



Geophysical Society of Houston

VOL. 31, NO. 8

NEWSLETTER

APRIL 1996

Letter from the Editor

I heard recently that mankind's cumulative knowledge is doubling each year. At this rate, technological advances occur in the blink of an eye.

I'm all for progress, but I just wish it would slow down long enough for me to catch up! I still remember the day they came to take away my typewriter and give me a personal computer. Then they hauled off the old telex machine. It was sad to watch it go, but they replaced it with a fascinating new form of communication ...and the fax age began.

Now I can't imagine working without my computer or fax machine. The adjustment took time but technology was keeping up with me. I struggled at first with office networking, fax modems, and new software updates, but I managed. As the pace of technology began to quicken in the late 80's, however, it soon became an uphill battle to keep my grip on



Pamela Moore
New World Horizon

technology.

I was watching the news a few weeks back and learned that it is now possible to send 3-D faxes. Basically, the object is scanned into the computer and a 3-D image is sent by fax. On the receiving end, a grid plate of soft resin forms the image. This three dimensional object then rises from the resin plate before your eyes. The hardened image is within a 1/4 inch accuracy of the original.

I'm also beginning to get a handle on the Internet and "Surfing the Web." Of course, my internet software fights with all my other software on a daily basis resulting in lovely crashes—can't they make these programs get along?!?

Which brings me to the purpose of my ramblings. To all of you who struggled with me this year in meeting the demands of our growing technology, I applaud and thank you. Your concerted efforts to provide your newsletter articles and abstracts in digital or electronic form have resulted in a more efficient, less costly production for our Society. This allows us to channel our saved time and money into other worthwhile GSH efforts.

In addition, I am very pleased to announce our newsletter is now on-line and can be accessed on the new GSH WWW Home Page. I am grateful to Victor Koosh and Scott Sechrist for their efforts in bringing this new technology to our doorstep.

My only question is — *what's next??*

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Golf Tournament and Dinner

Monday, April 8 at Kingwood Country Club

SEG Gulf Coast Technical Meeting

April 10-11 (8:00 am - 5:00 pm)

Exxon Auditorium, 800 Bell

(See page 9 for details)

Looking Into the Earth Forum

Environmental and Non-Invasive Geophysics

April 12-13

(See page 10 for details)

Spring Technical Workshop

Case Histories of Seismic Attribute Mapping

April 17 (8:00 am - 4:30 pm)

Marathon Auditorium

(See page 14 for details)

GEOPHYSICAL SOCIETY OF HOUSTON

Margaret Blake, Office Manager • 7171 Harwin Drive, Suite 314 • Houston, Texas 77036-2190

(713) 785-6403 • Fax (713) 785-0553 • Office Hours 7 a.m. - 4 p.m.

Event Reservations Number: (713) 917-0218

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	P.O. Box 740099, Houston, TX 77274		
Assistant Editor	Cliff Kelley, Schlumberger Well Services	368-8103	Fax 368-8184
Company Contacts	Scott Sechrist, EnTec	464-8200	Fax 856-7445
Electronic Publishing	Victor H. Koosh, New World Horizon	773-2627	Fax 773-9620
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Alt. SEG Section Rep.	Merry Lynn Southers, Business Archives	840-8282	Fax 599-9110

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Technical Luncheon SEG Spring 1996 Distinguished Lecture

Date: Monday, April 15, 1996
Place: HESS, 3121 Buffalo Speedway
Time: Social, 11:30 a.m.
Meeting, 12:00 noon
Cost: \$17 Pre-registered GSH members
\$22 All Others
Topic: **Applied Seismic Inversion for
Estimating Earth Models in Depth**
Speaker: Oz Yilmaz, Schlumberger/Geco-Prakla,
Gatwick, England

Please make reservations by calling the GSH reservation number **917-0218** prior to noon, Friday, **April 12**.

Processing and inversion, both are intended to estimate earth models from seismic data. Nevertheless, they differ in one fundamental respect - the output domain. Processing yields an earth model in time, whereas inversion yields an earth model in depth.

A way to judge accuracy of an earth model derived from processing and inversion is by way of time and depth migration, respectively. In fact, we apply these two migration methods to post- and prestack data to derive an earth model itself. Representation of an earth model in time usually is in the form of a velocity field for time migration. Representation of an earth model in depth usually is in the form of a detailed velocity-depth model for depth migration, which comprises two sets of parameters - layer velocities and reflector geometries.

In processing seismic data, we usually make a straight-ray assumption and do not have to honor significant ray bending at layer boundaries. As a result, we obtain earth models with velocities which vary smoothly in the vertical and lateral directions. In contrast, detailed definition of earth models derived from inversion of seismic data with a more stringent requirement in accuracy means that we do have to honor ray bending at layer boundaries, account for vertical velocity gradients and strong lateral velocity variations. Hence, to a large extent, processing can be automated, while inversion requires an interpretive pause at each layer boundary.

A fundamental problem with inversion is velocity-depth ambiguity, which requires independent estimate of layer velocities and reflector geometries. Due to velocity-depth ambiguity, an output from inversion is an estimated velocity-depth model with a measure of uncertainty in layer velocities and reflector geometries. It now is widely accepted that results of inversion are geologically plausible only if there is a sound interpretation effort put into the data analysis. In this context, inversion can be viewed as interpretive processing in contrast with conventional processing.

In practice, there exist several ray- and wave-theoretical

Technical Breakfast — April

Date: Tuesday, April 9, 1996
Time: 7:30 - 9.00 a.m., Technical Presentation will start at 8.00 a.m.
Place: University Club, 5051 Westheimer, Galleria Entrance No. 2, Post Oak Tower, 3rd Floor, Northside, between Lord & Taylor & Cheese Factory
Cost: NO CHARGE (underwritten by Seitel)
Topic: **Integrating Multiple Seismic Surveys to Interactively Interpret a Salt Dome Flank**
(An ingenious application of the work station technology in investigating an industrial waste disposal site)
Speaker: H. Roice Nelson, Jr., Walden 3-D, Inc.
Carl L. Brassow, Secured Environmental Management, Inc. (co-author)

Advance reservations urged — The host company needs an accurate head count. Please call GSH (917-0218) prior to Thursday, **April 4**.

Three seismic surveys were integrated to interactively interpret the northern flank of a salt dome, onshore South Texas. The specific objective was to evaluate if there is a salt overhang that could decrease the horizontal extent of salt between the salt-sediment interface and four planned salt caverns proposed as an industrial waste disposal site. The seismic surveys consisted of: (1) SEM, a high-resolution (0.25 ms sample rate) 3-D seismic survey on the crest of the dome; (2) Sheik, a high-resolution (2.0 ms sample rate) 3-D seismic survey off the north flank of the salt dome; and (3) S-2, a 2-D seismic line orthogonal to the salt dome and passing near both the SEM and Sheik surveys.

