Geophysical Society of Houston

VOL. 33, NO. 4 NEWSLETTER DECEMBER 1998

I N S I D E

GSH Meetings

SEG 1999 Spring Distinguished Lecture 1

Technical Breakfast 1

SEG Distinguished Instructor Short Course 4-5

Reservoir Geophysics Seminar Information 6

Data Processing SIG 9

Articles and Comments

Notice to all GSH Members 6

Technical Article 7

GSH Photo Pages 8

Book Review 10

Social Events

Upcoming Events 10

Sporting Clays 12

December 10th at the Marriott Westside

SEG Distinguished Instructor Short Course

Course Presenter: Phil Schultz

"The Seismic Velocity Model as an Interpretation Asset"

SEE PAGE 4

There will be no Technical Lunch in December

SEG 1999 Spring Distinguished Lecture

Dr. David H. Johnston

4D Seismic: Can a Difference Make a Difference?

4D seismic reservoir monitoring (time-lapse seismic) has the potential to significantly increase recovery in existing and new fields. Changes in fluid saturation, pressure, and temperature that occur during production induce changes in the reservoir's density and compressibility that may be detected by differencing repeated seismic data. As a result, seismic data can be used to help monitor and predict the inter-well position and movement of reservoir fluids, locating bypassed oil, avoiding premature breakthrough, optimizing infill well locations, and evaluating EOR pilots prior to full field implementation.

However, most published seismic reservoir monitoring examples have been demonstration projects and the impact of the technology on reservoir profitability has not been well established. The cost of reservoir monitoring must be recovered through increased production rate, added reserves, and/or reduced operating costs. Locating fluid saturation fronts allows optimization of the recovery process. Better placement of infill and development wells, elimination of dry holes, balancing injection and production rates, and more accurate workovers can decrease costs and increase recovery. Although studies suggest that the potential economic impact is great, the acceptance of 4D

SEG 1999 continued on page 3

The GSH Technical Breakfast Committee is proud to announce the December Westside Breakfast meeting will feature Mr. John Pritchett of Amoco Production. John will present "Subsalt Exploration; Leveraging solutions to create value worldwide". There is no charge to attend this GSH Technical Breakfast. Texaco is generously hosting this meeting with a complimentary Continental Breakfast at:

Texaco's Research facility at 3901Briarpark
on Tuesday, December 15,1998 from 7:00am until 8:45am.
Early reservations are advised, deadline
noon Monday, 14 December 1998.

Reservation options are as follows: GSH and HGS members may use the automated reservation system, register online at the GSH or HGS websites, or anyone interested may call the GSH Business office at 713-785-6403.

If you have a suggestion for a great paper that can be presented this spring, please contact the GSH Technical Breakfast Committee Chairman Scott Sechrist at Panaco, Inc.; 713-970-3189; mailto: scottse@Panaco.com; or at acoustic@neosoft.com.

GEOPHYSICAL SOCIETY OF HOUSTON

Joan Henshaw, Office Manager • 7457 Harwin Drive, Suite 301 • Houston, Texas 77036 • Office Hours 8 a.m. - 5 p.m.
Phone: (713) 785-6403 • Fax: (713) 785-0553 • Event Reservations Number: (713) 917-0218
email: reservations@hougeo.org • website - http://www.seg.org/sections/gsh/gshhome.html

