Autonomous unmanned platforms and sensors for polar research applications

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Development of small unmanned aerial systems (UAS) has progressed dramatically in recent years along with miniaturization of sensor technology. The small UAS is deployable from ships or field camps to carry a range of sensor payloads for a broad range of scientific applications. Recent applications include small UAS for studies involving hurricanes, volcanic activity, sea ice changes, glacier melt, biological monitoring of land and sea species, wildfire monitoring, and others. Small UAS sensor capabilities that are currently available include optical imagers (including multi- and hyperspectral); gas spectrometers; chemical sensors and samplers; microbal sensors; and numerous others, including magnetometers and LIDARS.   Other technologies such as nanotechnology and imaging software offer another new range of sensing capabilities and many other technologies.

A recent example of UAS assisting in Greenland climate research includes utilizing a miniaturized hyperspectral sensor in a preliminary study at the Greenland Ice Sheet in August 2007. The scientific goal was to collect preliminary data to use the hyperspectral sensor to remotely measure the depth of the supra-glacial meltpools to assist in quantifying the rate of glacial melting. Recent advances in sensor technology has also been applied to microbial prospecting in the arctic, the developed method and prototype devices have resulted in a sensitivity of ~10 cells/cm^2 under environmental conditions with handheld or airborne systems available. This technology can distinguish viable and non-viable cells as well as spores. It has been most recently use in the determination of the microbial load of soils in glaciated soils and rocks in Svalbard. Additional examples will be discussed.