The seismic data for each of these surveys was loaded on a Landmark Graphics interpretation workstation.** Three projects were set up: SEM; Sheik; and Composite. A well-based interpretation of the Top-of-Caprock was gridded and entered into a horizon in the Composite Project. The smoothed travel-time exported version of this horizon was imported to the SEM survey to provide a check for picking the Top-of-Caprock. There is a direct correlation to a strong reflector consistent across the SEM survey. This reflector was interpreted as the Top-of-Caprock. This reflector ties nicely to the salt-sediment-interface interpreted on S-2. The S-2 salt-sediment-interface projects to the top of a no-data-area in the Sheik 3-D seismic survey, which was interpreted as top-of-salt. The location of the proposed salt caverns were converted to seismic travel-time and loaded into the SEM survey as both "faults" and "horizons" to show their spatial relationship to the Top-of-Caprock.

The interpretation process and results were captured in the ESF HyperJournal, a hyperlinked multimedia "living re-

Data Processing SIG

Date: Wednesday, April 17, 1996
Time: Social, 4:30 p.m.
Presentations, 5:00 p.m.
Place: Texaco Bellaire Auditorium
Enter through main gate at 4800
Fournace, n.w. corner & West Loop
South. Drive around
to the 6 story building.
Topic: **Velocities From Seismic Versus Well
Information - Part I**
Organizers: Jozica Gabitzsch and Joe Keliher
Speakers: Richard Verm; Richard O. Lindsey

Velocity. Velocity? Velocity!

Richard W. Verm* and Fred J. Hilterman, GDC

Exploration geophysicists who deal with reflection seismic data have to be concerned with the velocity of the earth materials in order to satisfy processing requirements, lithologic identification and depthing. Typically the velocity measurements available come from three independent sources, borehole sonic, checkshots and seismic reflections. Unfortunately, the velocities obtained from the different methods do not agree and reconciling the observed differences can be difficult.

Most of these differences can be explained by examining the methodology of acquisition and processing. Checkshots are most affected by wavelet dispersion, that is velocity is frequency dependent. Consequently the wavelet observed changes character with depth. Now the borehole sonic uses frequencies (10,000 hz) that are two orders of magnitude higher than those observed in checkshots (100 hz). Immediately this complicates the comparison because the dispersion effects will be completely different. In addition the borehole sonic is greatly influenced by local conditions. Such factors as shale caving, invasion by drilling fluids and overbalanced drilling will result in a sonic measurement not representative of the in-situ uninvaded formations.

Measurements of rock velocities from surface seismic measurements will differ from checkshots because of processing and physical conditions. Checkshots typically involve a vertical straight line travel path while surface seismic depends upon non-normal incident reflections for its velocity measurements. Usually only a homogenous (i.e. RMS stacking velocity) approach is used. An accurate extraction of velocity from surface seismic data, however, requires a tomographic solution. Even for short spreads, anisotropy affects the wavefront curvature and thus the estimate of RMS velocity from surface seismic data. A correction between surface seismic velocity and checkshot derived velocities must be applied. In a similar fashion because of anisotropy, sonic velocities derived from deviated holes must be compensated in order to tie sonics from vertical holes.

Continued on page 11

Reservoir Geophysics SIG

Date: Thursday, April 18, 1996
Time: 5:00 p.m.
Place: Texaco EPTD
3901 Briarpark, Conference Room A
NO CHARGE
Cost:
Topic: **Practical Aspects of Performing a
Multidisciplinary Reservoir Study**
Speakers: Mike Curtis; Adrian Hassall, Halliburton
Energy Services
Organizer: Phil Inderwiesen, Texaco

Please make reservations by calling Kathy Gough at **954-6003** by **April 16**.

This presentation will lead through many of the practical aspects encountered when performing a complete multidisciplinary study for field development planning. The discussion will be focused on the South Tano Field, offshore Ghana.

The Upper Albian of South Tano forms a challenging reservoir as it is both thinly bedded and compartmentalized by subtle faulting. These conditions could potentially limit both the vertical and lateral flow of fluids which could adversely effect production and field performance. A detailed reservoir understanding of the field allows us to minimize the impact of the complex stratigraphy and compartmentalization.

A study team included geologists, geophysicists, petrophysicists and reservoir engineers who constructed a series of static geophysical, geologic and reservoir models of the field. Production history matching was applied to validate the final reservoir model.

Field performance has been predicted during a series of simulation runs, results of which were applied to "fine tune" the location and design of the proposed wells to optimize simulated production.

Field development of South Tano requires both horizontal and highly deviated wells to develop the oil and gas reserves. The established plan will minimize the potential for water coning and gas break-through.

Reservoir understanding can significantly reduce technical and financial risk during both field development and production enhancement, it also improves general confidence in the development strategy. In South Tano the first horizontal well has been drilled. Results confirm the accuracy of the complex reservoir model.

Mike Curtis has B.Sc. from the University Of Wales - Swansea. During his 22 years with GSI and Halliburton Energy Services he has gained worldwide data processing and 3D interpretation experience. Currently Mike is a Geoscience Consultant with Halliburton, managing and performing integrated studies.

Adrian Hassall has a masters degree in Petroleum Geology from Aberdeen University, Scotland. He has worked with Occidental, Amerada Hess and Halliburton Energy Services appraising fields from Europe, Africa, Latin America and the USA. Currently Adrian works as a Senior Geoscientist with Halliburton in Houston.

Technical Luncheon SEG Spring 1996 Distinguished Lecture

Continued from page 3

methods of estimating layer velocities and delineating reflector geometries. Estimation of velocity-depth models for structural and stratigraphic targets from different exploration basins generally require different procedures which are made up of a suitable combination of inversion methods. What the explorationist wants is not the individual methods, rather a proper combination of appropriate methods - a procedure for inversion, to solve a specific exploration problem. Below, are four examples of inversion procedures.

(1) A combination of Dix conversion of stacking velocities to estimate layer velocities and vertical-ray depth conversion of time horizons picked from time-migrated volume of data to delineate reflector geometries. A procedure appropriate for cases with negligible ray bending at layer boundaries, and lateral velocity variations judged to be within the bounds of time migration.

(2) A combination of stacking velocity inversion to estimate layer velocities and image-ray depth conversion of time horizons picked from time-migrated volume of data to delineate reflector geometries. A procedure appropriate for cases with some ray bending at layer boundaries and significant vertical velocity gradients, and moderate lateral velocity variations.

