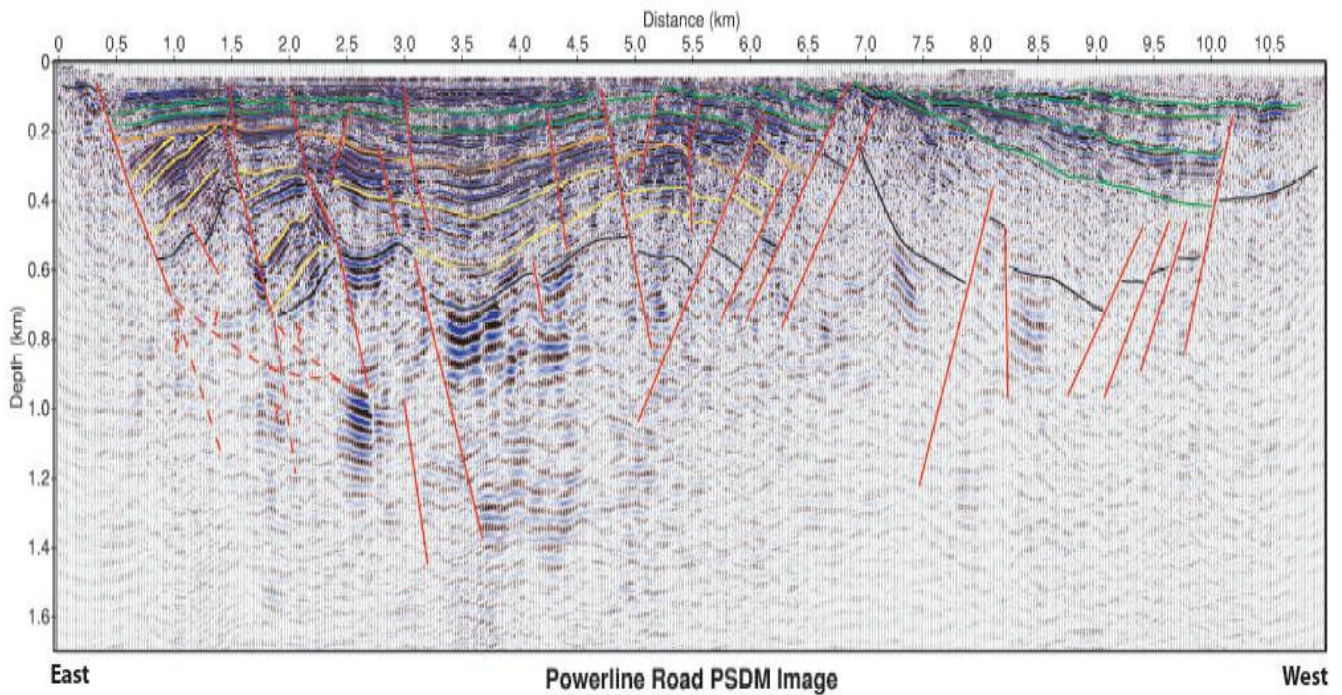


## ACCELERATED WEIGHT DROP SYSTEM P- SHOOTER



- P-Shooter belongs to the light seismic sources.
- The soil coupling is produced by the round plate hit by the accelerated 146 kg weight.
- P-Shooter is an entirely hydraulic system. All the operations are controlled from the cabin.
- Vehicle specifications :  
HATZ diesel engine  
6 m x 2,46 m x 2,8 m  
Total weight : 7500 kg  
Buggy 4x4
- Drop Weight Specifications  
Mass weight : 146 kg (321 lb)  
Mass Stroke : 2,8 m  
Acceleration by Spring : 15 m/s

To test the fault zone interpretation, and begin to build a large scale image of basin geometry, we acquired an 11 km seismic reflection profile perpendicular to the suspected fault zone. The profile consists of 30-fold CMP data acquired using a trailer mounted, 200 lb (90 kg) accelerated weight drop. Reflections are evident to depths of at least 1 km. Evidence for faulting is clear with the seismic image showing a complex normal fault zone bounded to the west by a structural high. Refraction analysis suggests that the structural high is basement rock, and that this basement high controls the piezometric surface in the area with higher pressure to the west.



