Summary of the 2004-05 Airborne Geophysical Survey of the Amundsen Sea Embayment, Antarctica (AGASEA) with preliminary results for the Thwaites Glacier catchment

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The glaciers of the Amundsen Sea Embayment (ASE) have become a focus for integrated studies by both the U.S. and European scientific communities due to satellite observations of non-steady behavior and the ASE's dominant role in WAIS mass balance. The community-driven Amundsen Sea Embayment Science and Implementation Plan (ASEP) has the overarching objectives of assessing the present and predicting the future behavior of the ice sheet in the ASE. In order to accomplish some of the primary ASEP objectives and to guide future surface-based research, the University of Texas (UT) and the British Antarctic Survey (BAS) have recently undertaken a comprehensive aerogeophysical survey encompassing the two major drainage basins within the Amundsen Sea Embayment - Pine Island and Thwaites glaciers. We conducted this survey during the 2004/05 austral summer, operating from two remote field camps and using two survey aircraft. The survey design that was originally proposed required modification due to logistical support limitations which restricted fieldwork to one season. We developed a strategy that balanced coarse coverage of the glacier catchments, higher-resolution coverage of the fast-flow regimes, and along-flow profiles. In spite of the distance from logistical centers and significant weather hindrances, the survey was a clear success. Over 65,000 line-km of multi-instrumented aerogeophysical data covering both the Thwaites and Pine Island Glacier catchments were collected in 73 flights of the UT aircraft and 31 flights of the BAS aircraft. Due to the limited extent of previous geophysical data in that region, this survey represents an enormous step forward in our ability to understand the dynamics of Thwaites and Pine Island glaciers.

The multidisciplinary nature of coupled lithosphere and ice sheet studies requires a broad approach for which multi-instrumented airborne surveys are well suited. Radar sounding data were acquired to determine bed morphology and to provide measurements of ice thickness necessary to calculate ice sheet driving stress and hydrologic potential. Gravity and magnetics data were collected to help identify crustal blocks, sedimentary basins, volcanic activity, and to characterize geothermal flux, all of which are critical to models of ice sheet dynamics. Laser surface elevations were acquired to enable detailed mass balance calculations and satellite altimeter calibrations. We have produced grids of surface elevation, ice thickness and bed elevation for use by the community for planning new field studies. Gridded potential fields data will be available in the near future.

The radar sounding data have been analyzed to determine surface and bed elevations. This yields a new picture of bed topography that is a major extension of what was previously known. Most of the region lies below sea level, with a broad coastal sill bounding an extensive Thwaites Glacier interior basin fed by broad, deep drainage channels. The relatively high ground of the Marie Byrd Land volcanic province to the west of Thwaites Glacier is deeply incised. In this area, several volcanic edifices are visible above the ice surface. The radar data reveal many additional edifices below the ice surface. Surface elevation and preliminary potential fields data will also be presented.