

## The Problem

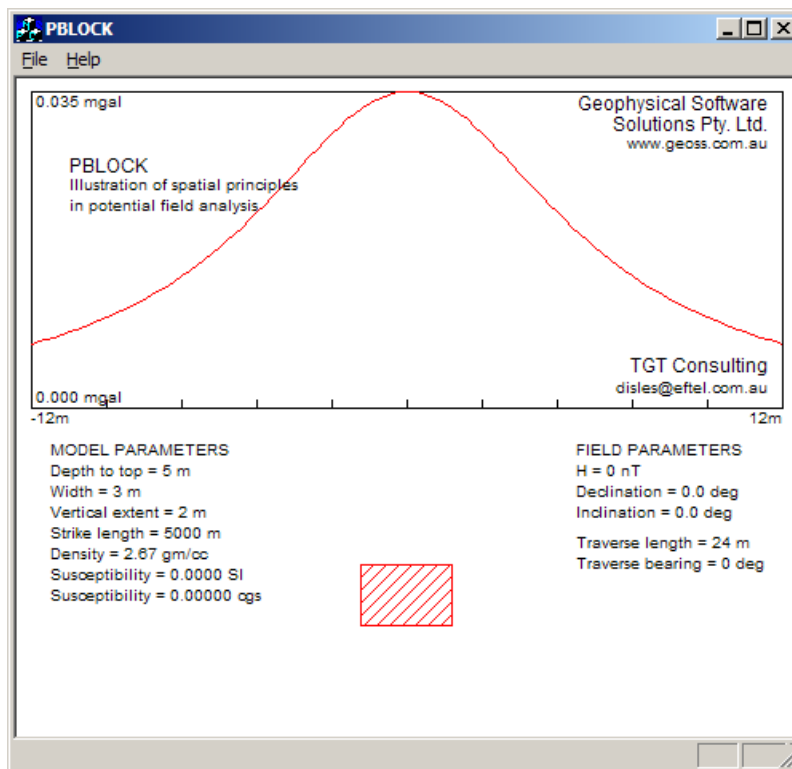
Suppose the U.S. Drug Enforcement agency calls due to their suspicion of drug smuggler's tunnels crossing the Canadian border into Montana. The DEA has no idea of where the tunnels might be but they hope to narrow that down in the near future. Currently, they want to know: 1) if it would be possible to detect tunnels with a gravity meter, and 2) how much it would cost to survey 100 meter long strips with a gravity meter to explore for the tunnels.

## Expectations and Observations

The hypothesized tunnels have both width and height of about two meters. The tunnel's tops are suspected to be between 3 and 5 meters below ground level. Assume air fills the tunnel and that the surrounding sedimentary rocks have a density of 2,500 kg/m<sup>3</sup> (2.5 g/cm<sup>3</sup>). Assume the ground is nearly flat.

## Assignment

Use [PBLOCK.EXE](#) (from [Geophysical Software Solutions](#)) to calculate the gravity anomaly caused by the tunnel at the minimum and maximum proposed depths. Present your results as a two page (without figures) bid to do a gravity survey designed to determine the existence of the tunnel.



Your bid should include:

1. A short description of the problem (one paragraph).
2. The distance between your proposed gravity observations; you determine this by experimentation. You must justify this with a figure demonstrating that your proposed number of stations will be sufficient to reveal the tunnel if it exists. Too many stations and your cost rises too high.
3. Figures of the calculated gravity anomalies. You can capture a screen image in windows with CNTRL-Print Screen and then paste that into a Word document.
4. The difference in gravity observations between the deep and shallow targets and the required instrument sensitivity. The instrument sensitivity must be less than the anomaly you seek. That is, if your anomalies are 0.20 mgals, then the instrument should be able to provide observations at 0.10 mgals or better. The closer the instrumental precision to the observation, the more observations you have to average to increase the signal/noise ratio.
5. Breakdown your proposed survey costs assuming 10 minutes per gravity station, three hours of travel, time for report writing and of data processing at \$55/hour, and \$200 per day for equipment rental.