NEW GEOSCIENCE CLASS PREPARES STUDENTS FOR OIL INDUSTRY CAREERS

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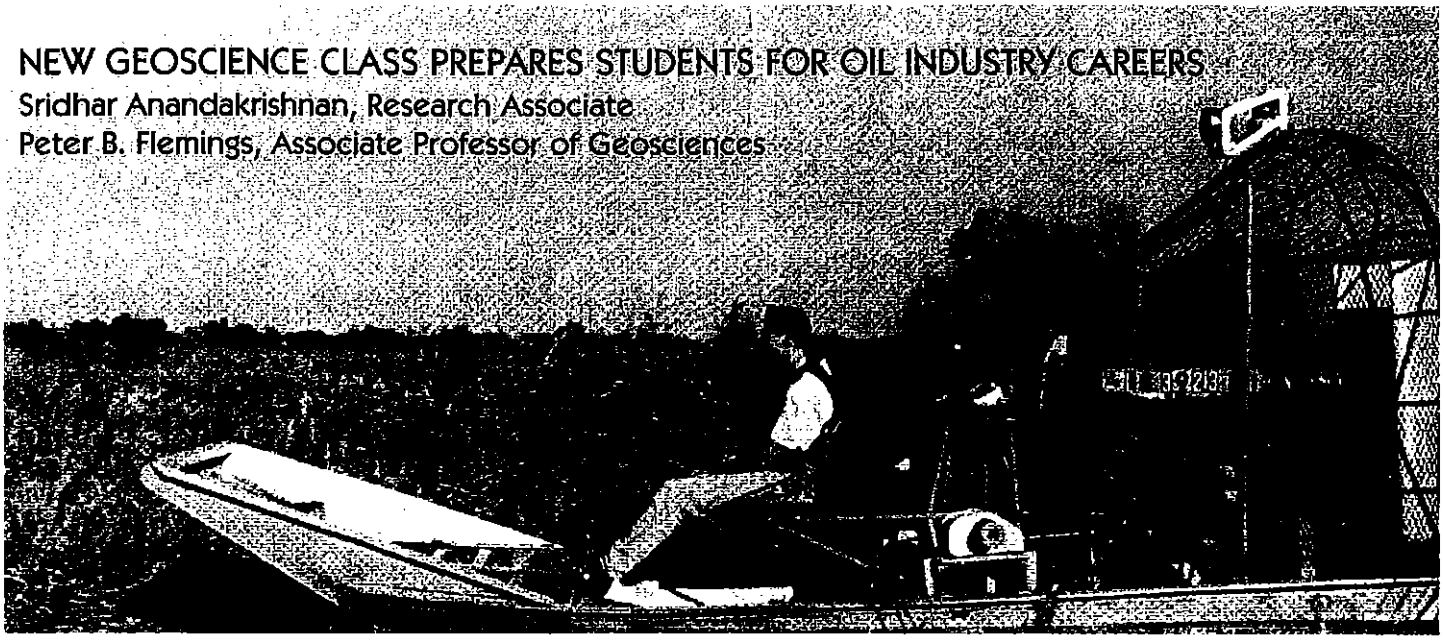


Bats do it. Dolphins do it...and we do it.... Geophysicists call it seismic reflection processing. From the steaming bayous of south Louisiana to the frozen wastes of Antarctica, people are trying to "look" deep into the Earth. To image rocks at depths of a mile, ten miles, or one hundred miles is not an easy job. However, if one is looking for oil, or trying to figure out how an ice sheet works, there is no better tool than seismic reflection geophysics.

Seismic reflection consists of making a loud noise on the ground surface and listening for the echoes that bounce off layers deep within the Earth, then return to us at the surface. Bats and dolphins do much the same thing when they "echo-locate" their prey. By measuring the time it takes for the echoes to return, we can work out the structure of the Earth beneath us. By far the most prolific users of this method (multichannel seismic reflection or MCS) are the oil and gas industries. Industry spends millions of dollars profiling an area with MCS so that they can locate their drilling targets and have some degree of confidence that the drilling will be profitable. Research scientists studying the structure and composition of the Earth's crust, the history of oceanic sediment deposition, the flow of glaciers and ice sheets and other fields all have come to rely on MCS data to image the interior of the Earth.

