ARCTIC SEA ICE:
USING AIRBORNE TOPOGRAPHIC MAPPER (ATM) MEASURMENTS TO DETERMINE SEA ICE THICKNESS

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Although projections vary, scientists agree that the Arctic is heading towards ice-free summers. By understanding the Arctic environment now scientists will be able to predict the change in the future. Thus, it is important to study the volumetric variation of sea ice in the Arctic. This paper looks at the steps, process and approximations behind determining sea ice thickness given raw sea ice elevation data collected from the Airborne Topographic Mapper (ATM), a laser altimeter that took measurements during NASA's IceBridge campaign in 2009 and continues to be the primary laser altimeter used in IceBridge today.

Using the Airborne Topographic Mapper (ATM), sea ice elevation can be measured from an aircraft flying overhead relative to the WGS84 ellipsoid. From this elevation data, an approximate freeboard is calculated in relation to the earth's geoid model. By determining locations of leads in the ice, further calculations may be performed to get a sea ice freeboard measurement. Then, through the use of the hydrostatic equation and density approximations, sea ice thickness may be calculated for the region between successive leads.

With the Arctic changing faster than any place on earth, ice-diminishment is cause for immediate concern. This rapid change in turn poses numerous challenges for the United States Navy. An open ocean in the near future may increase water traffic, create boundary disputes, and raise questions over sea sovereignty, calling upon American diligence in defending its borders and keeping Arctic sea lanes free and safe. Thus, because of the growing national security implications, it is important to study the altering Arctic environment in greater detail now so that the U.S. Navy is better prepared to operate there in the future.