(3) A combination of coherency inversion to estimate layer velocities and poststack depth migration to delineate reflector geometries. A procedure appropriate for cases with significant ray bending at layer boundaries and significant vertical velocity gradients, and strong lateral velocity variations with sharp changes in reflector curvatures.

(4) A combination of image-gather analysis to estimate and update layer velocities, and stacking of image gathers from prestack depth migration to delineate reflector geometries. A procedure appropriate for cases with significant ray bending at layer boundaries and significant vertical velocity gradients, and severe lateral velocity variations associated with salt and overthrust tectonics.

Estimation of earth models in depth may require application of multiple combinations of inversion procedures. For example, in the Southern Gas Basin of the North Sea, which has been subjected to salt tectonics, combination 3 can be used to estimate the earth model within the overburden and combination 4 must be used to estimate the earth model within the subsalt region. In the eastern half of the Gulf of Mexico, where there exist large masses of salt embedded into a thick sand-shale sequence, combination 1 may be used to estimate the earth model associated with the simple background velocity field for the sand-shale sequence, and combination 4 can be used to refine the model in the subsalt region. I shall present examples of earth models in depth estimated from inversion of seismic data from various exploration basins in the world.

Technical Breakfast — April

Continued from page 3

port.” Key stages from this report are available on the INTERNET at <http://www.hypermedia.com/w3d/geotechnology/W3D95C/index.html> using a browser like NetScape or Mosaic. The interpretation results were also transferred to The University of Houston’s Virtual Environment Technology Laboratory and the spatial relationships evaluated in their visually immersive CAVE (for those familiar with StarTrek terminology, a computer generated “holodeck”). This virtual environment has proven to be a very useful means of communicating complex spatial relationships.

One of the more interesting results to be presented is the relationship of seismic amplitudes to calcite distribution in the caprock. Using the interactive system we evaluated the seismic amplitudes in 10 ms intervals (less than 30 feet). We interpret the strong difference between these amplitude maps to mean that the calcite zone is totally within the top 30 feet of the caprock. The map across the entire dome shows this to be a relatively simple dome. The structure of the Top-of-Caprock is simple in the area of the proposed salt caverns. Based on this integrated interpretation, there does not appear to be any salt overhang on the north side of the dome. This means there is virtually no possibility of water reaching the proposed salt caverns and their proposed storage of industrial wastes within the next few thousand years.

***Seismic data and interpretation results are available for viewing on a workstation at Interactive Interpretation & Training, Inc.*

H. Roice Nelson, Jr. received a B.S. degree in Geophysics from the University of Utah in 1974 and an MBA from SMU in Dallas, Texas in 1981. He is the co-founder of Landmark Graphics Corporation and the founder of HyperMedia Corporation, Dynamic Oil & Gas Corporation, Advanced Structures Incorporated and Walden 3-D, Inc. He is a geoscientist by training and disposition with 20 years experience. He worked at the University of Houston’s Seismic Acoustic Laboratory as Senior Research Scientist and Allied Geophysical Laboratory as General Manager; Mobil E&P, Dallas as Geophysicist. He has also worked with Amoco in Denver and Applied Geophysics Corporation and the University of Utah in Salt Lake City. He wrote a series of articles in early 80’s which were published as the book “New Technologies in Exploration Geophysics”. Additionally, He has presented over 130 papers at professional meetings. professional affiliations include: AAPG, CSEG, GSH (honorary member), HGS, SEG and ULI.

Please fax your suggestions to Dave Agarwal at 650-3822 for the “Best of GSH” series Breakfast Meetings regarding Topics, Speaker, Place and Potential Sponsors.

**GEOPHYSICAL SOCIETY OF HOUSTON
ANNUAL HONORS AND AWARDS BANQUET**

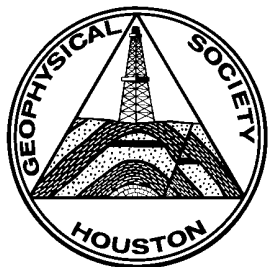
Wednesday, May 8, 1996

Lakeside Country Club

6:30 p.m. - Cash Bar

7:15 p.m. - Dinner

Music by Marshall Maxwell



GSH LIFE MEMBER

Thomas K. Fulton

GSH HONORARY MEMBERS

James L. Allen

Davis W. Ratcliff

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U. E. Neese

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SEG 25-YEAR HONOREES

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John Tumison

Santos Villar

Neil Wendling

Russell Wharton

Jon Wisda

Neal Wylie

Thomas Yoakum

ANNUAL HONORS AND AWARDS BANQUET

Wednesday, May 8, 1996

On Wednesday, May 8, 1996 the GSH will host its Annual Honors and Awards Banquet in the Grand Ballroom of the Lakeside Country Club. Our special guests will be your friends who have 50 or 25 years of membership in the SEG along with this year's GSH Honorary and Life Members. Bring your spouse or guest and enjoy cocktails (cash bar) from 6:30 - 7:15 p.m. in the Pine Lake Room. Then at 7:15 p.m., enjoy an elegant seated dinner and music by Marshall Maxwell. SEG President Dr. Gordon Greve, will give the Presidential Address and assist GSH President, Ms. Cheryl Stevens, in presenting the awards.

The cost for the dinner is \$30.00 per person, with pre-paid reservations necessary to accommodate the guarantee requirements of Lakeside Country Club. Make your check payable to the GSH and forward it by **April 30th** to M. L. Southers, Petroleum Information, 5333 Westheimer Road, Suite 100, Houston, Texas 77056. Please indicate on your check that it is for the Awards Dinner.

Menu

- Roasted Garlic Soup
- House Salad
- Breast of Chicken New Orleans
- Red New Potatoes
- Green Beans Almondine
- Ice Tea
- Breads/Butter
- Apple Cinnamon Cake Ebi

I-10 Katy Fwy.		
	Memorial	
Lakeside Country Club	Briar Forest	Belt
Willcrest	Westheimer	West

ANNUAL HONORS AND AWARDS BANQUET

Wednesday, May 8, 1996

Lakeside Country Club

Name: _____
(as you want it to appear on name tag)

Guest: _____
(as you want it to appear on name tag)

Address: _____

City: _____ State: _____ Zip: _____

Check No.: _____ Amount: _____ No. Of Attendees: _____

GSH Officer Candidates for 1996-97

FOR PRESIDENT-ELECT

BILL GAFFORD



BOB TATHAM



FOR FIRST VICE PRESIDENT

DAVE AGARWAL



JOZICA H. GABITZSCH



FOR SECOND VICE PRESIDENT

SCOTT SECHRIST



LLOYD WEATHERS



FOR SECRETARY

LORINDA DRISKILL



DAN EBROM



FOR TREASURER

JOEL STARR



RICHARD VERM



FOR EDITOR

CLIFF KELLEY



Full biographical summaries will be published and mailed with the Ballot.