At Penn State, we have developed a course **GEOSC 497K: Multichannel Seismic Reflection Processing and Interpretation** to introduce a new generation of students to the power of this tool. The course extends from the basics of data acquisition (how to make that loud noise and how to listen for the echoes) to processing (how to turn those echoes into a picture of the Earth's interior) to interpretation (what does the image mean?). Our philosophy is one of "problem-based" teaching, where we tie theory to practice for each step of the course. We wanted the students to look at and manipulate data in the lab while they learned the theory behind those manipulations in the classroom.

This teaching approach is expensive. Seismic reflection profiling generates massive quantities of data and requires complex computations to process these data. You need sophisticated hardware and software—equipment the College could not afford to provide. For support, we turned to the oil industry because they will benefit most from having a new generation of professionals skilled in multi-channel seismics. Initially, the program was seeded with $20,000 from the Shell Foundation and a $3 million dollar software grant from the Landmark Graphics Corporation. Eventually, Chevron, Texaco, the Department of Geosciences, and the College's Wilson Fund also joined with Shell and Landmark to fund and create a new laboratory: the Applied Geophysics Instructional Facility (AGIF). (http://www.geosc.psu.edu). This lab boasts three fast computers, disk space, and seismic processing and interpretation software. We are currently looking for additional industry support to extend this lab to include more computing power, more disk storage (an eternal problem in the data-rich seismic industry), and expanded plotting capabilities.

Shell Offshore Inc. donated a number of seismic lines in their pre-processed form. Each week, in the classroom, we would go over the basic geophysical theory involved. Then, during lab, the students would apply that theory to successive steps in data processing. Through the course of the fall the students witnessed

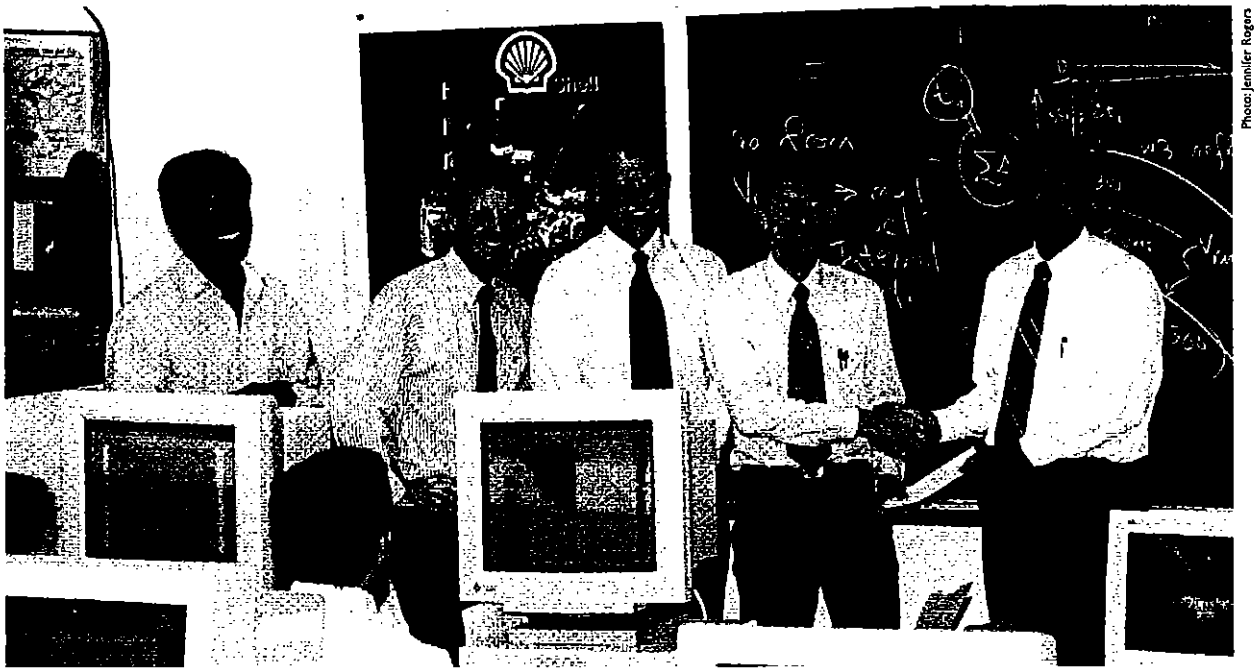
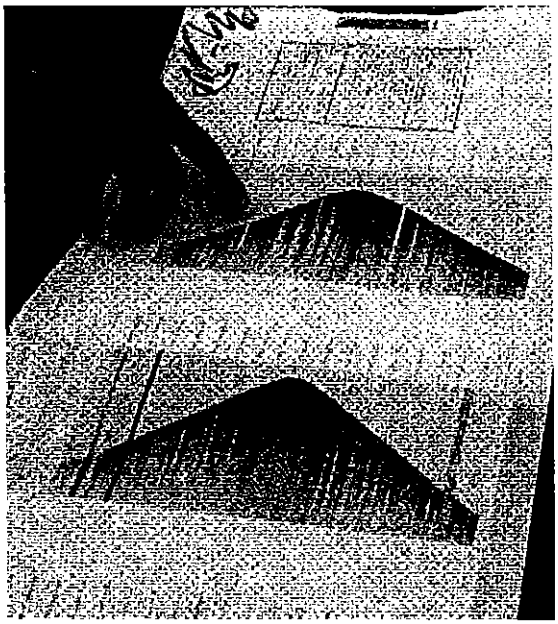


