Letter of Interest:

Title: Determination of diurnal changes in the rotation rate of the Earth

Collaborator(s): W. M. Roggenthen

Description:

Changes in the rate of rotation of the Earth are caused by factors such as the monthly tidal variations, changes in the moment of inertia of the Earth due to the movement of air masses, and changes in the moment of inertia due to changes in the shape of the Earth resulting from earth movements and possibly volcanic eruptions. The rate of rotation of the Earth is routinely measured on a monthly basis and it is possible to measure the diurnal changes through dedicated campaigns.

This proposal would enable changes in the rotation rate to be measured routinely on a daily basis, an hourly basis, or, perhaps, on a fraction of an hour basis. On the simplest level, a ball dropped from the surface into the Ross Shaft will not land directly below the point at which the ball was released. Rather, it will land approximately 0.8m in the direction of the Earth's rotation due to the rotation of the Earth while the ball was dropping. Obviously, if the Earth's rotation rate does not change from one drop to another, then the ball will always land in the same location. If, however, the Earth is subjected to small changes in its rate of rotation, the ball will land in slightly different locations. The challenge is to be able to measure those changes in location sufficiently accurately to produce useful data. Although preliminary calculations suggest that the ability to produce positional data may not rise to the level of precision currently available through astronomical observations, the ability to provide information on short duration basis may provide the needed incentive for the experiment.

Infrastructure Requirements:

Although "dropping a ball" may not be the best way to produce such a measurement, most, if not all, alternatives will require similar infrastructures and accommodations at Homestake. They will require a small diameter pipe which will probably require some level of vacuum. It will also require access to one of the shafts, preferably the #5 shaft due to its longer drop distance. The amount of the shaft occupied by the pipe will be minimal although the vacuum system may require space within the shaft at selected points. Electrical requirements should not be excessive but may be dependent upon the number of vacuum systems required to provide a sufficiently efficient means of maintaining a vacuum over such a long distance.