GSH Board of Directors = GSH Executive Committee + SEG Section Representatives

		PHONE	FAX	
PRESIDENT	Bob Tatham*	954-6027	954-6113	tatharh@texaco.com
Corp. Relations	Wulf Massell	713/650-3820	713/659-3735	wulf@epicgeo.com
Historian	Art Ross	423-5476	423-5202	Art.H.Ross@exxon.sprint.com
Honors & Awards	Wulf Massell	713/650-3820	713/659-3735	wulf@epicgeo.com
Museum	Tom Fulton	464-1300	464-1615	
Nominating	Bill Gafford	281/366-7873	281/366-7569	wtgafford@amoco.com
PRES.-ELECT	Pat Starich*	281/423-7234	281/423-7399	pjstarich@exxon.sprint.com
Academic Liaison	Hua-Wei Zhou	713/743-3424		
Advisory	Lee Lawyer	531-5347	531-5347	ujhr40a@prodigy.com
Employment Ref.	Sam LeRoy	556-9766	556-9778	earthview@aol.com
Finance	Joel Starr	781-4000	781-7858	joel@hstn.tensor.pgs.com
Office	David Forel	713/953-6810		david.forel@pgs.com
Volunteers	Open			
FIRST VP	Dan Ebrom	713/954-6252	713/954-6911	ebromda@texaco.com
Continuing Ed	H. Roice Nelson	713/974-6907	713-974-1496	roice@continuum-corp.com
Speakers	Dan Ebrom	713/954-6252	713-954-6911	ebromda@texaco.com
Tech Breakfasts	Scott Sechrist	281/856-8029	281-856-7445	acoustic@neosoft.com
Tech Luncheons	Shane Coperude	713/981-8181		shane@fairind.com
Tech Committee	Dave Agarwal	713/650-0325	713/650-3822	Dave0836@aol.com
Tech Transfer	David Forel	713/953-6810		david.forel@pgs.com
SIGS				
Data Processing	Karl Schleicher	713/782-1234		karl@geodev.com
Near Surf Geophysics	Tom Dobecki	281/679-5558		tdobecki@fugro.com
Interpretation	Randy Hoover	713/682-1039		
Potential Fields	Mike Kowalski	713/432-6828		kowalma@texaco.com
Res. Geophysics	Quincy Chen	713/689-5778	713-689-5757	Quincy.chen@waii.com
SEC. VP	Jock Drummond	281/873-3901	281/874-3470	jock_drummond@anadarko.com
Annual Meeting	Jim Moulden	281/293-5711		james.k.moulden@usa.conoco.com
Awards Banquet	Carmen Comis	713/393-4833	876-1359	ccomis@ParadigmGeo.com
Golf Tournament	George Lauhoff	713/981-8181	713/963-2030	
Bass Tounament	Greg Doll	713/658-8096	713/951-0343	gqdoll@msn.com
Shrimp Peel	Tim Hartnett	713/961-8346	713/960-8400	Hartnett.Tim.T.@bhp.com.au
Sporting Clays	Chris Tutt	713/689-2648	713/963-1928	chris.tutt@waii.com
Christmas Party	Lorinda Driskill	281/560-1104	281/560-1169	ldriskill@lgc.com
Tennis Tounament	Joe Jones	281/438-5626	281/682-6928	
SECRETARY	Ingrid Swendig	713/689-7865	713/689-7890	ingrid.swendig@westgeo.com
Directory	David Forel	713/953-6810		david.forel@pgs.com
GSH Membership	Steve Starr	498-7008	498-0913	sstarr9711@aol.com
Ladies Auxiliary	Roshan Agarwal	281/890-4024	713/650-3822	Dave0836@aol.com
OTC Rep	Alf Klaveness	713/468-5123	713/468-0900	
SEG Membership	Steve Starr	498-7008	498-0913	sstarr9711@aol.com
TREASURER	Stephen Johnson	281/366-3647	281/366-5856	sjohnson@amoco.com
Student Loans	Don Ashabranner	669-372	669-3725	deashab@ppco.com
EDITOR	Jess Kozman	713/623-2481	713/621-9432	jkozman@seismicexchange.com
Newsletter Staff	Elizabeth Fisher	281/597-1777	281/597-5377	eafisher@jasongeo.com
Company Contacts	Scott Sechrist	281/856-8029	281-856-7445	acoustic@neosoft.com
Electronic Pub.	Richard Verm	782-1234	782-1829	richard@goedev.com
Photography	John Freeland	281/423-7223	281/423-7801	
Publicity	Scott Sechrist	281/856-8029	281-856-7445	acoustic@neosoft.com
Company Store	Ingrid Swendig	713/689-7865	713/689-7890	ingrid.swendig@waii.com
Training Notices	Lloyd Weathers	775-2453	775-4123	Lloyd_r._weathers@ccmepus.mobil.com
PAST PRES.	Bill Gafford*	281/366-7873	fax 281/366-7569	wtgafford@amoco.com
PRIOR PAST PRES.	Wulf Massell*	713/650-3820	713/659-3735	wulf@epicgeo.com
SEG SECTION REPS*	Mike Schoenberger	713/966-6114		mike.schoenberger@exxon.sprint.com
	Art Ross	281/423-5476		art.h.ross@exxon.sprint.com
	Dave Agarwal	713/650-0325		
	Jim DiSiena	281/287-5757		disiena@swbell.net
	Joe Starr	281/443-8150		
	Claire Bresnahan	713/880-5910		
	John Sumner	713/431-6096		john.r.sumner@exxon.sprint.com
Alternate SEG Sec. Reps.	Hugh Hardy	713/729-9208 (home)		mghwh@aol.com
	Lee Lawyer	281/531-5347 (home)		ujhr40a@prodigy.com
	Phil Inderwiesen	713/954-6244		inderpl@texaco.com
	Jock Drummond	281/873-3901		jock_drummond@anadarko.com
	Alf Klaveness	713/468-5123		

