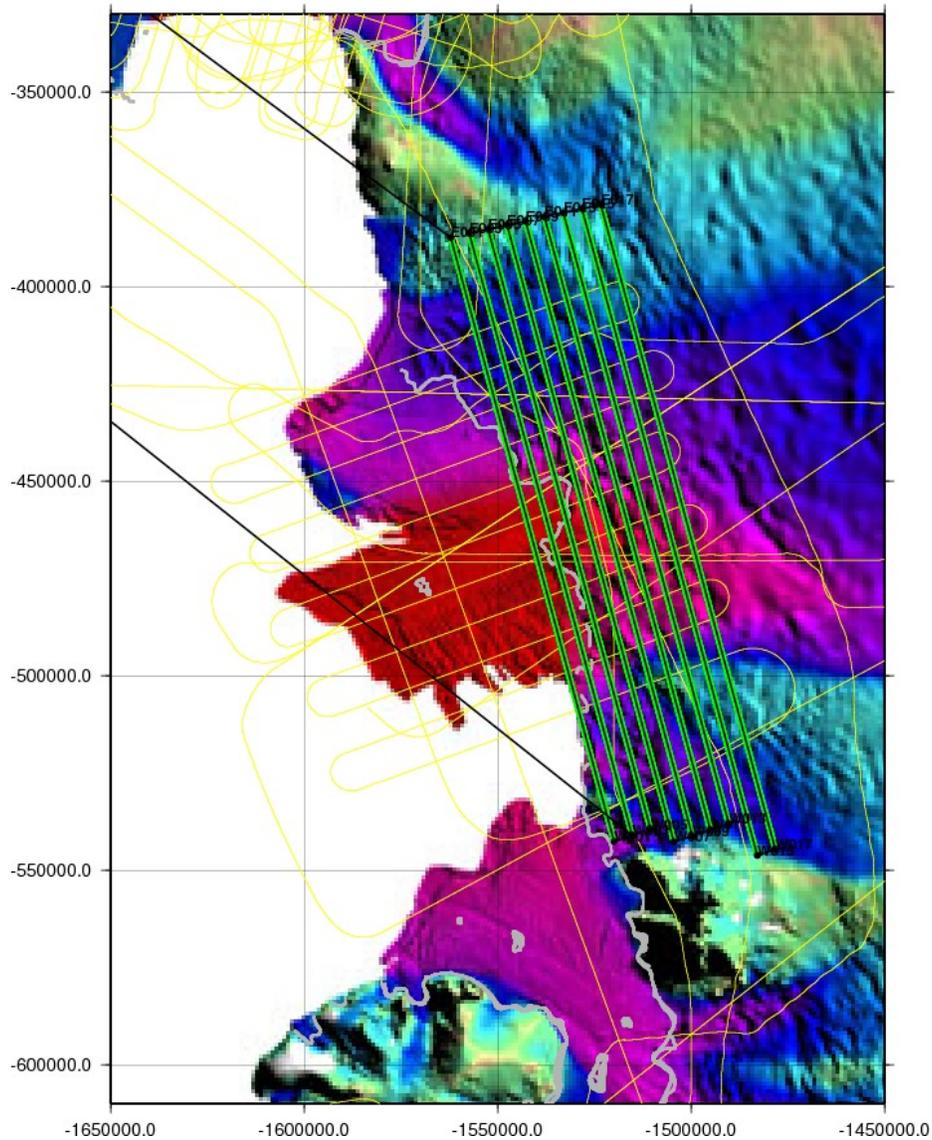
**Instrument Priority:** not specified

**ICESat Track:** none

**Remaining Design Issues:** none

## Thwaites Grounding Line 2

11.4 hrs total / 4.2 hrs survey  
440 knots transit / 250 knots survey



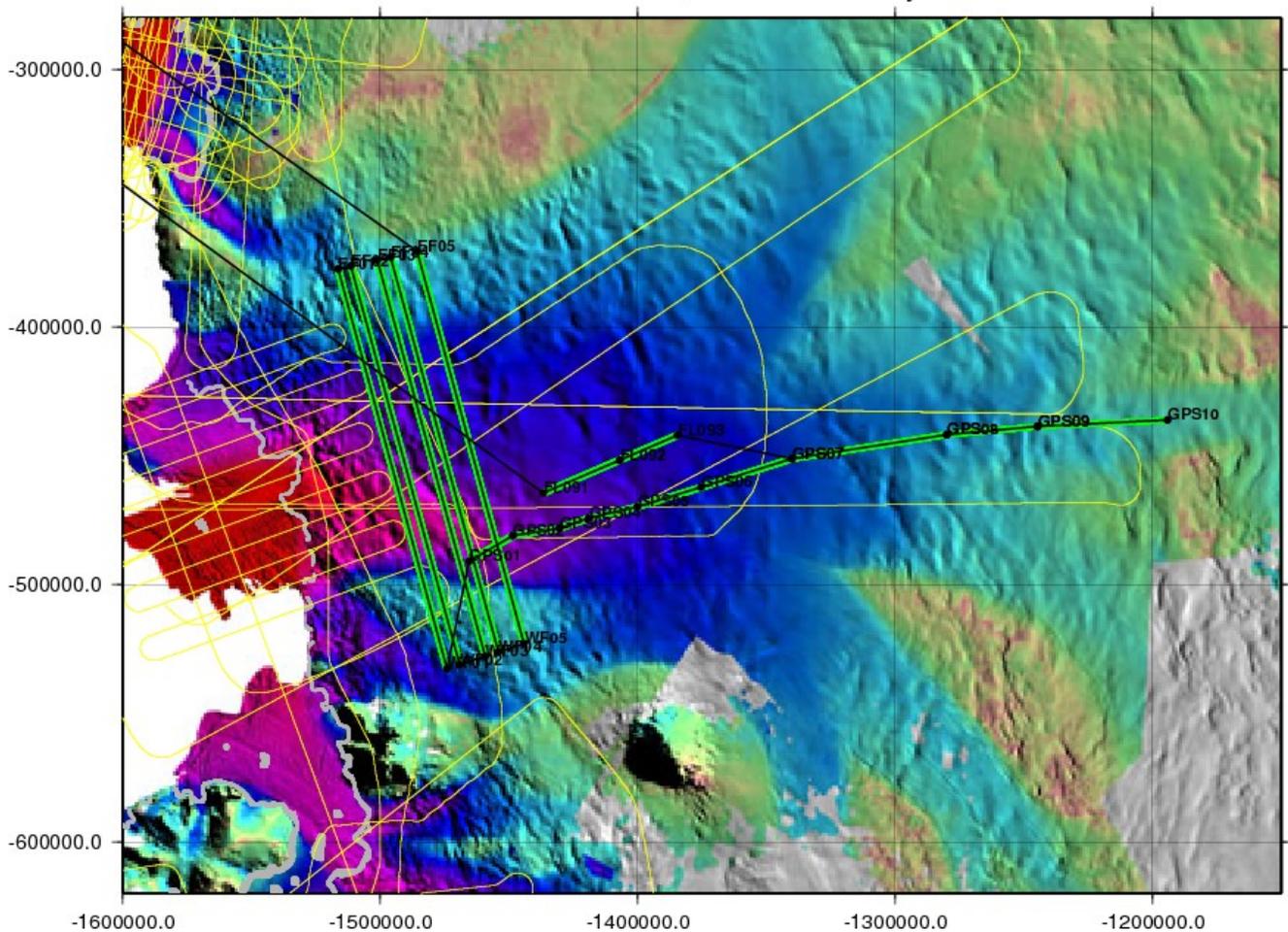
# Land Ice – Thwaites Upstream 1

This is a new mission, designed with three goals in mind. First, we occupy a number of seismic and in-situ GPS survey lines established by Penn State University scientists along two flowlines of Thwaites glacier. Second, we extend the upstream coverage of the grounding line grid from the Thwaites Grounding Line 1 and 2 missions, in conjunction with the UTIG AGASEA grid. The combined coverage of all three missions will include a 2.5 km grid across the lower part of the grounding line, a 5 km grid upstream of that, transitioning to the 15 km UTIG grid. Third, the upper part of the longer flowline is flown twice, once in each direction, to facilitate instrument self-consistency checks. See the Appendix for a composite map showing all OIB and UTIG coverage in this area.

- Flight Priority:** High
- Instrument Priority:** not specified
- ICESat Track:** none
- Remaining Design Issues:** none

## Thwaites Upstream 1

10.9 hrs total / 3.7 hrs survey  
440 knots transit / 250 knots survey



# Land Ice – Thwaites Upstream 2

This is a new mission. It is intended to densify the existing AGASEA 15 km grid to a 5 km grid, to facilitate flux gate analysis and ice sheet modeling. It is designed in conjunction with mission Thwaites Upstream 1, to extend the grid started in that mission farther upstream. See the Appendix for a composite map showing all OIB and AGASEA missions in the lower Thwaites area.