SEG Gulf Coast Exploration and Development Technical Meeting

April 10-11, 1996

Exxon Auditorium, 800 Bell • Houston, Texas

The Geophysical Society of Houston is proud to serve as the Host Society for the SEG 12th Annual Gulf Coast Exploration and Development Technical Meeting to be held in Houston April 10-11, 1996.

We extend a sincere invitation to the exploration and production community in the Houston area and to all of our sister societies in the Gulf Coast Region which share in the success of this meeting annually. We ask that you place these dates on your calendar and make plans to attend this year's Gulf Coast Meeting.

Exploration in the Gulf Coast continues to change, hopefully for the best, and so should the SEG Gulf Coast Annual Meeting. Many changes have been made to the meeting this year due to feedback from attendees and fellow Gulf Coast Sections:

- The meeting has been moved from the J.W. Marriott to the Exxon Auditorium downtown
- The date has been changed from April 3-4 to April 10-11
- Lunch will be provided both days for all registrants
- A social function will be held at the Petroleum Club Wednesday evening April 10th
- Exhibits have been excluded this year allowing for all efforts to be concentrated on the technical program
- A printed copy of the proceedings will be provided to each registered attendee
- A concentrated effort has been made to invite key speakers with current topics of interest
- The technical program has been simplified to a single session of back to back speakers

The Exxon Auditorium will comfortably seat in excess of 400 people and it is our goal to fill the auditorium to the capacity. As previously stated, printed copies of the presentations will be made available to each of the pre-registered attendees with mailings to each of the onsite registrants after the meeting. We would encourage you to take this opportunity to pre-register to ensure your reservation and to secure your printed copy of the proceedings at the meeting.

Gulf Coast Meeting contacts:

Don Robinson
General Chairman
713/395-2749

Dan Ebrom
Tech. Program Chairman
713/743-9144

Claire Bresnahan
Arrangements Chairman
713/622-0991

SEG 12th Annual Gulf Coast Technical Meeting April 10-11, 1996 Houston, TX

Name: _____

Title: _____

Company: _____

Address1: _____

Address2: _____

City: _____ State: _____ Zip: _____

Work#: _____ Home#: _____

Pre-registration fee: \$100

Onsite Registration: \$120

Checks should be made payable to the Geophysical Society of Houston (GSH). Mail the completed pre-registration form and check to: SEG Gulf Coast Meeting • c/o Don E. Robinson • 24731 Lakebriar Dr. • Katy, TX 77494

Speakers:

Matthew Simmons,
Simmons & Company
Peter Duncan,
3DX Technology
Brian Anderson,
LCT, Inc.
Philip Schultz,
Advanced Data Solutions
Mike Bahorich,
Amoco Corporation
Richard Lindsay,
Diamond Geophysical
Subhashis Mallick,
Western Geophysical
Chip Story,
Amoco Corporation
David E. Moore,
Chevron Petroleum Tech.

Walt Lynn,
PGS Tensor
Davis Ratcliff,
Diamond Geophysical
Stuart Fagin,
Paradigm Geophysical
Bob Hardage,
Bureau of Economic Geology
Prof. John Anderson,
Rice University
Richard Verm,
Geoph. Development Corp.
Fred Hilterman,
Geoph. Development Corp.
Lloyd Weathers,
Mobil

Topics:

Gulf Coast Economics
3-D Acquisition Case History
Complex Salt Feature
Resolved using Grav., Mag.
& Seismic
Seismic Imaging in Depth
Stratigraphic & Structural
Interpretation with 3-D
Coherency
3D Subsalt AVO
Pre-Stack Waveform Inversion
3D Seismic Redev. of Louisiana's
Tuscaloosa Trend

Field Wide Formation Pressure
Gradient & Fracture Pressure
Characterization
3-D, 4-D and Beyond
Subsalt and Complex Imaging
Solving the Fault Shadow
Problem
Interpretation of Subtle Seismic
Anomalies
Sequence Stratigraphy
AVO/Rock Physics
Why Synthetics Don't Tie in the
Gulf Coast
Reservoir Characterization

Geophysical Society of Houston Environmental Applications Special Interest Group

will host a 2-day forum April 12-13, 1996
(following the SEG Gulf Coast Section meeting)

LOOKING INTO THE EARTH:

Environmental and Other Applications of Non-invasive Geophysics

to avoid risks when you plan to

√ Explore for natural resources √ Characterize the subsurface √ Analyze 'Brownfields'

People who will benefit from this 2-day forum:

- Appraisers and assessors
- Environmentalists
- Environmental managers
- Public health specialists
- Chemical engineers
- Environmental attorneys
- Hydrologists
- Geophysicists and geologists
- Construction and civil engineers
- Environmental biologists
- Internal auditors and investigators
- Principle responsible parties

Talks and Exhibits for Hunting Treasures or Avoiding Risks

Chairperson: Dr. Warren Franz, 499-0937
Location: Texaco EPTD, 3901 Briarpark (@ Westpark near Beltway 8), Conf. Room A
Date and Time: **Friday April 12** from 9 am-4:30 p.m.

The talks and exhibits are an introduction to the best available non-invasive geophysical technology to explore for resources and characterize the near-surface and environmental conditions in and around Harris County. The talks will be followed by a round table discussion.

Field Demonstrations

Chairperson: Mr. Alf Klaveness, 468-5123
Location: Rice University soccer field at entry #12. Visitor parking entry #12 off Rice Ave.
Date and Time: **Saturday April 13** from 9 am-3 p.m.

The field demonstrations will include non-invasive geophysical methods to:

- 1) Characterize the near-surface geology (strata, faults, and migration pathways).
- 2) Explore for buried treasures (old dumping grounds, oil and gas, and other natural resources).
- 3) Avoid hazards in Harris and the adjacent counties (landfills, waste pits, wells, and pipelines).

Local professionals will demonstrate: Electromagnetics/ Conductivity, magnetic interpretation, seismic reflection and refraction methods. Non-invasive methods are used to reduce the time and cost of sampling and drilling.

2-Day Preregistration: \$10 includes refreshments and snack at on site registration, box lunch, and a program booklet. Make check payable to the Geophysical Society of Houston and mail it to: GSH, 7171 Harwin, Suite 314, Houston, Texas 77036-2910. On site registration \$15.

