Investigating power variation in first breaks, reflections, and ground roll with different charge sizes
Christopher C. Petten*, Gary F. Margrave
ccpetten@ucalgary.ca

Introduction
- Dynamite is a common tool used in exploration seismology to image the subsurface.
- The power of a dynamite shot is proportional to the charge size.
- Reflections are of particular interest in exploration geophysics as they contain most of the valuable information regarding the subsurface.
- In this study, we investigate the link between charge size and reflection power in order to improve survey design and interpretation.

Data Acquisition
- The data for this study was obtained during the Hussar low frequency experiment conducted by CREWES in the Fall of 2011.
- Test charges ranging in size between 1 and 4 kg were buried 15 m deep at three separate locations along the seismic line.
- Data was recorded by a 3-component geophone array, consisting of 5 different receivers at each recording location.
- We used the vertical component of a 10 Hz receiver to carry out this investigation.
- The sample and geophone intervals were
  - $\Delta t = 2$ ms and $\Delta x = 10$ m
- Data was collected for a total of 17 different charges

Isolation of the Components
- First breaks, reflections, and ground rolls were isolated into time windows using straight lines in $x$-$t$ space.
- A specific set of criterion was used to isolate each component, as shown in the figures below.
- MATLAB was used to compute the power in each component of the seismogram by using the lines for indexing.

Power Analysis in MATLAB

Results and Conclusions
- Quasi-linear relationship between power and charge size
- Power increases with charge size
- Most of the power is dissipated in the ground roll
- Reflection power is independent of the other two components
- Increased charge size will result in more reflection power
- Fractional power remains constant with varying charge size

Acknowledgements
I would like to thank Dr. Margrave for supervising this project and for all of his help during the data analysis. I would also like to thank Kevin Hall and Malcolm Bertram for their help with the technical portions of this project.

CREWES
www.crewes.org