

Airborne Measurements of Glaciers and Fjords

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Gravity measurements have long been used to determine bathymetry in regions without ship tracks. Most of the familiar Google Earth ocean floor images come from satellite derived gravity measurements. Gravity has been part of the Operation Icebridge instrumentation suite since the first deployment to Antarctica. Magnetic measurements been added recently. Gravity supports the critical objective of constraining sub-ice bedrock topography and bathymetry in areas where radar data is ineffectual. The magnetics are a powerful constraint on the regional geologic framework. In Antarctic gravity has been used to constrain the bathymetry beneath the Larsen C and Abbot ice shelves and much of the permanently ice covered portions of the Amundsen Sea. In Greenland gravity is proving to be an important tool for determining bathymetry.

Knowledge of the bathymetry of Greenlandic fjords is essential for understanding the interactions between relatively warm ocean water and the ice at the grounding lines of the glaciers draining the Greenland ice sheet. Greenlandic fjords can be over 100 km long and over 1000 m deep and often contain bathymetric sills rising a few hundred metres above the bottom of the fjord. Where available, boat and submarine-based surveys have provided valuable information on the bathymetry of the fjords, but many regions remained unsurveyed by marine methods. The scale of the fjords, and the sills commonly found within them, make them appropriate targets for aerogravity surveys.

Operation IceBridge has flown the Sander Geophysics AIRGrav system along the axes of more than 40 outlet glaciers distributed around the coast of Greenland. The AIRGrav system has high precision, fast recovery from turns and the capacity for draped flights, all of which improve the quality of data acquisition along fjord axes. Operation IceBridge survey flights are conducted at or lower than 500 m above ground surface, at speeds of ~140 m/s, allowing full amplitude resolution of features larger than ~5 km, and detection of smaller scale features.