Program coordinator: Dr. Stephanie Hrabar, CPG **phone/fax 683-0638.**
Program arrangements: Dr. Phil Inderwiesen 954-6244.

√ **Explore for mineral resources** √ **Characterize the subsurface** √ **Analyze 'Brownfields'**

Data Processing SIG

Qualitative and quantitative examples of these effects will be shown along with certain implications for data interpretation; for example, why synthetics based on sonics do not correlate to stacked seismic data or why walkaway VSPs do not tie surface seismic data.

Upscaling the Rock Properties of Interbedded Sequences to Seismic Wavelength

Richard O. Lindsay*, Diamond Geoscience Research
Davis W. Ratcliff, Diamond Geophysical Service Corporation

In 1962, George Backus published a paper on averaging the elastic moduli of a thinly layered sequence of rocks. Backus' contribution, beyond recognizing and bringing the problem to the attention of the geoscience community, was in recognizing that velocities don't average. Velocities are not rock properties but measurements made upon rocks. The elastic moduli are rock properties and can be averaged by finding the harmonic mean value over an interval (wavelength). Backus disassembled V_p , V_s and density into incompressibility (K) and rigidity (G) which are averaged via the harmonic mean. The bulk density is averaged via the mean (Figure 1). The new K , G and density log curves are thereby smoothed or upscaled to seismic wavelength by using a moving window. The resulting smooth curves are then reassembled back into V_p , V_s and density. The new curves represent the rock properties as if they were measured at the seismic wavelength (Figure 2). Most synthetics software, obeying the instructions of its creators, block logs into thicker beds that don't, supposedly, alias when resampled. Yet, there are two enormously erroneous and dangerous assumptions being made by blocking. First, the assumption is made that longer, square corner blocks will prevent aliasing. This is untrue. Square corners contain very high frequencies. It's why they appear square. And secondly, the assumption is being made that all geologic beds are blocky. This is untrue. In fact, blocky beds are rare in geology! Most geologic interfaces are gradients. With two failed assumptions (out of two), why do many geoscientists still block logs to make synthetics? From Backus averaged log curves, two way travel times are calculated at each depth sample using V_p and depth leaving a set of curves that can be decimated to a constant two-way travel time increment, Δt . No aliasing occurs and the gradational interfaces are preserved. From these curves, now evenly sampled in time, reflection coefficients are calculated at each interface (Δt increment). A synthetic seismogram is produced that, when filtered, represents the band-limited reflectivity as if the rock properties were measured with a seismic wavelet.

Richard Verm is Manager of Exploration Projects at Geophysical Development Corporation. He has been involved in the development of AVO and VSP technology for the past 10 years. Prior to joining Geophysical Development Corporation, he has worked at the Allied Geophysical Laboratories at the University of Houston and

before that at Geosource. Verm holds a BA degree in mathematics from Rice University and Masters and Ph.D. degrees in geophysics from the University of Houston.

Richard Lindsay is Vice President of Diamond Geoscience Research Corporation. He has been involved in seismic interpretation, rock properties modeling and seismic lithology prediction for the past 14 years and has applied lithology prediction technologies worldwide including three extended assignments in Siberia. Before forming Diamond Research, he led a team of geoscientists and programmers at the Geoscience Research Division of Amoco Production Company's Tulsa Research Center. Richard holds a BGS in geophysics from the University of Kentucky.

Preliminary Announcement

GSH/HGS/SPWLA Joint Meeting on Fractured Reservoir Evaluation

Date: Monday, June 24, 1996
Time: Afternoon/Evening (Specific times to be announced next month)
Place: Petroleum Club, 800 Bell
Cost: Tentatively \$35.00 (includes Catered Lunch, Joint Meeting, and Social Hour)
Organizers: GSH: Phil Inderwiesen, Texaco EPTD (Reservoir Geophysics SIG)
HGS: Charles Sternbach, Shell Western E&P Inc.
SPWLA: Steve Solomon, Conoco

Reservations will begin May 1. Please call Kathy King at tel: 972-4223.

GSH Auxiliary Spring Bus Trip To Grand Casino Coshatta

Date: Wednesday, April 17, 1996
Time: 8:30 a.m. — 7:30 p.m.
Cost: \$10.00 per person (includes lunch)

Seating is limited to 47 persons (members, spouses, and/or friends are welcome). The seats are going fast, so make your plans now to be on the auxiliary bus headed for the Grand Casino Coshatta in Kinder, LA. **Reservation deadline: Wednesday, April 10.** Contact Joyce Gore, chairperson, at 437-7467 or Carol Gafford, GSH Liaison, at 370-3264 for details.

Annual Business Luncheon

Kristy Sechelsky will be our guest speaker at our annual GAH business luncheon on May 7. She will discuss the benefits of aromatherapy. Business reports of the year will be presented and the officers for 1996-97 will be installed.

Technical Breakfast — May

Date: Tuesday, May 7, 1996
Time: 7:30 - 9.00 A.M, Technical Presentation will start at 8.00 A.M. Sharp.
Place: Anadarko Petroleum Corporation, 8th Floor Training Facility
17001 Northchase Drive, Greens Point, next to Wyndham Hotel.
Cost: NO CHARGE (underwritten by Paradigm Geophysical)
Topic: **Solving the Fault Shadow Problem - Case History from Wilcox, South Texas**
Speaker: Stuart Fagin, Paradigm Geophysical
Organizer: Dave Agarwal, Interactive Interpretation & Training

Advance reservations urged — The host company needs an accurate head count. Please call GSH at 917-0218 prior to Friday, **May 3**.

Imaging distortions in the footwall of faults in the Wilcox trend of South Texas are shown to be caused by velocity effects associated with the truncation of overlying high-velocity Queen City Sandstone and low velocity Reklaw shale. The thinning of these units by extension across the fault gives rise to velocity sags and pull-ups which are likely to be interpreted as fault-independent closures. In addition this thinning also gives rise to non-hyperbolic reflections from underlying surface. When stacked these create disrupted reflections which are likely to be interpreted as fault splay closures. The only imaging solution which is free of these artifacts is prestack depth migration. A synthetic example is used to demonstrate fault shadow imaging artifacts, and also their elimination by prestack depth imaging. Identical artifacts are identified on real data from the Wilcox trend where two major faults set up fault shadow problems. Prestack depth imaging is shown to eliminate the problem on the real data as it does on the synthetic.