### Noise Testing for 3D Seismic Survey

Due to the strong site dependence of shallow seismic investigations, a critical first step in any study is a noise test. This is comprised of a set of measurements designed to test the local earth response to various combinations of source/receiver pairs. At this site we fired seven sources into two linear receiver arrays - one with sixty 10 Hz geophones and the other with forty-eight 100 Hz geophones. Receiver spacing within each array was 0.5 m. The seven sources tested were a .223 rifle, a .22 firing rod, a 25 lb weight drop, a 16 lb weight drop, a dead blow, a silver dollar tamper on wood, and a silver dollar tamper on rock.

All seven sources were fired into the arrays at relatively small offsets (up to 48 m). The conditions at the site were excellent. Good reflections were observed for all sources, but there were some significant differences. We found that the 100 Hz geophone array had a significantly better high frequency response, while not compromising bandwidth. The .223 rifle produced about 2 orders of magnitude more energy than any of the other sources. Surprisingly, the 25 lb weight drop, dead blow, and silver dollar tamper on wood and rock all produced about the same amount of energy and similar bandwidth. The .22 firing rod produced the lowest energy, but had good bandwidth and high frequency content.

Three sources were fired into the arrays at large offsets - up to 120 m. These were the .223 rifle, the 25 lb weight drop and the 16 lb weight drop. Reflections are clearly evident to times of at least 300 ms, which corresponds to a depth of roughly 270 m. The rifle source provided the highest energy and clearest reflections. It also produced a large air blast which obscures reflection energy at near offset. The 25 lb weight drop produced significantly less energy and had lower frequency content. On the other hand, it produced lower amplitude coherent noise, and some reflection energy is more clearly observed in the near offset range. Overall, the .223 rifle appears superior to all other sources tested. For the actual 3D survey data collection, the rifle was modified to include a blast plate and silencing system to reduce scattered debris and coherent air wave noise.

## CANADIAN SEISMIC WITH A THUMP

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### Comments on Environment and Economics

Acquisition in forestry areas of Canada can be both expensive and difficult to permit. Part of the hope for these tests was that it would lead to the development of new source techniques which would be of the same quality of data as dynamite (or better), but would also lead to easier permitting procedure through more "environmentally friendly" techniques. Neither of the sources require access for drill rigs. Prior to testing it had been hoped that ice spheres could be formed and dropped. Unfortunately, the meteorological balloons which were used as formers for the ice spheres proved to be too weak to hold more than about 25lbs of water, and larger weights could not be constructed using this method. Subsequent experiments with other construction methods have shown that environmentally friendly disposable drop weights can be constructed.

Typical costs for dynamite source points in this area are just less than C\$100. (Direct costs associated with drilling holes and cost of dynamite.), of course there may also significant costs associated with cutting and survey.

Helicopter rental costs in this area are approximately C\$1,500 / hour, which means that a break even cost compared to conventional dynamite operations would be achieved if 15 drop points / hour were achieved. This seems to be a very achievable target; it is difficult to see why 30 or even 60 drops / hour could not be achieved. It would of course be important to verify that data quality in the area is sufficient to justify the use of the method.

These costs assume that weights can be dropped at any location without need to survey prior to the drop point, and with no requirement to clear or cut trees.

### Results and Conclusions

These tests were designed to examine alternative weight drop systems which increased the kinetic energy of the impact by increasing the velocity of the drop weight, by either dropping from high altitude, or by acceleration under a separate force.

Alternative weight drop systems produced records in the test area which are at least as good as conventional dynamite. Figure 6 shows data from a weight drop which can be compared directly to a dynamite record in Figure 7.

While both of weight drop systems examined had some unanticipated problems, all of these could be overcome relatively easily. Initial concerns about the determination of position and time of a high altitude drop weight source proved to be groundless, as these problems were easily overcome using analysis of first breaks from the 3D spread to solve for source position and source static. Helicopter weight drop systems may well be a desirable source for many different areas.