**Flight Priority:** Low

**Instrument Priority:** not specified

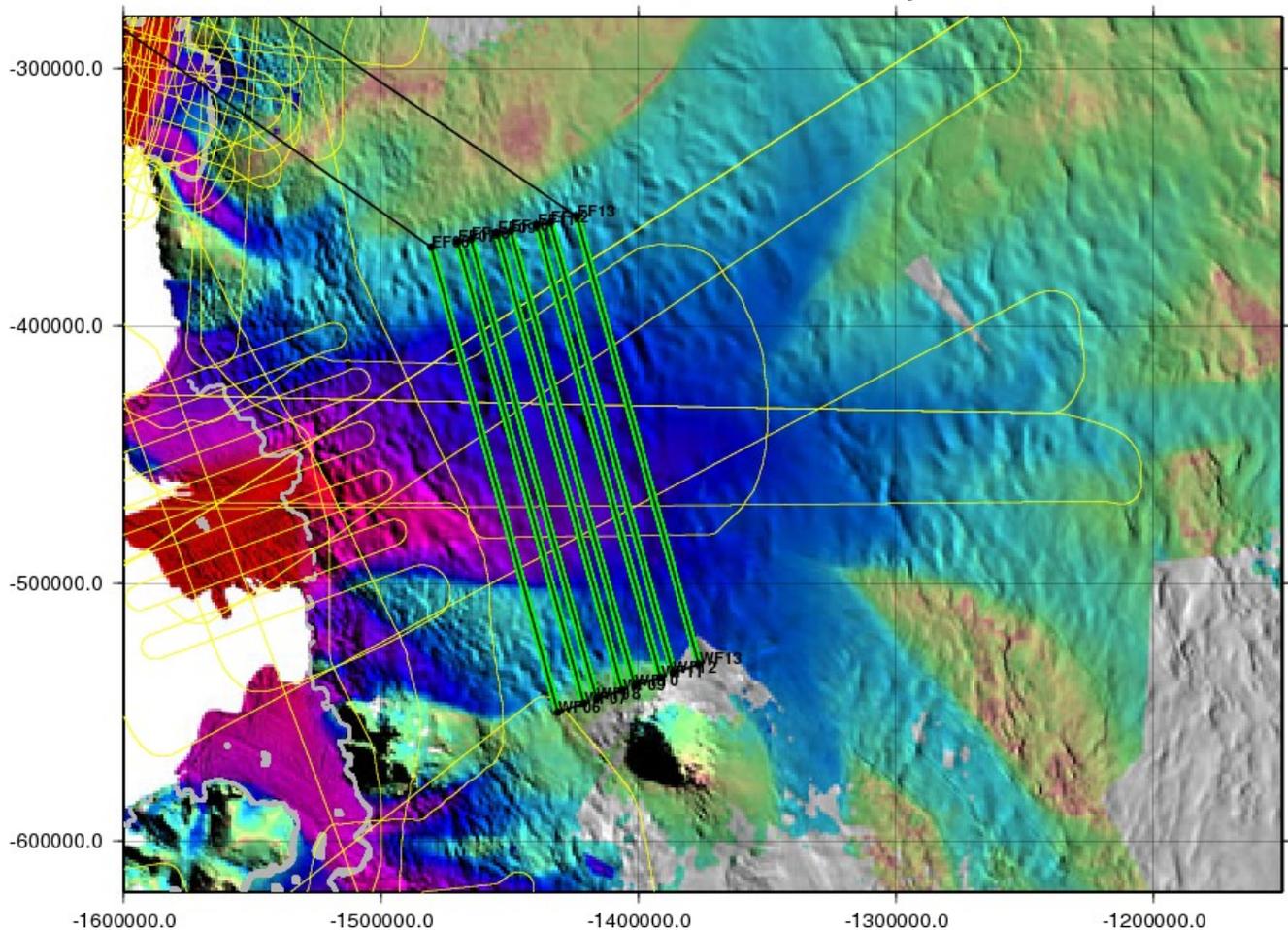
**ICESat Track:** none

**Remaining Design Issues:** none

## Thwaites Upstream 2

11.3 hrs total / 4.0 hrs survey

440 knots transit / 250 knots survey



# Land Ice – WAIS Cores

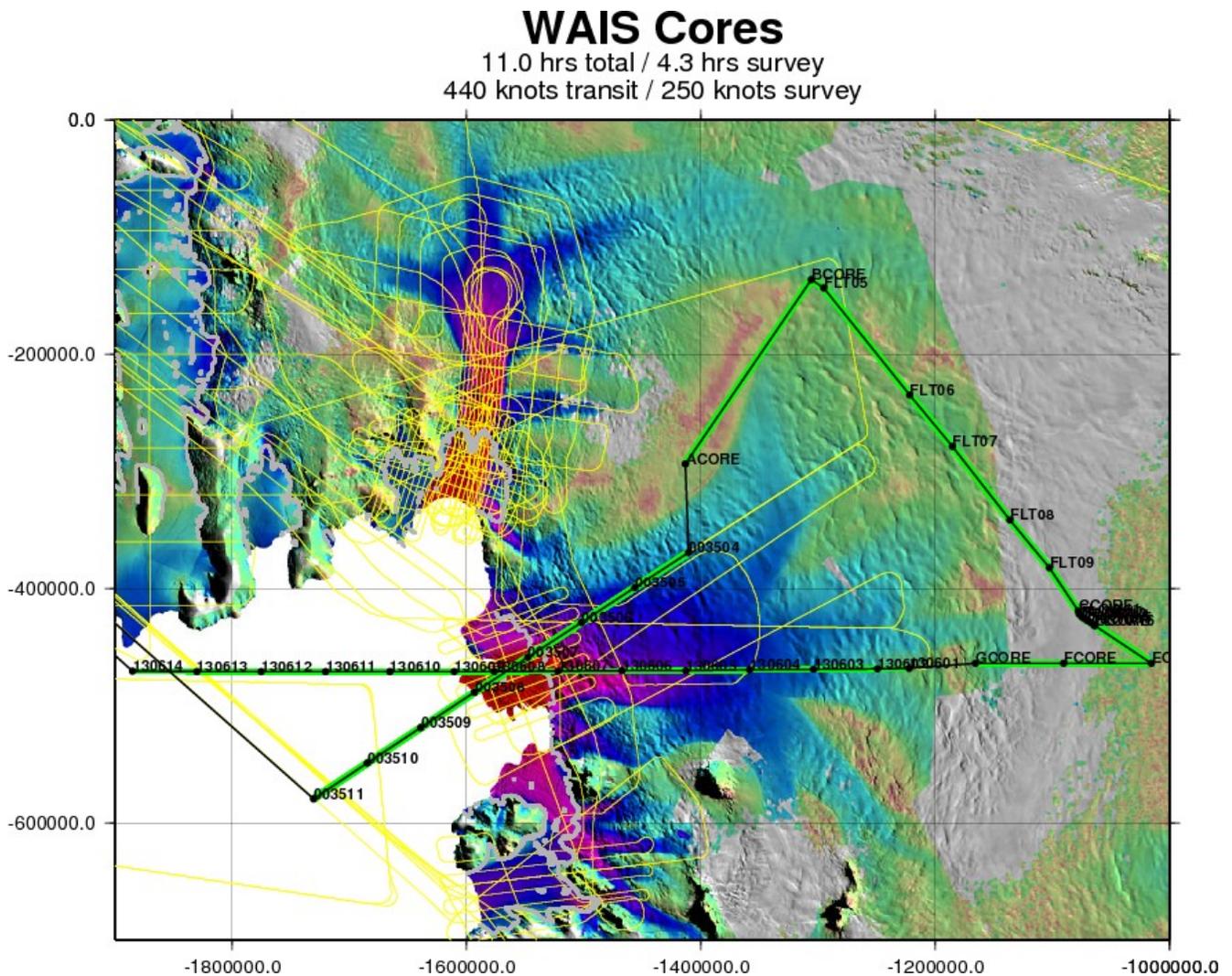
This is a new mission, and its primary purpose is to connect ice core sites high on the west Antarctic ice sheet to better interpret accumulation patterns in the region using the snow, KU-band, and MCoRDS radars in conjunction with the data revealed by the cores themselves. Its secondary purpose is to occupy parts of two ICESat lines first flown by OIB during the 2009 TSK2 flight. This flight extends altimetry measurements from the outlet glaciers to the glacial divide to monitor changes in thinning. Finally, we extend ICESat tracks 0035 and 1306 well into the Amundsen sea in order to collect sea ice measurements in waters close by the glaciers in this area.

**Flight Priority:** High

**Instrument Priority:** validate accumulation radar

**ICESat Track:** 0035,1306

**Remaining Design Issues:** none



# Land Ice – TSK2-CryoSat

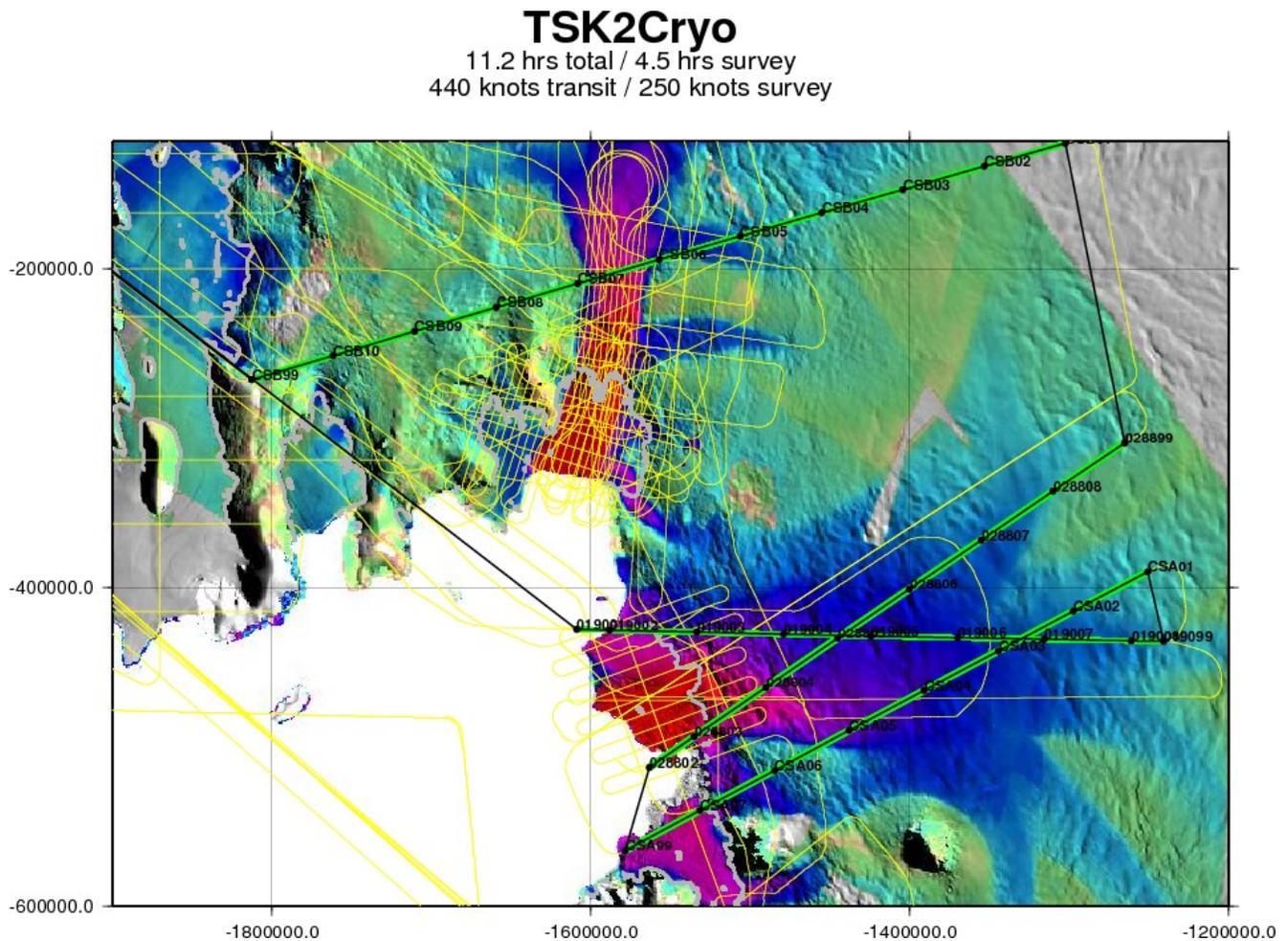
This mission is similar to the 2010 TSK2 CryoSat mission, but with some changes. We replace one of the two ICESat lines flown in 2010 with another (from the 2009 TSK2 flight), to avoid duplication with a line occupied during the WAIS Cores flight. Also, the two CryoSat lines shown here are placeholders, since we will select CryoSat lines which the spacecraft will occupy within a few days of our own overflight, in order to minimize geophysical changes between the collection of the two datasets due to snow accumulation.

**Flight Priority:** High

**Instrument Priority:** Ku-band radar, ATM

**ICESat Track:** 0190,0288

**Remaining Design Issues:** replace CryoSat placeholder lines with actual groundtracks to be occupied within a few days of OIB underflight



# Land Ice – TSK 5

This flight is a continuation of the effort to map the bathymetry under the Thwaites ice tongue, using the gravimeter supplemented by the other low-altitude instruments. The grid lines in this mission are offset from each other by 10 km, but when combined with the 091118 IceBridge mission the resulting grid will be at 5 km, which is the same resolution as the Pine Island gravity grid flown in 2009.

