Student Research Projects
Spring 2016
MNGN 444 – Explosives Engineering II
**Project 1: Characterization and Validation of a Blast-Shield**

The use of explosives brings countless benefits to our everyday lives in areas such as mining, oil and gas exploration, demolition, or avalanche control. However, because of the potential destructive power of explosives, strict safety procedures must be an integral part of any explosives operation. The goal of this project is to conduct studies of blast overpressure inside and around the AXPRO blast shield. The blast shield was specifically designed and tested for protecting personnel against potential air blast and fragmentation during explosive operations. Ultimately, students should develop a significant understanding of explosive-industry safety procedures.

**Deliverables:**
- Students will conduct a thorough literature review of various blast shield designs used by the industry (ballistic, blast-shields, soil, barricades, etc.), safety parameters, and personal protection requirements. This collected information should provide a thoughtful comparison between shield designs, and thus create a characterization for AXPRO’s blast shield.
- Students will review operation procedures for explosive charges used in avalanche control. A parametical model will be developed for the prediction of blast loading on, around, and behind the shield. Safety distances will also be established.
- Students will develop an experimental testing method to validate their parametical model. Experimentation will be conducted at the Explosives Research Laboratory (ERL). A full-scale blast shield model, as well as high-speed imaging and pressure gauges, will be used for data collection. The collected data will be analyzed with commercial software, and ultimately compared with the parametical model.
- Students will develop a detailed technical report and PowerPoint presentation.

**Project 2: Analysis of Case Charge Blasting Parameters for Avalanche Control**

Recently, the Colorado Department of Transportation introduced a new avalanche mitigation method involving the use of case charges. A case charge contains two components: ANFO and a booster. CDOT personnel place the charge at the bottom of an avalanche zone, and then initiate it to artificially trigger an avalanche with the use of air-blast overpressure. In general, this method demonstrated positive results during the last season but some of the technical challenges still remain unsolved. Students working on this project will need to profile the slope at the ERL (slope angle and slope distance), and based off of this, determine the effects of various angles and distances on the case charge blast.
Deliverables:

- Students will conduct a literature view of explosive avalanche mitigation methods similar to case blasting (used in Canada, as well as in the ski industry).
- Students will develop a profile of various slopes at the ERL, and create a plan for experimentation with two different shape charge geometries.
- Students will conduct experimentation at the ERL. 11 and 33 lb charges will be deployed for a slope angle larger than 38 degrees (at distances up to 200 feet). Students will be using instrumentation, such as pressure gauges to monitor the blast over-pressure from the two charges, high-speed imaging to validate the blast, and a seismograph to analyze ground vibration. The data collected will be analyzed thoroughly.
- Students will develop a detailed technical report and PowerPoint presentation.

Project 3: Determining the Explosive Energy Required to Stimulate Oil and Gas Wells

The goal of the project is to study the influence of two initiations point and comparing with single initiation in oil shale samples and the currently used technology at CSM to validate the test results. This student project should develop an understanding of the economical and effective use of explosive energy to create fractures to stimulate oil and gas wells in oil shale rock samples.

Deliverables:

- Students will conduct a literature review of different methods on current work and research such as hydrofracturing, propellant, and explosive and other methods.
- Students will characterize explosives used for oil and gas, and will develop a parametric model to predict the crushing zone in the rock mass with different explosives and rock parameters.
- Experimental testing will be conducted at AXPO’s on-campus laboratory to validate the parametric model for oil shale rock properties. Data will be analyzed for comparison with other technologies.
- Students will develop a detailed technical report and PowerPoint presentation.