Dr. Stuart Fagin is the vice president of Technology for Paradigm Geophysical Corporation. In his role, Dr. Fagin facilitates the transfer of model-based depth imaging technology to the petroleum industry through the presentation of workshops, lectures and technical articles. As vice president of technology, he guides the development of new model based depth imaging products and services. Dr. Fagin is the author of the SEG volume, Seismic Modeling of Geologic Structures. Dr. Fagin has 12 years of experience, having worked for Exxon Production Research Company and Exxon Exploration Company. His research at Exxon involved investigation of the seismic definition of geological structures with particular emphasis on seismic modeling. He received his Ph.D in geology from the University of Texas in 1983.

Highlights of the 1996 Offshore Technology Conference

May 6-9, 1996
Houston Astrodome

Impact of 3D Seismic on Reservoir Characterization (May 6: 9:30 - 4:30)

3D seismic data are having a growing impact on reservoir characterization. This session provides an overview the business impact and reviews the technology. Case histories will be shown spanning the globe from the Gulf of Mexico to the North Sea. The afternoon session emphasizes quantifying the business impact of 3D seismic technology and illustrates applications including lithology identification, monitoring reservoir fluids through attribute analysis, time-lapse seismic, and engineering applications.

Optimization of 3D Seismic Surveys (May 7: 9:30 - 12:00)

The focus is on planning, acquiring, processing and interpreting 3D seismic surveys emphasizing cost effectiveness, data processing for data improvement, and integrating seismic data with other data types, e.g. gravity and magnetics.

Integration of Geophysical Measurements for Geological Interpretation (May 7: 2:00 - 4:30)

This session on using data integration to enhance geological interpretation includes combining gravity and satellite data to map tectonic structures, monitoring subsidence in the North Sea with GPS data, reservoir evaluation through integrated borehole information, combining bathymetry, gravity and seismic data to interpret the structure of oceanic crust, refraction data used for basement studies, and a discussion of the industry in Southeast Asia.

Exploring Around Salt (May 8: 9:30 - 12:00)

This session explores geological theories of salt movement and salt distributions both in the Gulf of Mexico and in the Norwegian North Sea, includes papers on a single-well technique for imaging salt bodies and a physical model study used to evaluate 3D seismic imaging through 3D pre-stack depth migration.

Joint SEG and AAPG Technical Luncheon May 6, 1996

Global Basin and Research Network: Eugene Island 330
Roger Anderson of Lamont-Doherty Earth Observatory of Columbia University

Geoscientists Offer an Excellent OTC '96 Program

Harrison T. ("Spud") Brundage

The 1996 Offshore Technology Conference (OTC), to be held again at the Houston Astrodomain, May 6-9, 1996, offers an excellent and varied program, emphasizing global sedimentary basins of interest and value to professional geoscientists. Scheduled Monday, May 6 is an OTC luncheon on the theme of "Global Basins." The 1996 OTC program has, as always, a heavy engineering emphasis. However, this emphasis now has a very definite strong plus side for geoscientists — because engineering, particularly petroleum engineering, is constantly becoming more earth science-oriented — duly integrated with geophysics and geology. With an enthusiastic reception for and attendance and participation in OTC '96, Gulf Coast geoscientists can help preserve this vital international trade conference as a major contributor to the Houston economy.

A Wednesday session deals with the impact of salt on exploration. One such paper, OTC 8014 by G. Jamieson, Geco-Prakla, is titled "Regional Salt Distribution in the Louisiana South Additions Area from 3D Seismic Data." It is preceded by "Single-well Salt Flank Imaging" by Exxon Production Research Co.'s D.S. Cameron and S.T. Chen. The 1995 OTC subsalt Gulf of Mexico session participants who viewed prospects of critical importance to the U.S. economy in general and that of the Gulf Coast area in particular, should remember them well and may anticipate additional robust subsalt OTC presentations this year.

Another recent, significant geoscience-oriented engineering trend prominently displayed at OTC is utilization of three-dimensional seismic data for petroleum reservoir computer modeling and drainage analysis and other applications. This has been carried further to a fourth dimension, namely time-lapse seismology. Repeated identical seismic surveys provide increasingly accurate visualization of petroleum production results, and now guide more precise drilling to tap previously bypassed and/or incompletely drained oil and gas reservoirs. For example, Chevron Petroleum Technology Co. Geophysicist M.J. Mikulich has made striking Society of Petroleum Engineering (SPE) presentations on 3D seismic analyses of Gulf Coast oil fields, including Bay Marchand and Eugene Island 330 offshore Louisiana, as well as some Indonesian oil zones. OTC paper 8256, titled "The Application of 3D Seismic Technology to Reservoir Management: Some Recent Examples" by Mikulich and M.K. MacLeod is scheduled for Monday morning May 6.

Numerous other 3D seismic papers are scheduled in this and other OTC sessions. The May 6 morning OTC session, chaired by Linda Zimmerman, Exxon Production Research Co. and E.O. Nestvold, IBM Corp., is titled "Impact of 3D Seismic on Reservoir Characterization."

The scheduled Keynote Address is by M. Downey, Arco International Oil & Gas Co., titled "Understanding the Value of 3D Seismic." M. Schoenberger, Exxon Production Research Co. will follow with "The Growing Importance of 3D Seismic Technology." This session is to be continued Monday afternoon, chaired by Ed Stoessel, BP Exploration, and Nina Rach, Landmark Graphics Corp. It includes northern European papers from BP Exploration and Shell E&P. Of special interest to Houston-area geoscientists is a scheduled OTC paper 7961 titled "Identification of Lithology in Gulf of Mexico Miocene Rocks" by F. Hiltebrand, Geophysical Development Co.

The 3D seismic papers will continue through Tuesday, with a morning session titled "3D Seismic and Other Exploration-Based Technologies for Geohazards Assessment," chaired by Kerry Campbell, Fugro-McClelland Marine Geosciences Inc. and Martiris F. Smith, BP Exploration. The Keynote Address, by A.W. Hill, BP Exploration Operating Co. Ltd. is titled "The Use of Exploration 3D Data in Geohazard Assessment: Where Does the Future Lie?" The Tuesday afternoon geohazard session chaired by Earl Doyle, Shell Offshore Inc. and Kerry Campbell, follows with six more similar presentations.

A Tuesday afternoon session chaired by Yoram Shoham, Pecten International Co. and Sen Tsuen Chen, Exxon Production Research Co. is titled "Integration of Geophysical Measurements for Geological Interpretation." These OTC papers deal with Geosat and ERS-1 Satellite altimetry, North Sea subsidence, bathymetry — gravity, borehole, and seismic data — and southeast Asian offshore oil and gas fields, among other topics.