**Flight Priority:** Low

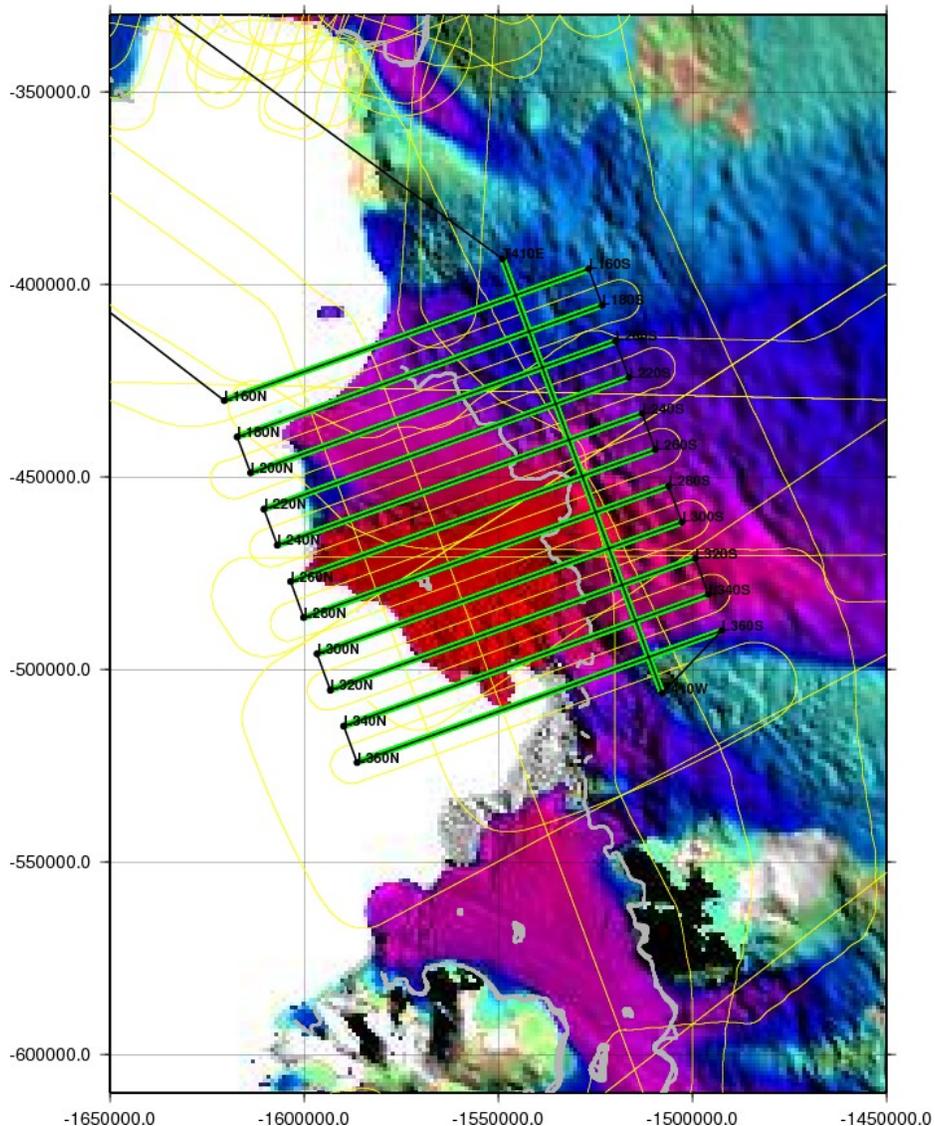
**Instrument Priority:** not specified

**ICESat Track:** none

**Remaining Design Issues:** none

## Thwaites-Smith-Kohler 5

11.1 hrs total / 4.0 hrs survey  
440 knots transit / 250 knots survey



# Land Ice – PIG Grounding Line 1

This flight is a new design, intended to capture two concepts for missions in this area. The first is to extend cross-flow coverage using a series of lines progressing from the grounding line upstream as far as practical, by interspersing the similar BBAS lines and extending upstream with a spacing of 4 km. The BBAS lines are shown below in magenta. Since these lines were not evenly spaced nor parallel, these new lines are not either. The second purpose was to collect altimetry, radar, gravity and photo measurements on the floating PIG shelf in concert with the planned Bindschadler in-situ project, by overflying a number of their field sites and traverse lines.

**Flight Priority:** High

**Instrument Priority:** not specified

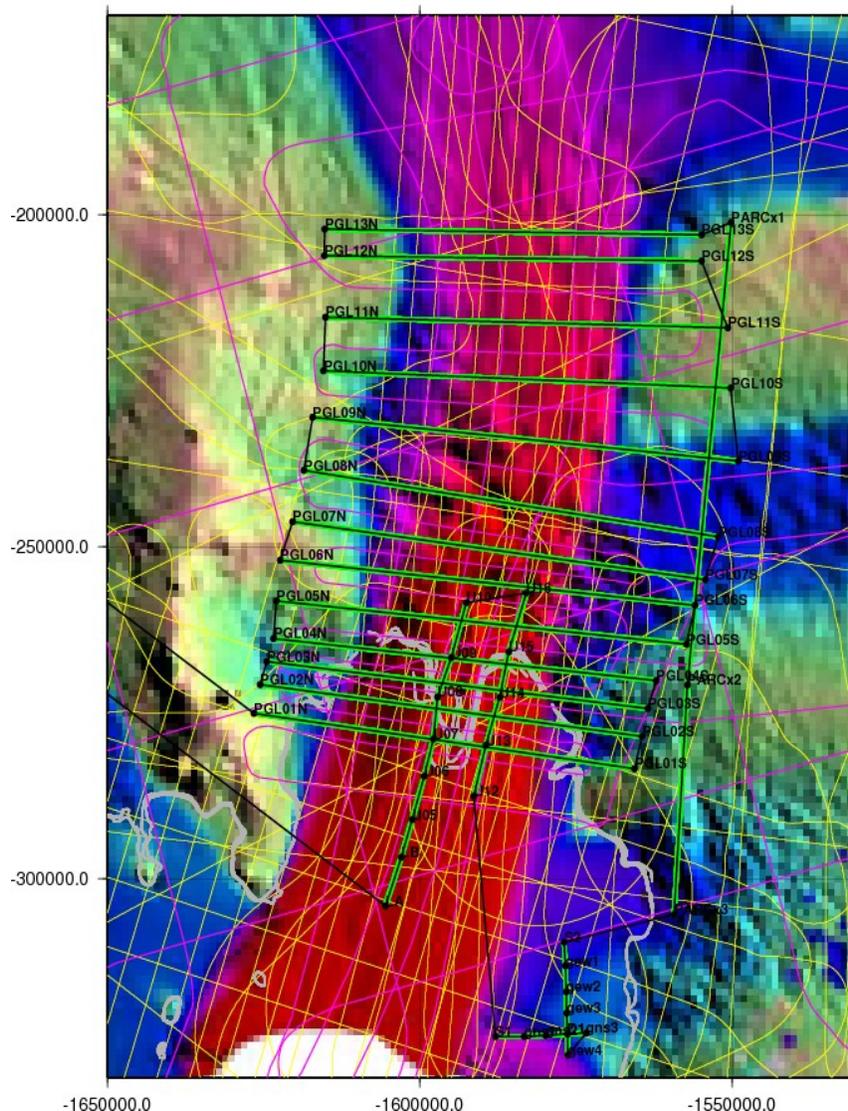
**ICESat Track:** none

**Remaining Design Issues:** none

## PIG Grounding Line 1

10.9 hrs total / 4.1 hrs survey

440 knots transit / 250 knots survey



# Land Ice – PIG 1

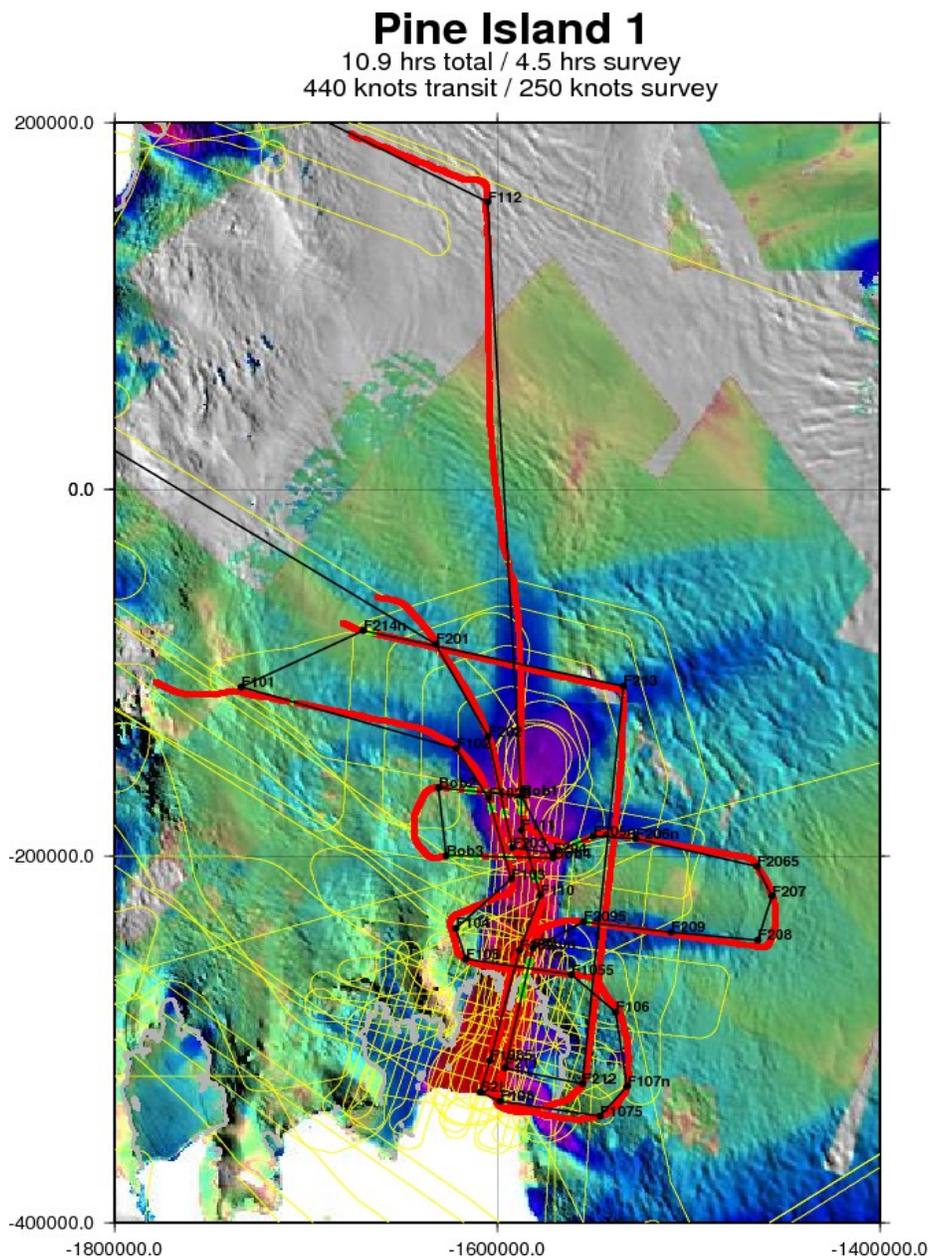
This flight is a repeat of the 091029 IceBridge flight, which itself was a repeat of flight lines flown a number of times since 2002 by the ATM/KU teams. It is intended to track ongoing changes in the Pine Island Glacier trunk.

**Flight Priority:** Low

**Instrument Priority:** not specified

**ICESat Track:** none

**Remaining Design Issues:** none



# Land Ice – PIG 2b

This flight is a near repeat of the 091027 IceBridge flight. It is intended to track ongoing changes in the Pine Island Glacier trunk, by comparison along ICESat ground tracks. This version differs slightly from the 2009 flight, in that three lines on the floating shelf of the glacier, intended to target the gravimeter to the findings of the BAS auto-sub, have been removed and replaced with two additional ascending ICESat lines on the upper trunk of the glacier. The original purpose of the “autosub” lines was superseded when we flew a 5 km grid over the shelf in 2009.

