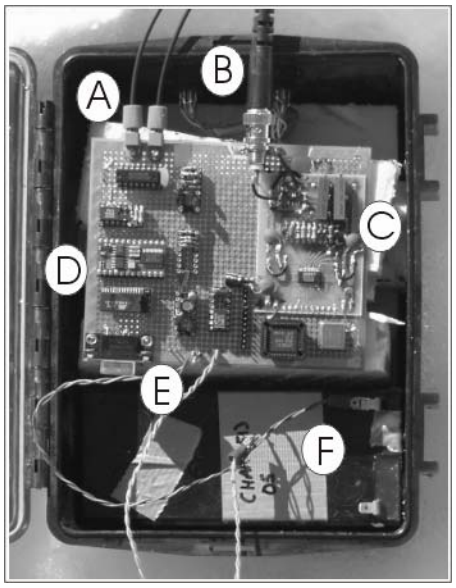
The monitoring radar is designed to show temporal changes in englacial and subglacial water pathways. The radar consists of 3 transmitters and one receiver, along with antenna arrays. The transmitters and receiver are arranged in an analogous pattern to a 'constant moveout' in seismic terminology, but with receivers and transmitters swapped. The receiver is microprocessor based and controls the transmitters by fiber-optic cables. It performs the trigger, 'shot-gather', record and communicate functions.

The radar system is light, inexpensive and portable. Total system weight is under 20lbs. The system will run unattended for at least 2 years, taking multiple 'shot-gathers' every hour and storing the full traces. Standby power is in the micro-amp range and the system runs from small gel-cell batteries. Optionally, the data can be stored for shorter time periods and transmitted or downloaded at intervals using a satellite 'Iridium' system.

The radar system monitors a 20m wide by 200m long swath of the glacier interior and bed. The radar is a pulsed system operating at 10MHz, which is optimum for a glacier with considerable water content. It has been shown to be able to detect changes in the englacial or basal water flow in the image region. Since the data is most dense in the time domain, it is necessary to fit the monitoring radar data in a space domain picture provided by the airborne and ground penetrating radar systems.

The physical layout of the radar receiver is shown in figure 1.



In the figure: A labels the fiber optic links for triggering the transmitters, B is the receiving antenna connection, C is the 100MHz amplifier and A to D converter, D is the microcontroller, real time clock and memory section, E is the serial communication section and F is the gell-cell battery. The unit is contained in a water-proof enclosure.

Figure 2 shows a section of data from a field study on the Bench Glacier in Alaska, June of 2005. The figure shows parts of two stacks of radar traces imaging the reflectors vertically below the radar which is sitting stationary on a glacier nominally 180m deep. The solid trace depicts reflections seen during the melt period (during daylight), while the red line shows the reflectors seen during the drainage period (during the brief night). The strong reflector at about 150m depth is the bed under the radar, while the reflector at about 180m is an out of plane reflector. From our other work on this glacier, we know the bed is flooded with water during this entire time, and the bed reflection does not vary from day to night. However, several shallow reflectors, particularly the reflector at 70m depth shows major changes between night and day. This change is repeated daily for several days, and is thought to represent the daily drainage and filling of water in an englacial planar void.