A final Thursday morning, May 9 session, chaired by Ron Winston, Harry Winston Inc., and Michael Cruickshank, Marine Minerals Technology Center, is titled "Marine Diamonds: Everybody's Best Friend." Numerous such OTC seabed reconnaissance papers are scheduled. OTC paper 8019, by A. Terhorst, TerraMare Remote-Sensing and M. Williams, Defense Research Agency, is titled "Textural Classification of Side-Scan Sonar Imagery in Context of Marine Diamond Exploration."

Doodlebuggers have much to gain by attending OTC '96!

Member News

Kenneth A Jeffers has accepted a position with Howell Petroleum as Staff Geophysicist in Howell's Gulf Coast exploration group and can be reached at 713-658-4000. Mr. Jeffers was formerly with Anadarko's onshore exploration group.

Hal Adams and **Steve Starr** have formed Adams & Starr, Geophysicists and can be reached at the Westside office at (713) 492-1856 and at the downtown office at (713) 659-2201.

GSH 1996 Spring Technical Workshop

Case Histories of Seismic Attribute Mapping

Date: April 17, 1996
Time: 8:00 am - 4:30 p.m. (on-site registration 7:30-8:00 a.m.)
Place: Marathon Auditorium, 5555 San Felipe
Moderators: Alistair Brown; Bob Hardage; Dave Johnston; Turhan Taner

Seismic Attribute Analysis and Calibration — A Case History from the Gulf of Mexico
(*Gianni Matteucci, Exxon*)

AVO Modeling, Inversion and Prediction Error
(*Jim Simmons, Bureau of Economic Geology, University of Texas at Austin*)

3-D Coherence Cube Processing — Interpretational Calibration of the Coherence Volume with Examples from both Onshore and Offshore 3-D Projects (*Tony Rebec, Coherence Technology Company*)

Reservoir Risk Reduction from Integrated 3-D Analysis (*John Sherwood, Western Atlas E&P Services*)

Seismic Delineation of Thin Sandstone Reservoirs in Shale-Rich Sequences Using Instantaneous Frequency and Reflection Amplitude, Texas Gulf Coast (*Kathleen Horkowitz, Sanchez-O'Brien Oil and Gas*)

Exploration Applications of 3-D AVO — Case Histories from the Deep Water Gulf of Mexico
(*Francis Rollins, Amoco*)

For more information contact Don Herron, BP, GSH Continuing Education Chairman at 560-3778.

GSH 1996 Spring Technical Workshop

Case Histories of Seismic Attribute Mapping

Registration Form

Name: _____

Company: _____

Address: _____

Daytime Phone: _____ Evening: _____

Please provide the following supplementary information:

Discipline (circle one)

geophysics geology
engineering other

Years of experience (circle one)

less than one year
1-5 years
more than 5 years

Primary interest (circle one)

exploration exploitation
environmental other

Please send this completed form with a check or money order for \$30 (GSH Members, unemployed and students - include proof of full-time enrollment), or \$50 (non-members*) to: Geophysical Society of Houston, 7171 Harwin, Suite 314, Houston, TX 77036. On-site registration will begin at 7:30 a.m. Cost for on-site registration will be \$40 and \$60, respectively. Pre-registrations must be received by **April 10, 1996**.

*non-members may join the GSH by sending their \$20 membership dues with the \$30 workshop fee. Membership applications are available from the GSH office or call Steve Starr at 498-7008. Membership dues will cover the remainder of this year and the full 1996-1997 year.

ANNUAL MEETING



**RAIN
or
SHINE**

and **Bar-B-Que**

5:00 p.m. to 8:00 p.m. on Thursday, May 16, 1996
at the Knights of Columbus Hall, 607 East Whitney

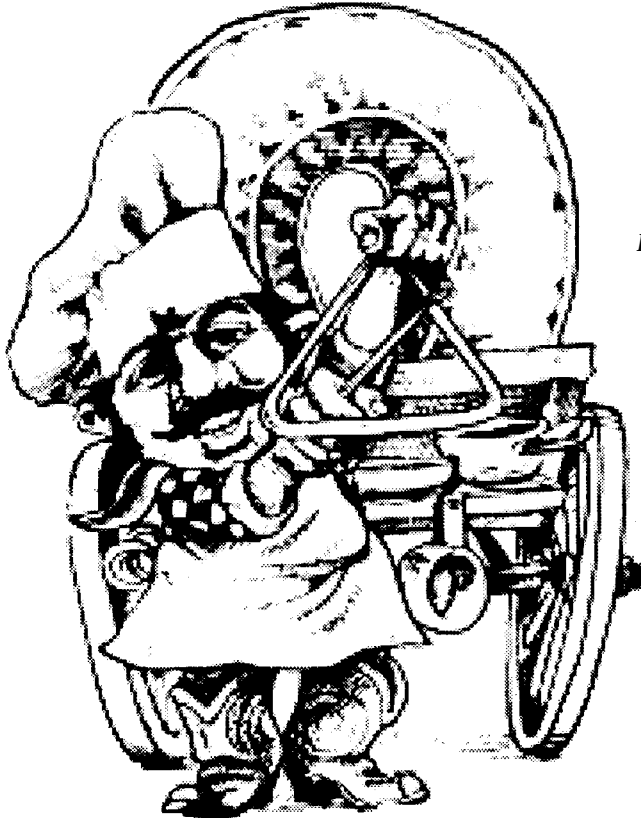
**Come Enjoy A Great Evening
Welcome The New GSH Officers**

Tickets:

Only \$12.00 Each
If Purchased By May 14, 1996
\$17.00 Each At The Door

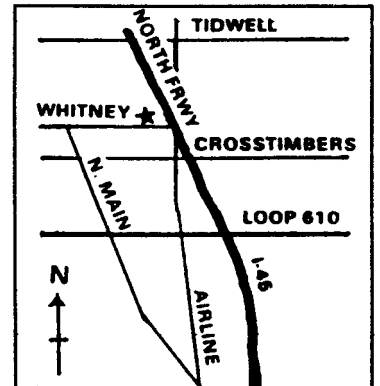
Note:

We Have To Guarantee The Number
Of Dinners, So You Must Prepay To
Be Guaranteed Your Meal.