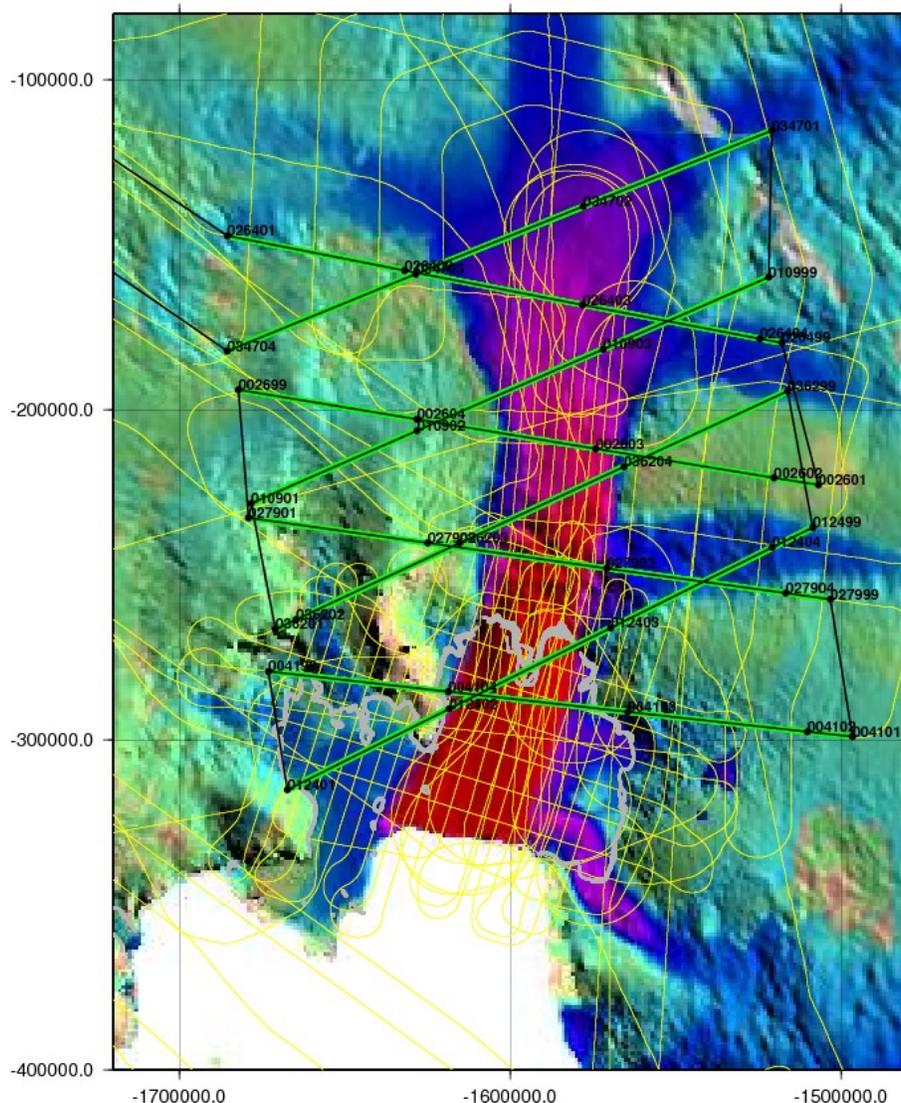
**Flight Priority:** Medium

**Instrument Priority:** not specified

**ICESat Track:** 0026,0041,0109,0124,0264,0279,0347,0362

**Remaining Design Issues:** none

**Pine Island 2b**  
10.8 hrs total / 4.3 hrs survey  
440 knots transit / 250 knots survey





# Land Ice – Alexander 1

This flight is partially a repeat of a portion of a 2008 NASA/CECS flight, and partially made up of new lines. The repeated portion is from the 30 October 2008 NASA/CECS flight, and incorporates several lines over the disintegrating Wilkins Ice Shelf. We augment these lines by adding four new ICESat tracks over the Wilkins as well. In addition, we interlace the northern George VI lines over the George VI Ice Shelf to improve the spatial resolution of the gravimeter-based bathymetric mapping of this area. A composite map of all George VI flight lines is shown in the Appendix.

**Flight Priority:** High

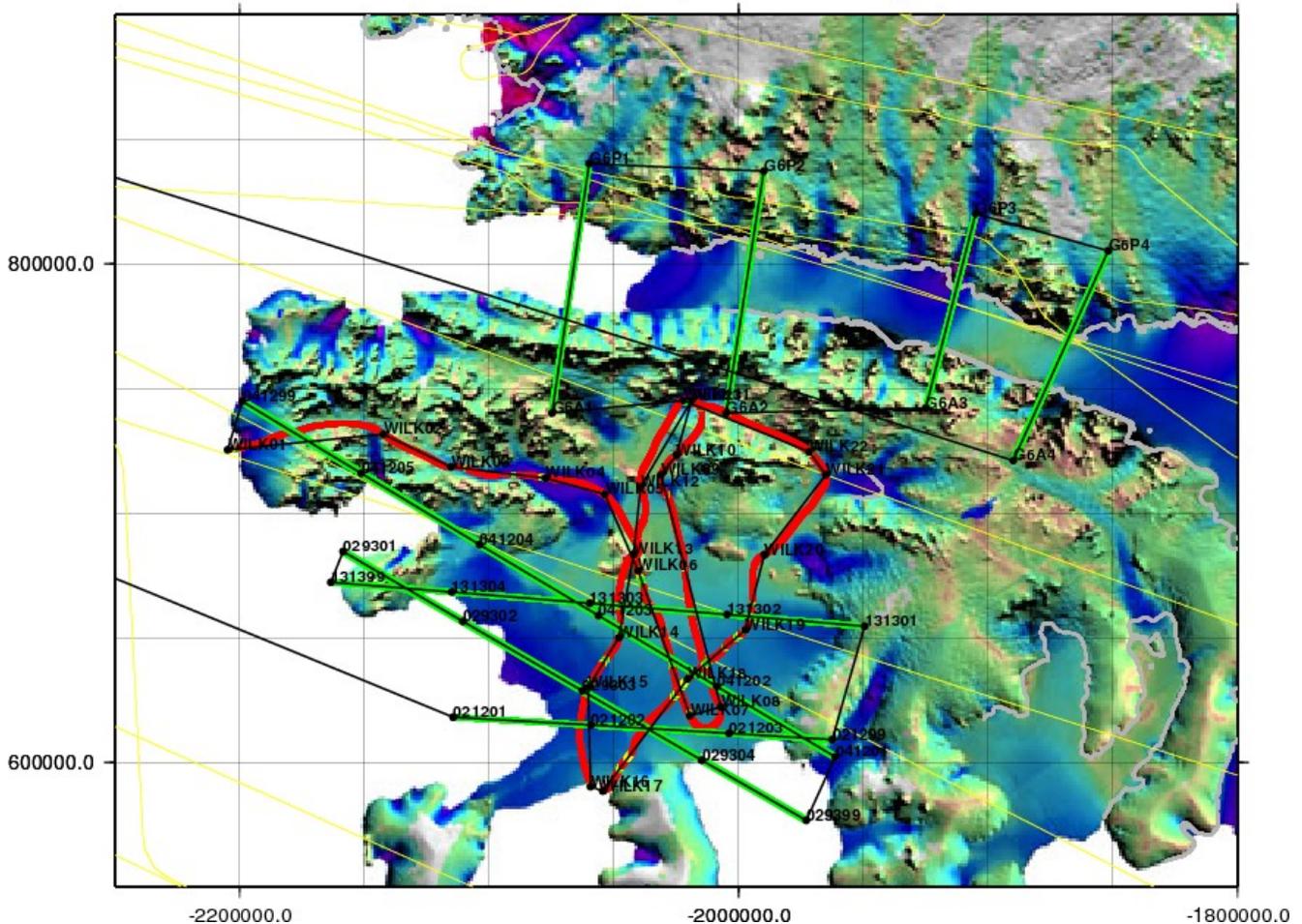
**Instrument Priority:** not specified

**ICESat Track:** 0212,0293,0412,1313

**Remaining Design Issues:** none

## Alexander 1

11.0 hours total / 6.1 hrs survey  
440 knots transit / 250 knots survey



# Land Ice – George VI

This flight is a new design, and it is intended to coarsely map the sub-ice shelf bathymetry of the George VI ice shelf on a coarsely-spaced set of lines. The lines over the ice shelf shown below are supplemented by others planned as part of the Elbow and Alexander 1 flights as well, and a composite map of all of these is shown in the Appendix.