The Geophysical Society of Houston Newsletter (ISSN 1082-0817) is published monthly except July and August by the Geophysical Society of Houston, 7457 Harwin, Suite 301, Houston, Texas 77036. Subscription to the Geophysical Society of Houston Newsletter is included in the membership dues ($20.00 annually). Periodicals Postage Paid in Houston, Texas.
POSTMASTER: Send address changes to Geophysical Society of Houston Newsletter, 7457 Harwin, Suite 301, Houston, TX 77036.

GSH Newsletter Due Dates

Issue ..... February 1999
Deadline ..... Dec. 17, 1998

Issue ..... March 1999
Deadline .... January 21, 1999

Issue ..... April 1999
Deadine .... February 18, 1999

Issue ..... May 1999
Deadline ..... March 18, 1999

Issue ..... June 1999
Deadline ..... April 15, 1999

SEG 1999 continued from page 1

seismic data in our industry remains limited — similar to the situation with 3D seismic data 10 to 15 years ago.

Indeed, there are many issues associated with the application of time-lapse seismic data. Two of the most significant technical issues are the repeatability of the seismic data in the non-reservoir portion of the data volume and the robustness and credibility of the seismic difference within the reservoir. In principle, estimates of dynamic reservoir properties, obtained over the entire field area from 4D seismic data, can be used to optimize reservoir management. However, because of non-uniqueness, the process of inferring dynamic reservoir properties from seismic data is hardly trivial. What then, is the likelihood that action will be taken based on seismic monitoring data that will result in an increase in the economic value of a field?

These issues are examined using several case studies. Seismic monitoring has become an integral part of the enhanced oil recovery technology at Imperial Oil's Cyclic Steam Stimulation Cold Lake Field in Canada. Seismic monitoring surveys provide definitive images of the fluid saturation fronts in the reservoir, where about 50% of the oil has been bypassed. These images were used to drill 46 deviated steam injection wells, three horizontal wells (which serve as injectors and producers), as well as to model and monitor new pilot processes. Early oil production data from the infill pilots indicate a significant improvement in oil rate. New reservoir technologies are being developed to attempt to capture the bypassed oil as identified by the seismic data.

An example from the Gulf of Mexico Lena Field looks at the application of 4D seismic data in a mature setting. The legacy seismic data over the field were not acquired or originally processed to maximize repeatability. Sequentially increasing the level of sophistication in the seismic re-processing effort, quantifying and reporting the results at each step establishes the costs and benefits in achieving a robust seismic difference. However, the acquisition of the repeat survey was not necessarily timed to optimally map reservoir changes or impact development decisions. While the interpretation of the seismic difference has yielded infill drilling opportunities, rig availability and other operations constraints may limit action.