WE WILL BE SERVING

- ☞ Bar-B-Que Brisket
- ☞ Sausage
- ☞ Chicken
- ☞ Beans
- ☞ Cole Slaw
- ☞ Bread
- ☞ Pickles
- ☞ Onions
- ☞ Draft Beer
- ☞ Wine
- ☞ Soft Drinks
- ☞ Iced Tea



Annual Meeting and Bar-B-Que

Thursday, May 16, 1996 Knights of Columbus Hall

Name: _____ Phone: _____

Name: _____ Phone: _____

Number Tickets Desired: _____ X \$12.00 Each = \$ _____

Enclose Check Payable To: Geophysical Society of Houston

And Mail To: Jim Moulden, c/o Legacy Data
16810 Barker Springs Road, Suite 204
Houston, TX 77084
713-398-0118

Tickets Will Be Held At The Door. If Your Company Is Purchasing A Block Of Tickets - Please Indicate Names On The Form To Eliminate Any Confusion At The Door.

Ticket Orders Must Be Received By May 14, 1996 to Obtain \$12.00 Price.

Geoscience Technology Training Center (GTTC)

Spring 1996 Course Schedule

For additional details and information on registration, course fees, directions etc, please call (713) 443-5600 or fax (713) 443-5633.

April 1996

Workstation Based Geographic Information Systems II. (GIS II.)

April 8 through May 13, Monday evenings, 6-10 pm
Winship Building - Room 261 - College Code 2C012

Workstation Interpretation - Landmark's Seisworks

April 9-11, 8 am - 5 pm
Winship Building - Room 261 - College Code 2E051

An Introduction to UNIX-Based Systems Administration

April 10 through May 5, Wednesday evenings, 7-10 pm
Winship Building - Room 261 - College Code 2D012

Introduction to Geophysical Data Processing

April 22-23, 8 am - 5 pm
Winship Building - Room 261 - College Code 2A031

Geophysical Data Processing using GeoCentre's SeisUP

April 24-26, 8 am - 5 pm
Winship Building - Room 261 - College Code 2A021

Geographic Information Systems - Environmental (PC based)

April 30 through May 16, Tuesday and Thursday evenings, 6-10 pm
Community Education Building - Room 201 - College Code 2C021

May 1996

Workstation Interpretation - GeoQuest Systems

May 4 through May 18, Saturdays, 8 am - 5 pm
Winship Building - Room 261 - College Code 2E031

seg adv.

Houston Meetings

April 8

HGS Dinner Meeting

The Race is On

Matthew R. Simmons

Post Oak Doubletree, 2001 Post Oak Blvd.

Social Period 5:30 pm; Dinner and Meeting 6:30 pm

Reservations by noon Friday April 5

April 9

GSH Technical Breakfast

Integrating Multiple Seismic Surveys to Interactively Interpret a Salt Dome Flank

H. Roice Nelson, Jr.

University Club, 5051 Westheimer

7:30 am

Reservations by Thursday April 4

April 12-13

GSH Environmental Applications Special Meeting

Environmental and Other Applications of Non-invasive Geophysics

Pre-registration recommended - contact GSH office

April 15

GSH Technical Luncheon

Applied Seismic Inversion for Estimating Earth Models in Depth

Dr. Ozdogan Yilmaz

HESS, 3121 Buffalo Speedway

Social 11:30 am, Luncheon 12:00 noon

Reservations by noon Friday April 12

April 15

HGS International Explorationists Dinner Meeting

A Perspective on the Arabian Peninsula

Jere B. Jay

Post Oak Doubletree, 2001 Post Oak Blvd.

Social Period 5:30 pm; Dinner and Meeting 6:30 pm

Reservations by noon Friday April 12

April 17

GSH 1996 Spring Technical Workshop

Case Histories of Seismic Attribute Mapping

Marathon Auditorium, 5555 San Felipe

8:00 am - 4:30 pm

Pre-registrations must be received by April 10

April 17

GSH Data Processing SIG

Velocities from Seismic Versus Well Information

Richard Verm; Richard Lindsey

Texaco Bellaire Auditorium, 4800 Fournace

Social Period 4:30 pm; Presentations 5:00 pm

April 18

GSH Reservoir Geophysics SIG

Multidisciplinary Reservoir Study

Mike Curtis; Adrian Hassall

Texaco EPTD, 3901 Briarpark

5:00 pm

Reservations by Tuesday, April 16

April 18

SIPES Luncheon

Petroleum Club, 11:30 am

April 22

HGS North American Explorationists Dinner Meeting

3-D Seismic Redevelopment of Louisiana's Tuscaloosa Trend-A Port Hudson Field Case History

Chip Story

HESS, 3121 Buffalo Speedway

Social Period 5:30 pm; Dinner and Meeting 6:30 pm

Reservations by noon Wednesday April 24

April 24

HGS Emerging Technologies Luncheon Meeting

Seven Poster Sessions on Various New Technologies

Houston Club, 811 Rusk

Social Period 11:30 am; Lunch and Meeting 12:00 noon

Reservations by noon Monday April 22

April 25

HGS Short Course

Salt/Sediment Systems in the Gulf of Mexico

Exxon Auditorium

May 7

GSH Technical Breakfast

Solving the Fault Shadow Problem

Stuart Fagin

Anadarko Petroleum, 17001 Northchase Dr.

7:30 am

Reservations by Friday May 3

Events

April 8

GSH Golf Tournament and Dinner

April 10-11

1996 SEG Gulf Coast Technical Meeting

April 17

GSH Auxiliary - Grand Casino Coshatta

April 19

HGS Tennis Tournament

April 27

HGS Dinosaur Track Field Trip

May 6-9

Offshore Technology Conference (OTC)

May 8

GSH Annual Honors and Awards Banquet

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
	1	2	3	4	5	6
7	8 HGS DINNER GSH GOLF TOURNAMENT 8:00 A.M. KINGWOOD COUNTRY CLUB	9 GSH TECH BREAKFAST 7:30 A.M. UNIV. CLUB	10	11 SEG GULF COAST MEETING EXXON	12 ENVIRONMENTAL & NON-INVASIVE GEOPHYSICS FORUM	13
14	15 HGS INT'L DINNER GSH TECHNICAL LUNCH 11:30 A.M. HESS	16	17 GSH SPRING TECH WORKSHOP DATA PROCESSING SIG 4:30 P.M. TEXACO BELLAIRE	18 SIPES LUNCH RESERVOIR GEOPHYSICS SIG 5:00 P.M. TEXACO EPTD	19	20
21	22	23	24 HGS LUNCH	25	26	27
28	29	30	Submittals and suggestions should be sent to the GSH Editor at 7171 Harwin, Suite 314, Houston, TX 77036-2190, or call Pam Moore, Editor, at 773-2627 , or Fax to 773-9620. Deadline for submission is the 1st of the month preceding publication: e.g., May 1 for the June issue. Digital or electronic submittals required. (e-mail: nwh@neosoft.com).		April 1996	

GEOPHYSICAL SOCIETY OF HOUSTON

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(713) 785-6403



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