ENIRON 590.51: Petroleum Exploration
Instructor: Victor Friedmann

Course Description
The objective of this class is to provide students in today’s energy related fields with an understanding of just why oil continues to be such a popular source of energy, the wide spectrum of expertise that is used in hydrocarbon exploration, the evolving sciences behind oil exploration, and what it takes to compete successfully for the right to drill for oil. A supporting but equally important objective is to encourage students to express their thoughts clearly, to make effective presentations, and to employ their experience and thought processes in embracing problem-solving even in areas where they may lack a great deal of expertise. Class exercises will focus on developing creative thinking and teamwork.

The course is intended for graduate students. It is meant to impart these students with a deeper insight of the science, techniques, and methods designed to image geologic formations thousands of meters beneath the surface of the earth. The course is organized in six modules and 14 classes. Each module will consist of more than one class.

Module One employs statistical tables to illustrate world production and use trends in the 20th century. The module continues with the history of oil and culminates with the discovery of the world’s largest oil fields in Saudi Arabia. The objective of this module is to impart an understanding of how oil came to be used thousands of years ago and why oil became such an important element in transportation and industrial development.

Module Two lays the geological foundation of the depositional setting necessary for the accumulation of hydrocarbons. The objective of this module is to impart a geologic understanding of how modern geologic occurrences lead to models that explain historical sedimentary deposition, geologic movement, and formations that are favorable to the accumulation of hydrocarbons.

Module Three is a survey of non-invasive subsurface imaging techniques. The physics of sound is then introduced in support of the use of sound sources such as Vibroseis and Hydroguns in exploration. The objective of this module is to impart an understanding of the challenges in imaging the subsurface and how relatively simple sound sources have been immensely successful in meeting this challenge. A visit to the Duke geologic modeling facility is planned.

Module Four presents the history, evolution, and impact of digital sampling and computer applications to geophysical data processing. The objective of this module is to impart a good understanding of the theory behind the digital revolution – how sampling theory made possible everything from large scale computing to IPods.
Module Five consolidates geology, geophysics, and data processing into the singular objective of discovering hydrocarbons and how oil companies compete for the right to drill. The objective of this module is to impart an understanding of the interrelationship of the many disciplines involved in petroleum exploration.

Module Six simulates a mock offshore oil lease sale that will be conducted by the class divided into four competing teams. The objective of this module is two-fold: one to determine how well class members can integrate their experience, creativity, and modules into a team project. The second objective is to exercise class members in the fine art of public presentation—the challenge of convincing a management team (that may not be so technically savvy) where to drill and why.

Wherever possible, live demonstrations will be used to illustrate theoretical offshore oil lease. Group presentations due at the beginning of Class fourteen.