**Flight Priority:** Medium

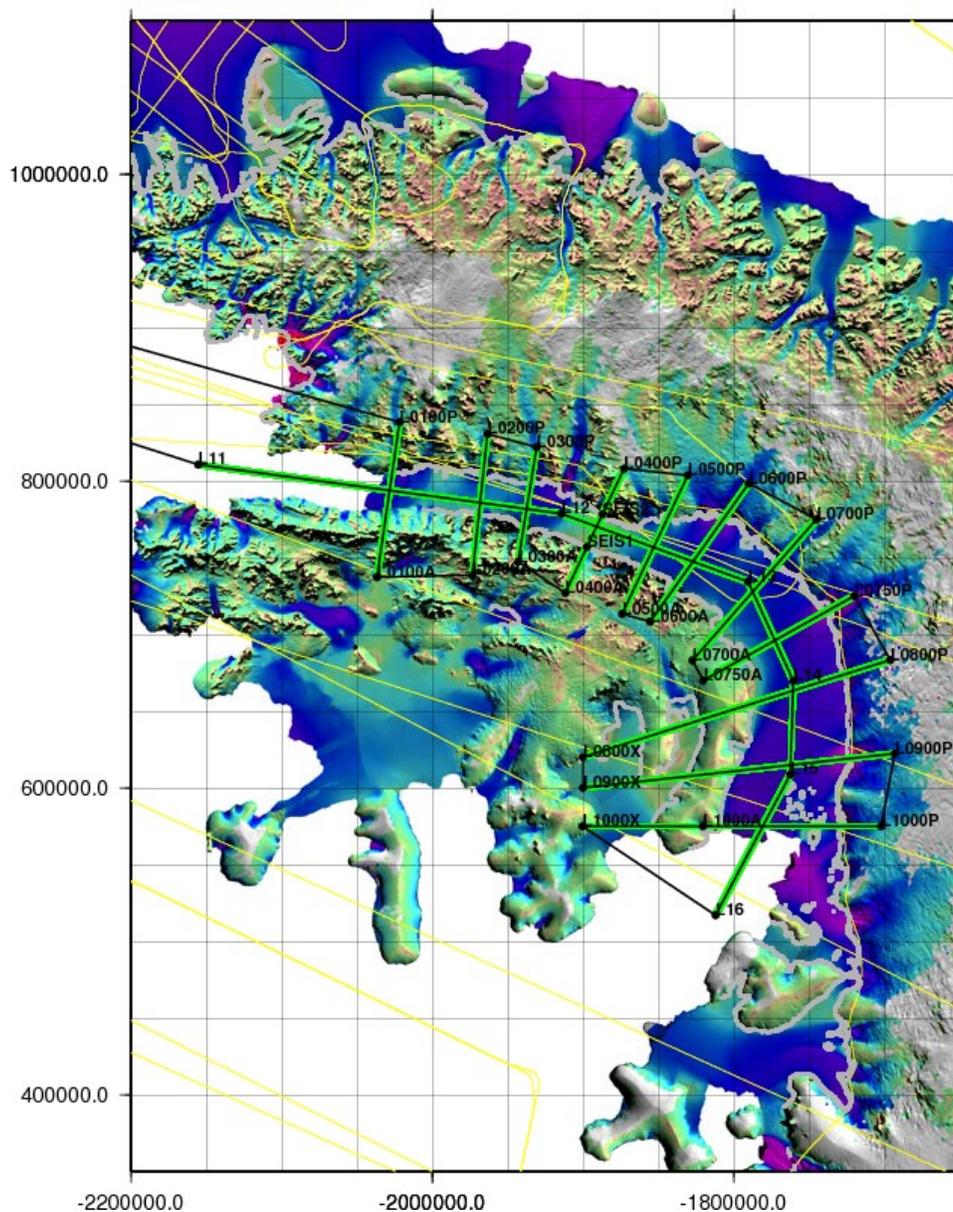
**Instrument Priority:** not specified

**ICESat Track:** none

**Remaining Design Issues:** none

## George VI

11.1 hours total / 5.9 hrs survey  
440 knots transit / 250 knots survey



# Land Ice – Evans 1

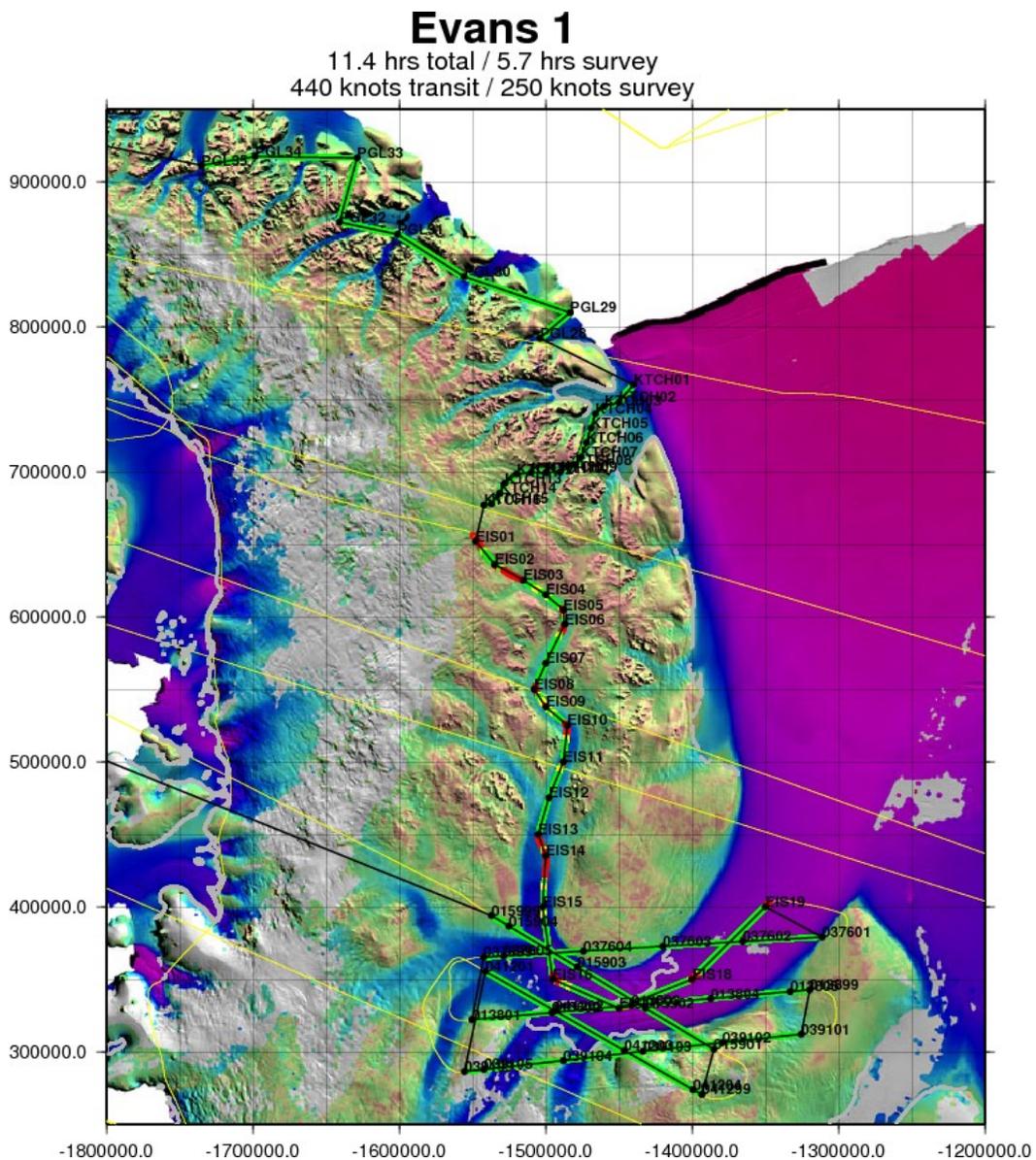
This flight is a near-repeat of the 091115 IceBridge flight (called “Pen 4” at that time). It is intended to track changes in the Evans Glacier area, by comparison mainly along ICESat ground tracks. In addition, we add a portion of the grounding line along the southeastern side of the Peninsula, and a centerline flight up the Ketchum Glacier. The mission is slightly long but can readily be shortened by cutting the ends of pairs of the ICESat lines if necessary in real-time.

**Flight Priority:** Low

**Instrument Priority:** not specified

**ICESat Track:** 0138,0159,0376,0391,0412

**Remaining Design Issues:** none



# Land Ice – Middle Peninsula

The main purposes of this mission are to fly approximations to the Peninsula grounding lines on parts of both the east and west sides, and to re-occupy many older flight lines as follows: (1) a number of ICESat ground tracks over the Dyer Plateau and one on the George VI ice shelf; (2) a pair of lines over the Fleming Glacier centerline, which feeds the remains of the Wordie Ice Shelf; and (3) several glacier lines at the south end of the Larsen-C. Most of these lines were first occupied by ATM/KU in 2002, and all were occupied during 2009 IceBridge. Parts of this mission were flown in 2010 as well, but persistent cloud cover reduced our ability to collect useable data.

**Flight Priority:** High

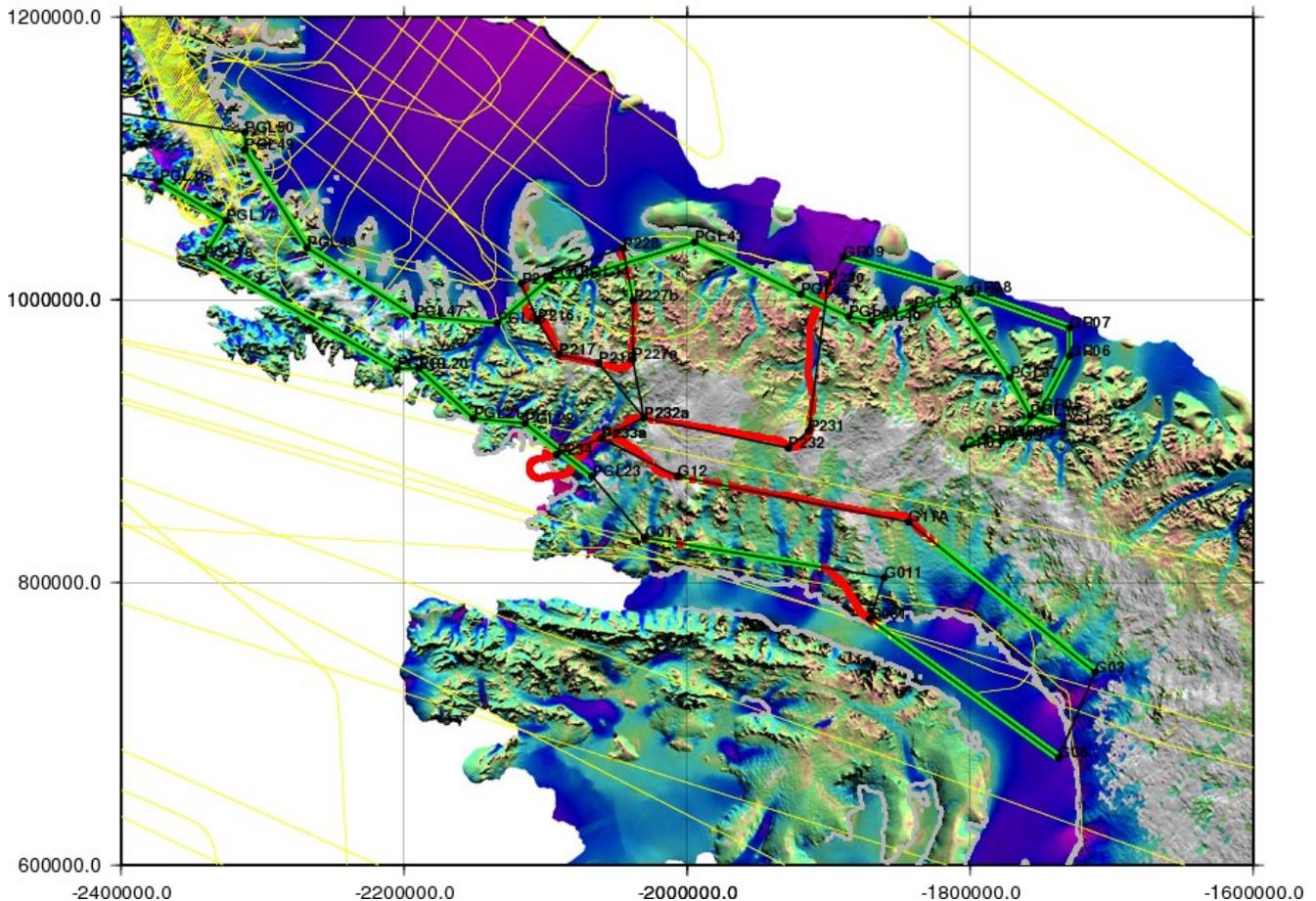
**Instrument Priority:** not specified

**ICESat Track:** several 183-day ICESat tracks (which were first flown prior to the 2003 launch)

**Remaining Design Issues:** none

## Middle Peninsula

10.7 hours total / 6.9 hrs survey  
440 knots transit / 250 knots survey



# Land Ice – North Peninsula

This flight combines centerline flights of glaciers that feed the old Larsen-A embayment (Drygalski), the old Larsen-B embayment (Hektor, Crane and Melville), the remnant Larsen-B ice shelf (Flask, Leppard and Starbuck), and the northern Larsen-C (Attlee), plus segments of the Peninsula grounding line on both the east and west sides, extending all the way to the northern tip. The grounding line segments are new for this season, while the northern glaciers were first occupied by ATM/KU in 2002 and several years since, including 2009 and 2010 IceBridge. Note, however, that the 2010 flight coverage was limited by marginal weather conditions.

**Flight Priority:** Low

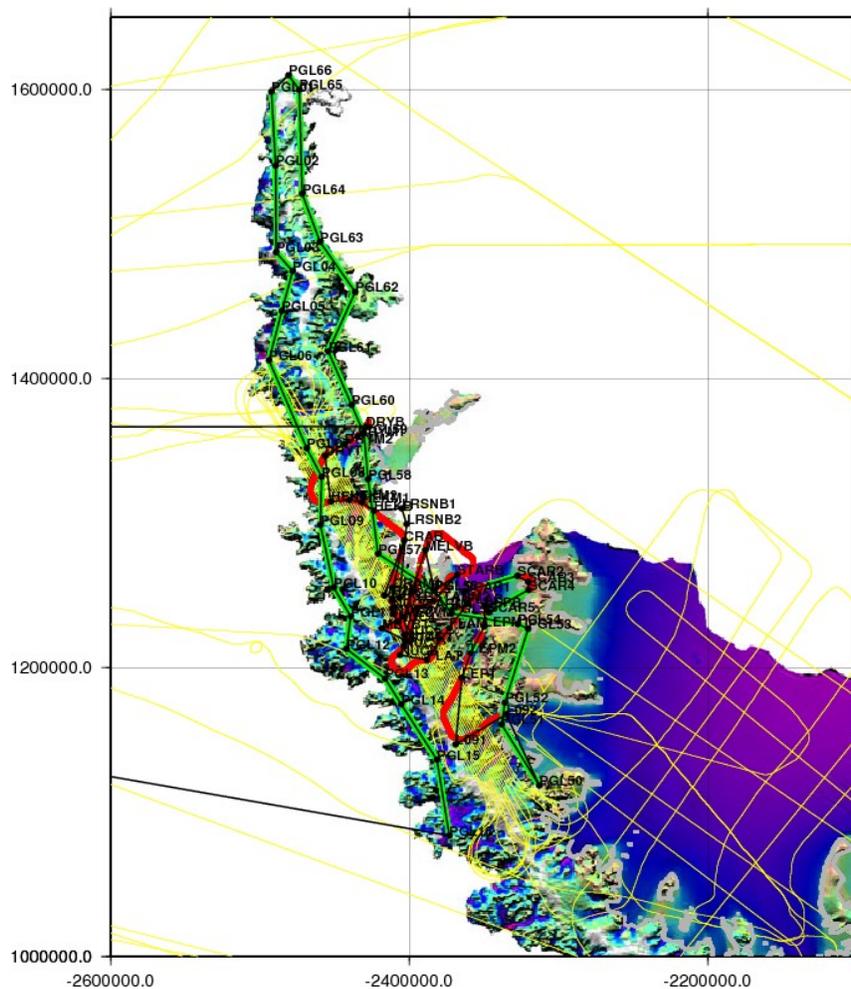
**Instrument Priority:** not specified

**ICESat Track:** none

**Remaining Design Issues:** can be lengthened significantly

## North Peninsula

8.9 hours total / 5.3 hrs survey  
440 knots transit / 250 knots survey





# Land Ice – Recovery Mid Lakes

This flight is a new design. The intention is to map the grounding line and lower part of Recovery Glacier using all IceBridge low-altitude sensors. It also includes a flight line specifically targeted over several subglacial lakes, specifically four on the upper part of the glacier's trunk. The lakes are depicted on the map below as white outlines. See the Appendix for a composite map of all four Recovery-area flight plans.

