# The Allied Geophysical Lab (AGL) 2015-2016


We are dedicated to making significant advances in the understanding and imaging of the subsurface. Specifically, we work with the resource industry and professional societies to create novel ways to discover and conscientiously recover resources while educating the next generation of geoscientists.

## Scope of Work

Making a more accurate and higher resolution image of the subsurface and its resources is always a primary task of applied geophysics. Estimating lithologies and associated petrophysical properties is, in turn, essential. Determining the saturation state of a reservoir and its change has become critical. There remain many grand challenges in applied geophysics: At AGL, we emphasize the physics behind making geologic images of the subsurface. This involves three main categories: Acquisition, analysis, and interpretation of largely seismic data. A key component of our effort is to make geophysical measurements in the laboratory, computer, and field. We have one of the few physical/robotic modeling facilities in the world dedicated to making scaled surveys of structures of energy interest. In addition, we write and employ a number of numerical modeling and analysis codes. Furthermore, we have an excellent capability to acquire geophysical data (seismic, VSP, well logs, GPS, GPR, and gravity). The University owns a section of land near Galveston that we have developed as a geophysical test site (the La Marque Geophysical Observatory) including two cased 425 ft wells which are now used for borehole geophysical teaching and research. UH also manages a 100-person geoscience field camp near Red Lodge, Montana which we use for the education of students in geophysical field methods. We recently acquired marine sonar and seismic systems and have been undertaking surveys in the Gulf of Mexico area.

On the processing and analysis side, we develop algorithms related to the imaging and understanding of geophysical (mostly seismic) data. We also use many of the industry-standard processing codes (Paradigm, Landmark, VISTA, Petrel, and Kingdom). Our particular expertise is in multicomponent seismic analysis, seismic attributes, borehole seismic, AVO, quantitative interpretation, attenuation, and anisotropy. We are involved with a number of case histories including resource targets as the Barnett, Bakken, and Marcellus shales. In addition, we have numerous studies relating to VSP and 3D (several 4C) seismic data sets in the Gulf of Mexico.

Along with our eight closely associated faculty (Stewart, Thomsen, Chesnokov, Zhou, Sager, Li, Castagna, and Zheng), we have some 70 graduate students and staff attached to our applied geophysics effort. We are enthusiastic about working with our industry partners!

**Consortium Proposal: *Allied Geophysical Laboratories***

**Agreement period: *October 1, 2015 – December 31, 2016***

**Company contribution (2015-16): *$45,000.***

Our goals are ambitious and moving forward will require sponsorship for the purchase of equipment, instruments, computers, and software. New personnel are needed to undertake research, maintain and operate equipment, as well as for administrative operations, university reporting, safety compliance, and sponsor communications. An overview of our proposed activities in 2015-16 is shown below.

## Activities and Timeline: 2015 - 16

| | December 2015 | March 2016 | September 2016 | December 2016 |
|---|---|---|---|---|
| Equipment | 200-ch seismic, ultrasonic upgrade, GPS, vibe electronics | 300-ch 3C seismic vibroseis; 120 3C land nodes | Shallow marine seismic boat: DAS system | Ocean-bottom seismometers; drones and rovers |
| Facilities & software | VISTA, Petrel, Kingdom, Focus, hardware upgrades | Transform, Landmark Hampson-Russell | Computer hardware upgrade | ProMax |
| Personnel | 5 new graduate students | Administrative assistant | Post-doctoral geophysicist | System & data geophysicists |
| Physical modeling | 3D VSP, subsalt; fracture/fault | Time-lapse sand; shale; microseismic | 3C structure nonlinear | 3C-3D anisotropy |
| Field work | Houston/local (salt & faults); Eagle Ford; Louisiana | Eagle Ford; Odessa,Texas; Utah sand; Belize | Gulf of Mexico marine; Dickinson salt dome | Gulf of Mexico marine |

## Deliverables and Other Benefits:

The new AGL aspires to make a significant impact on the science of geophysics and deliver clear benefit and advantage to our sponsors. A list of deliverables and other benefits follows:

- Physical modeling data will be available to sponsoring organizations
- Substantial AGL field data will be available to sponsors
- AGL theses, posters, preprints, expanded abstracts, and technical papers and reports will be provided to sponsors
- Software will be periodically released to sponsors
- Sponsor representatives will be invited to the AGL Annual Spring Meeting summarizing the year's research activities in addition to the Annual Dobrin Geophysics Lecture
- Each sponsor will receive periodic communication about AGL personnel, activities, and research
- Sponsors will have a voice on the AGL Industrial Advisory Board to provide guidance and counsel to the Lab
- Sponsors have the opportunity to become familiar with students (prospective staff) and their work