Alternative weight drop systems produced records in the test area which are at least as good as conventional dynamite. **Figure 6 shows data from a weight drop which can be compared directly to a dynamite record in Figure 7 recorded at the same location**

While the high altitude system examined had some unanticipated problems, all of these could be overcome relatively easily, and this helicopter weight drop systems may well be a desirable source for many different areas. We believe that a system could be developed that has almost no environmental impact, which would deliver data quality similar to current acquisition, at a similar cost. While the tests here are specifically aimed at problems in Canadian exploration, we believe that similar methods may be ideal for an environment where both access and drilling is difficult. This may include mountainous areas of the USA, or jungle regions of South America. We encourage others to experiment further with the ideas presented here.

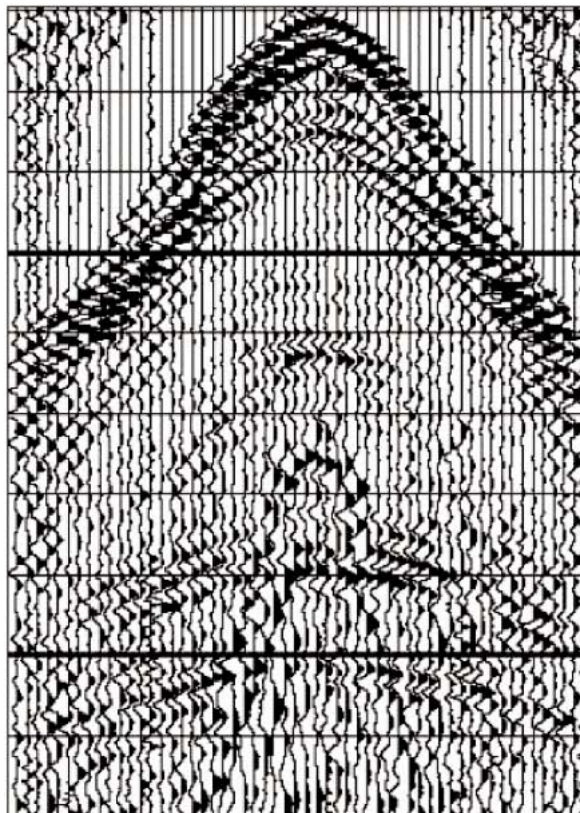


Figure 6: Weight Drop Record

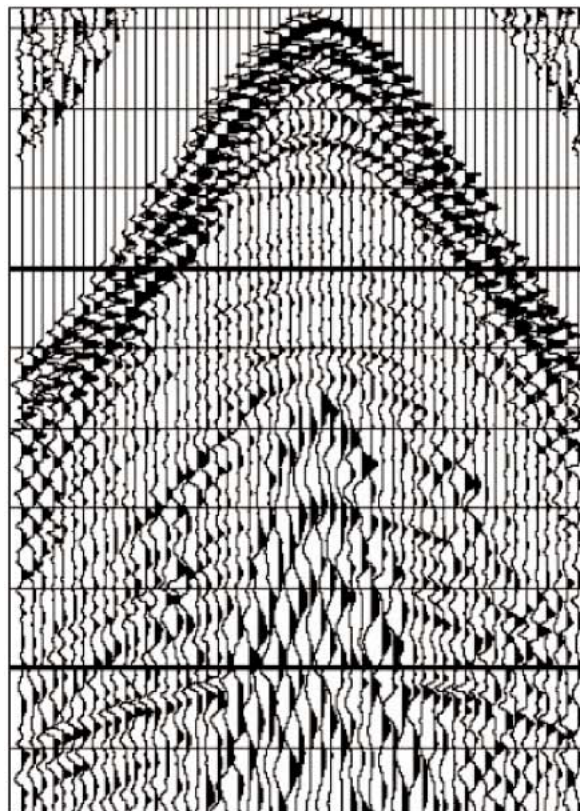


Figure 7: A dynamite record