**Flight Priority:** High

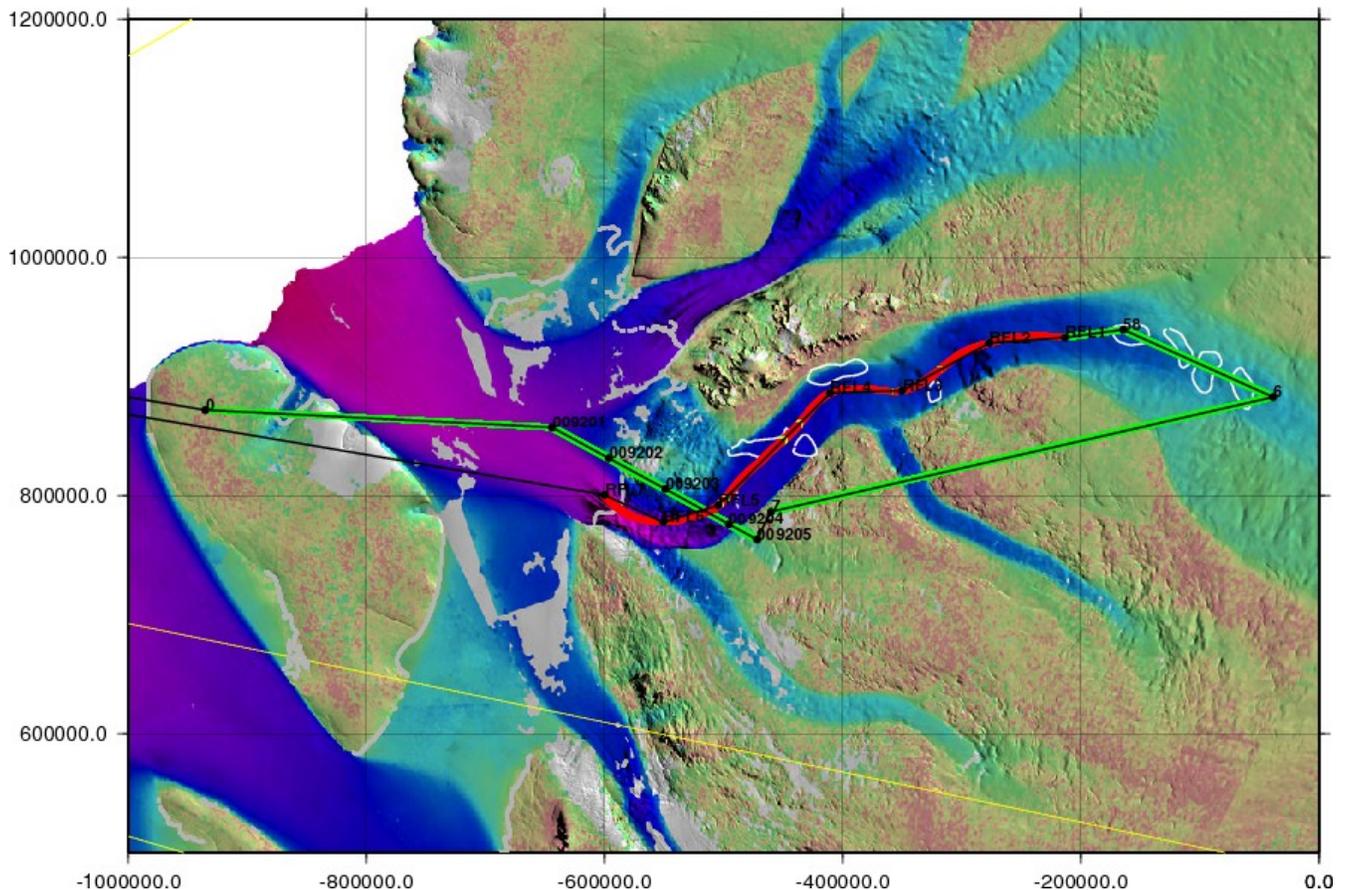
**Instrument Priority:** not specified

**ICESat Track:** 0092

**Remaining Design Issues:** none

## Recovery Mid Lakes

11.2 hrs total / 3.5 hrs survey  
440 knots transit / 250 knots survey



# Land Ice – Recovery Big Lakes

This flight is a new design. It is intended to provide the first airborne geophysical measurements of two large and one small subglacial lakes, all situated on the onset region of the upper Recovery Glacier, using all OIB low-altitude sensors. It does so along one ICESat track which straddles the two large lakes, and two other nearby tracks which are not ICESat lines. The lakes are depicted below as white outlines. The very small ratio of survey time to transit time on this particular flight is an inevitable consequence of the distance of the survey area from our base at Punta Arenas. See the Appendix for a composite map of all four Recovery-area flights.

**Flight Priority:** Low

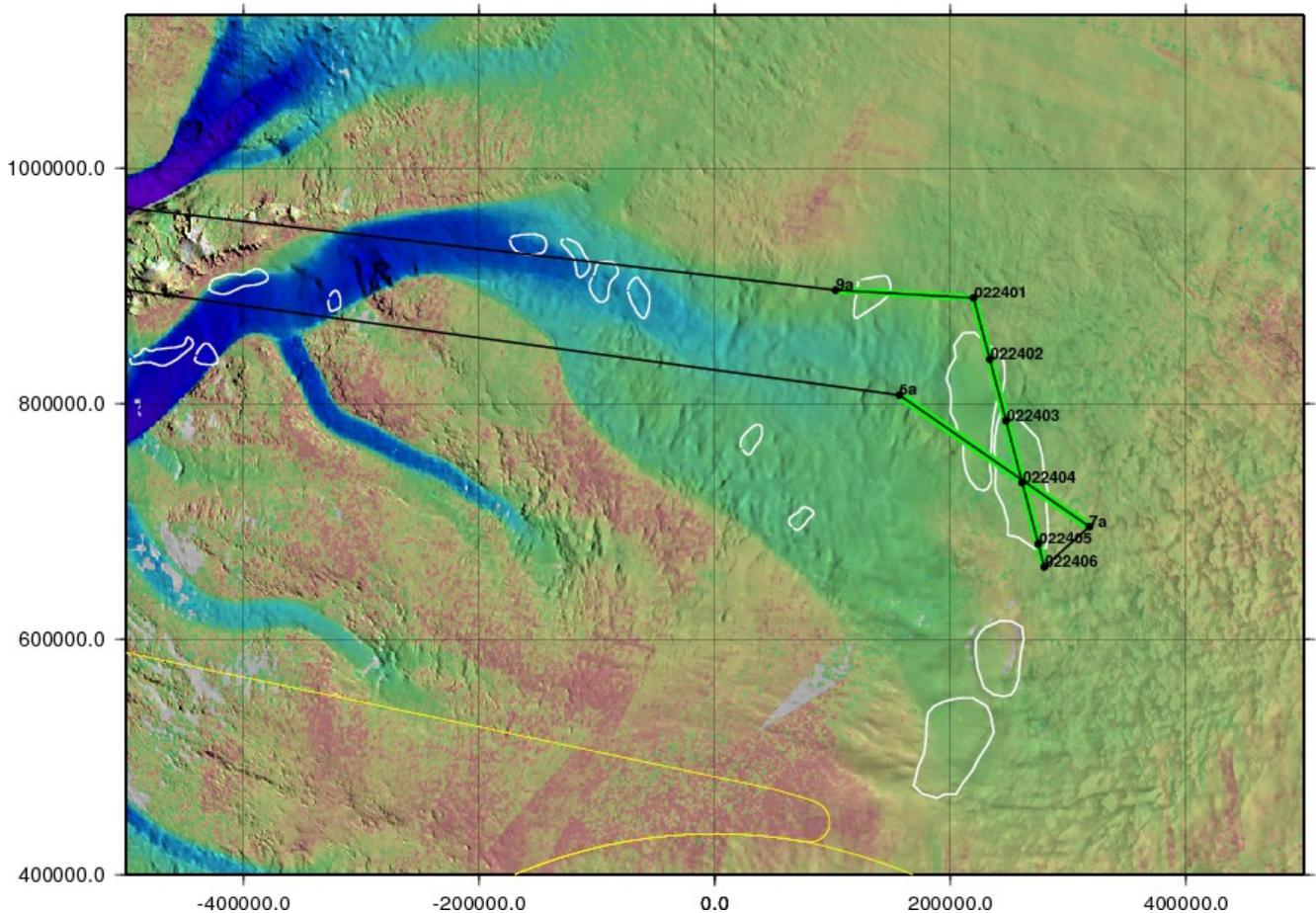
**Instrument Priority:** not specified

**ICESat Track:** 0224

**Remaining Design Issues:** none

## Recovery Big Lakes

11.3 hrs total / 1.4 hrs survey  
440 knots transit / 250 knots survey



# Land Ice – Slessor 1

This flight is a new design, compiled with the intent of sampling the grounding line and lower part of Slessor and Bailey Glaciers using all IceBridge low-altitude sensors. We also overfly two subglacial lakes on the lower Recovery Glacier, and an ICESat track connecting the two glacier basins. These lakes are depicted below as white outlines. Finally, the mission covers the Berkner Island drill site where ice cores have been recovered. See the Appendix for a composite map showing all four planned flights in this region.