Photo: Jennifer Rogers

In the new Applied Geophysics Instructional Facility, Geosciences Department Head Rudy Slingerland (right) accepts a check from Penn Stater Michael Kuzio, Manager Administrative Support, Shell Offshore, Inc. With them (l. to r.) are course instructors Sridhar Anandakrishnan and Peter Flemings and Michael Baranovic, Chief Geologist, Shelf Division, Shell Offshore, Inc.

their data evolve from raw unprocessed data to a seismic image of the Earth's subsurface. Through these rigorous labs, the students came to understand theory at a deeper level. It was extraordinary the number of questions that arose from the lab which would then focus and strengthen the classroom lectures.



In the final month of this course, students take their final processed data and perform a geologic interpretation to map what is in the subsurface. For example, what is the structure? what is the stratigraphy? and where is the oil? The emphasis on the integration of processing and interpretation reflects a broader trend within industry: there are no longer "geologists" or "geophysicists," there are geoscientists, and to these individuals, the seismic image is as fundamental as the rock hammer once was.

Lectures, labs, and digital data, came to life through a field trip to Louisiana and Texas where we witnessed seismic acquisition. We took the entire class of eleven students to Houston (courtesy of the Wilson Teaching Fund). There we met up with our Schlumberger Geco-Prakla friend, Bill Troxell, and set off to southern Louisiana. The students were struck by the huge investment made to acquire seismic data. Millions of dollars of equipment and hundreds of employees are required to make these seismic surveys. The class was also impressed with the curious mixture of extraordinarily high-tech equipment (computers, satellite technology, and electronics gear) and low-tech, back-breaking work, of slogging through the mud to plant geophones (the instrument that listens for the echoes) or of running the vibrator trucks (huge trucks that act as loudspeakers to send sound waves into the earth). Finally, it was an eye-opening experience for our students to witness a multi-national company with its rich heritage of employees from all over the globe, working together in southern Louisiana, to make a logistical nightmare run smoothly.

The class is evenly split between undergraduates and graduate students. Through this course, several of these will join the oil business. They will join that business with an unprecedented understanding of just what is involved and how to do it well. Others will take their seismic knowledge to greater depths through other courses and research. They will do so with a better appreciation of the practicalities of data acquisition and processing. Finally, the whole department is enriched by the establishment of AGIF, our new state-of-the-art computing facility.

(This course and AGIF would not exist without the extraordinary efforts of many people. We particularly thank: Bill Troxell (Geco-Prakla); Jim Beer and Mike Kuzio '70, '77 M.S. geophysics (Shell Offshore Inc.); Chris Archer and Tom Fisher (Landmark Graphics); Ed Fry '77 geophysics and John Kleist (Chevron); Kent Rinehart and Dick Andre '83 geoscience (Texaco); the Wilson Fund; and Geosciences Professor Richard Alley and the Packard Fund. And, of course, thanks to the students for willingly becoming guinea pigs for this experiment.)