## Budget Overview: 2015-16

Through 2015 and 2016, we intend to purchase, maintain, and upgrade a substantial amount of geophysical equipment. To date, the University of Houston has provided $1,500,000 toward this effort. We seek further contribution from the industry and various other agencies. Equipment purchases are to upgrade the existing physical modeling facility as well as provide an augmented field acquisition and data processing capability. We have assembled a full industry-standard land (Vibroseis) system and have a marine capability (boomer and sonar). Other supporting equipment includes GPS, well-logging, VSP, CG-5 gravimeter, and GPR instruments.

| 2015-16 Budget | Expenses | Revenue |
|---|---|---|
| Equipment, instruments, computers | $410,000 | |
| Personnel salaries | $400,000 | |
| Field work, travel, communication | $115,000 | |
| University, state, federal contribution (cash) | | $385,000 |
| Industry sponsorship (cash) | | $540,000 |
| **Total** | $925,000 | $925,000 |

***Lab instruments and Field equipment***

*Transducers, A/D converters, controllers, lasers, control & recording, software $75k*

*Upgrade 120 channels of seismic node recorders and 3C geophones $25k; 96-channels of Geodes $50k; Upgrade vibe electronics $60k*

*Well Logging tools, cable, winch, and truck $80k; VSP tools, cable and recorders, and GPS $45k*

***Computers***

*Hardware, software, and visualization $75k*

***Personnel***

*Five graduate students $150k; Four technical and admin. staff $250k*

***Field work and Travel***

*Survey travel $45k*

*Conferences, meetings, courses $20k*

***Communication***

*Publication costs, newsletters, seminars, meetings $50k*

***Total 2015-16 expenses $925k***

Specific projects and associated students for 2015-16 include:

| # | Name, year grad[d] | Subject/title of thesis | Present position |
|---|---|---|---|
| | | ***M.S.*** | |
| 7 | Ermolaeva, Elena | Imaging with S-P events | Univ. of Houston |
| 6 | Ross, Abigail | TBD | Univ. of Houston |
| 5 | Koller, Andrew | Bakken shale 3D & VSP | Univ. of Houston |
| 4 | Paris, Andrea | Assessing Q values | Univ. of Houston |
| 3 | Mao, Lingfei | Marine seismic processing - Galveston | Univ. of Houston |
| 2 | Ruiz, Fabiola | Marcellus shale - 3C-3D seismic inversion & interp. | Univ. of Houston |
| 1 | Brooks, Nick | Microseismic modeling & monitoring | Univ. of Houston |
| | | ***Ph.D.*** | |
| 9 | Silva, Eliene | Ocean-bottom nodes: Anisotropy & PS imaging | Fed. Univ. Rio, Brasil/UH |
| 8 | Zong, Jingjing | Salt petrophysics & velocity modeling | Univ. of Houston |
| 7 | Babalola, Ayo. | Norne pressure seismic inversion | Univ. of Houston |
| 6 | Silva, Alexandre | VSP and microseismic – Bakken & LaMarque | UH/Petrobras |
| 5 | Sayed, Ali | 3D anisotropic VSP | Schlumberger, Houston |
| 4 | Babalola, Afo., | Petrophysics & elastic attributes of Marcellus shale | Univ. of Houston/Shell |
| 3 | Huang, Long | Anisotropic inversion for fluid saturation | Univ. of Houston |
| 2 | Wang, Jiannan | Use and removal of guided waves in marine seismic | Univ. of Houston |
| 1 | Aziz, Azie | 3D GPR imaging – Sand reservoir analgues | Univ. of Houston |

We require a number of additional staff to operate and maintain the various computer and measurement systems as well as facilitate research. We anticipate hiring four staff throughout 2015-16. They would include an application geophysicist, postdoctoral fellow, system and data manager, and an administrative assistant. We seek AGL industrial sponsors from the energy, mining, engineering and related sectors. Annual sponsorship cost is $45k for 2015-16. A reduced rate of $15k is available for smaller enterprises (under $5 million annual revenue). We anticipate that this support and collaboration will arise primarily from the energy industry. We also offer a limited number of Founding and Sustaining Memberships that allow more direct involvement and impact on the future of AGL and its people.

Contact AGL Director Robert Stewart (rrstewart@uh.edu) for further information.