**Flight Priority:** Medium

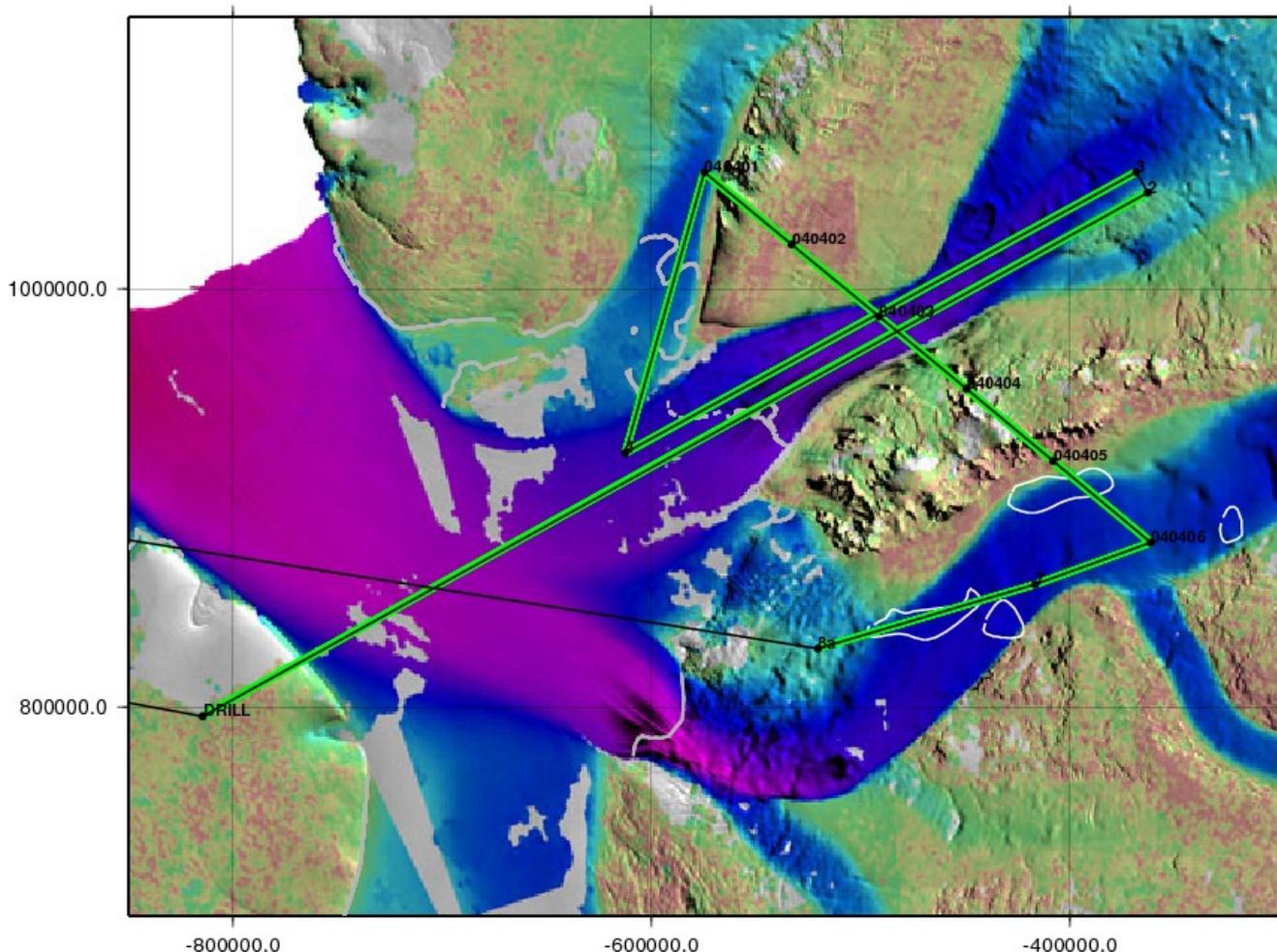
**Instrument Priority:** not specified

**ICESat Track:** 0404

**Remaining Design Issues:** none

## Slessor 1

11.1 hrs total / 3.2 hrs survey  
440 knots transit / 250 knots survey



# Land Ice – Recovery Grounding Line 1

This flight is a new design, compiled with the intent of thoroughly sampling the grounding line of Recovery Glacier on a 10-km grid. See the Appendix for a composite map showing all six planned flights in this region.

**Flight Priority:** Low

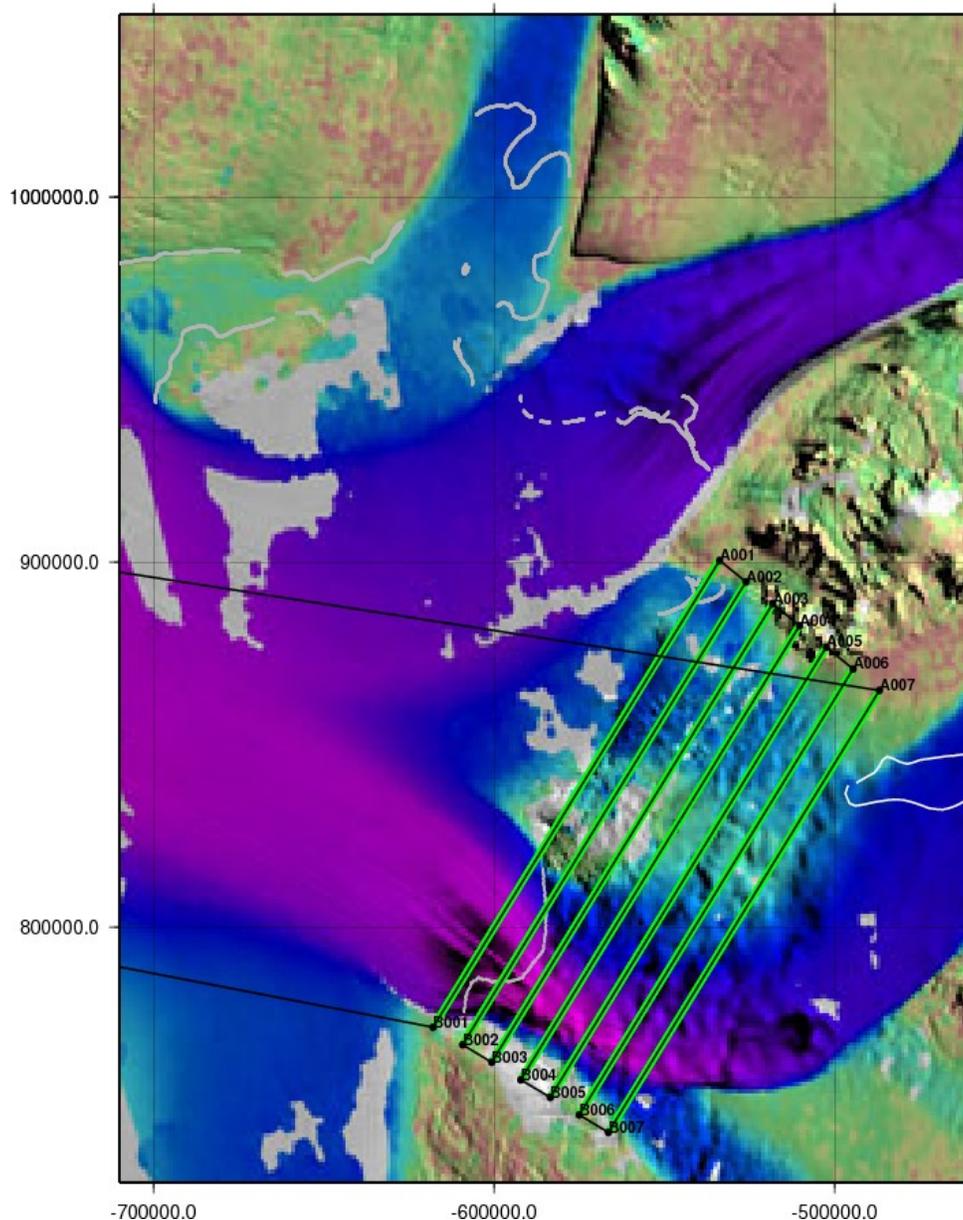
**Instrument Priority:** not specified

**ICESat Track:** none

**Remaining Design Issues:** none

## Recovery Grounding Line 1

11.3 hrs total / 3.0 hrs survey  
440 knots transit / 250 knots survey



# Land Ice – Slessor Grounding Line 1

This flight is a new design, compiled with the intent of thoroughly sampling the grounding line of Slessor and Bailey Glaciers on a 10-km grid. See the Appendix for a composite map showing all six planned flights in this region.

**Flight Priority:** Medium

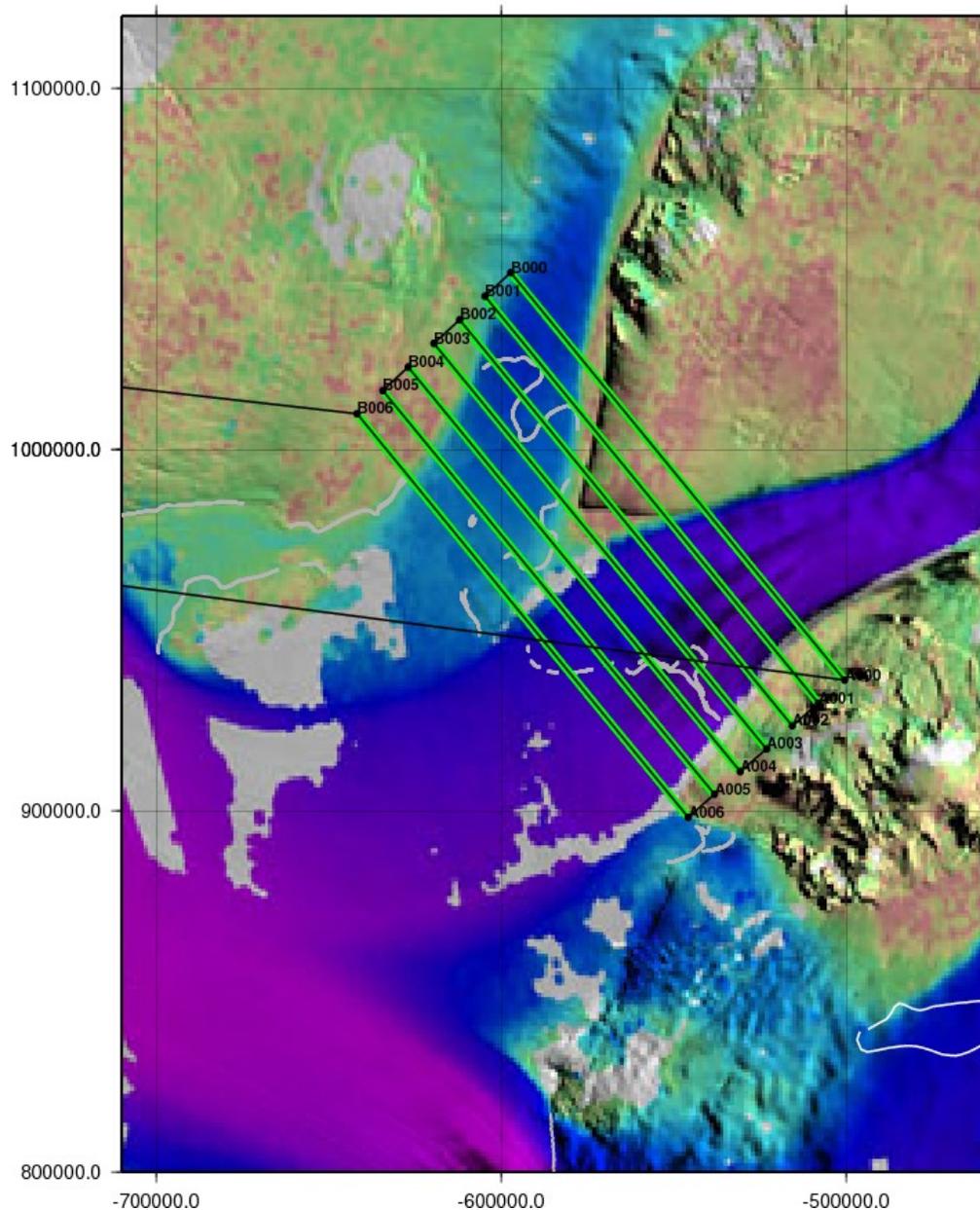
**Instrument Priority:** not specified

**ICESat Track:** none

**Remaining Design Issues:** none

## Slessor Grounding Line 1

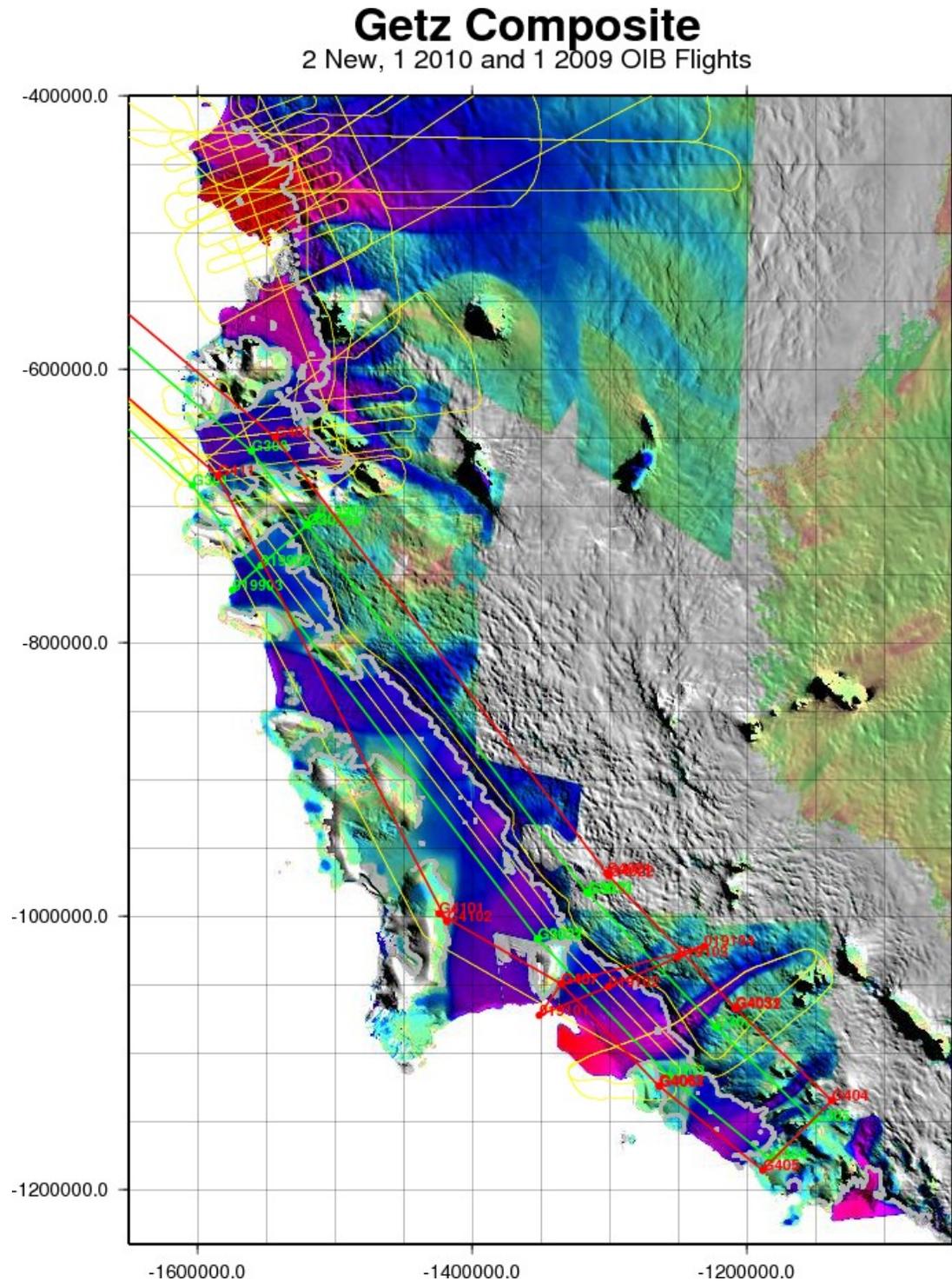
11.1 hrs total / 3.0 hrs survey  
440 knots transit / 250 knots survey



# Appendix – Supplementary Maps

# Composite Map of Getz Missions

This map shows the Getz3 (green) and Getz4 (red) flights, with the 2009 and 2010 OIB flights depicted in yellow.

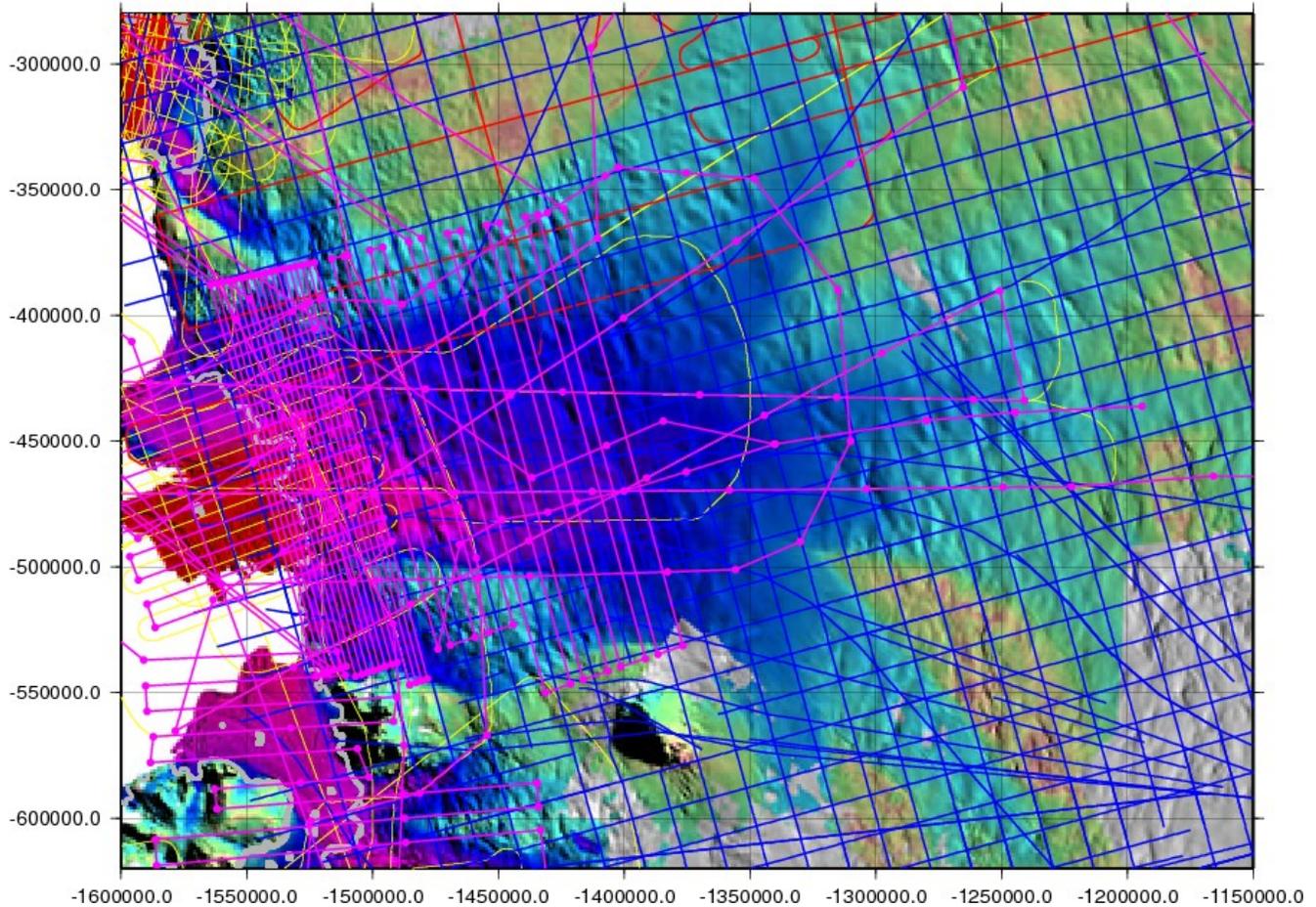


# Composite Map of Lower Thwaites Flight Lines

This map shows many sets of flight lines over the lower Thwaites Glacier. The nine planned 2011 OIB flights in the area are shown in magenta, previous OIB flights in yellow, AGASEA flights in blue and BBAS flights in red.

## Lower Thwaites Composite

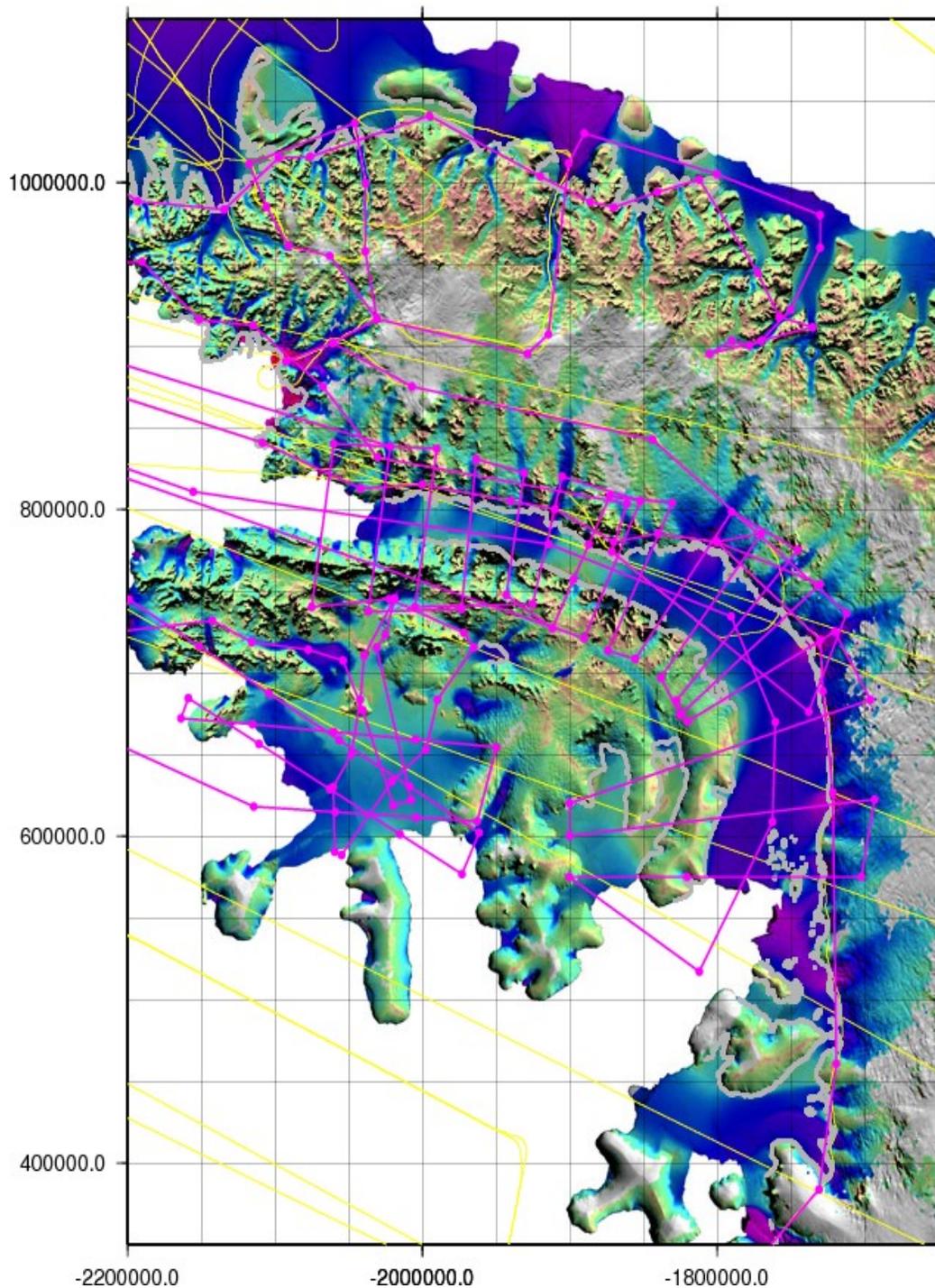
9 Flights



# Composite Map of George VI Flight Lines

This map shows all of the flight lines over the George VI ice shelf. The missions which include lines over this shelf are the George VI, Alexander 1, Elbow, and Middle Peninsula flights.

## George VI Composite Four Missions



# Composite Map of Recovery-Area Flight Lines

This map shows all of the flight lines over the greater Recovery Glacier area. The missions included below are the Recovery Downstream, Recovery Mid Lakes, Recovery Big Lakes, and Slessor 1 flights, plus the Slessor Grounding Line 1 and Recovery Grounding Line 1 flights. The subglacial lakes in the region are depicted as white outlines.

## Recovery-Area Proposed Missions