New field developments allow planning of time-lapse acquisition to have the greatest impact on field economics. In one such example, seismic modeling based on reservoir flow simulation illustrates that significant seismic differences associated with fluid saturation changes should be observed even within a few years after first oil. An engineering study of the impact of early field-wide production data afforded by 4D seismic shows the potential to improve reservoir description by identification of by-passed oil volumes. This can result in improved reservoir simulation models and performance prediction, reduced probability of dry holes, and reduced operating cost through more efficient injection/production strategies.

Seismic monitoring is a maturing technology and its impact on reservoir management is far from proven. As with the development of 3D seismic technology, industry experience through case studies will establish the costs and benefits of 4D seismic technology.

SEG 1999 Spring Distinguished Lecturer

David H. Johnston

David H. Johnston is a Senior Research Specialist for the Exxon Production Research Company (EPR) in Houston, Texas. He received a BS degree in Earth Sciences from the Massachusetts Institute of Technology in 1973 and a Ph.D. in Geophysics in 1978, also from MIT. He joined EPR in 1979 and has held assignments in rock physics research and seismic reservoir characterization. He is currently group leader for time-lapse seismic research and is responsible for the development and worldwide application of the technology.

Dr. Johnston is active within the Society of Exploration Geophysicists (SEG) and the Society of Petroleum Engineers (SPE). He was Secretary/ Treasurer of the SEG in 1990, Chairman of the Development and Production Geophysics Committee from 1987 to 1988, and Chairman of the Interpretation Committee from 1991 to 1992. He has served on SEG, SPE, and OTC technical program committees.

In addition to a number of published papers in Geophysics and other technical journals, Dr. Johnston was co-editor of the book Reservoir Geophysics, published by the SEG in 1992 and co-editor of the SEG Reprint Series volume on Seismic Wave Attenuation published in 1981. He has presented numerous papers on rock physics and reservoir geophysics including keynote addresses at several conferences. Dr. Johnston was awarded the Best Presentation by the SEG in 1993 and was an SPE Distinguished Lecturer from 1992 to 1993.

SEG Distinguished Instructor Short Course

December 10, 1998 • Houston Marriott Westside

"The Seismic Velocity Model as an Interpretation Asset"

Presented by the
Society of Exploration Geophysicists Continuing Education Committee
and the Society of Exploration Geophysicists Foundation

Sponsored by the Geophysical Society of Houston

Course Description

A velocity model can have enduring and growing interpretive value, beyond its initial creation to optimize the seismic image. The 3D velocity model is often built carefully with a combination of geophysical and geological input, because of the accuracy demands placed on it by the requirements of depth imaging. As such, this model becomes an increasingly effective interpretive tool. This course addresses the ways in which the interpreter should participate in the development of the velocity model, and underscores its interpretive value with numerous case study examples.

After a brief introduction and preview of the day, the course begins with a comprehensive case study example. In this example, interpretive input was key to development of all phases of the refined velocity model for depth imaging and depth conversion, and the interpretation itself was refined in conjunction with the development of the velocity model. Following this showcase study, and to complete the morning session, the course embarks on a concise overview of the general model building methodology. The course will review the types of geological settings requiring varied approaches to velocity model building, and will highlight those model building aspects where interpretive input is normally essential.

In the afternoon, the course focuses on over a dozen case studies, supplied by major, independent, and national oil companies, where some interpretation or exploration problem was solved by attention to the velocity model. The studies follow the thought processes of the interpreter in his or her approach to the problem. The case studies run from the simple to the complex, cover soft rock and hard rock environments, and touch on imaging, depth conversion, fault location, well placement, lithology, anisotropy, and other velocity-related issues. All studies carry the common theme that the velocity model was a key element in the development of the geological interpretation. Moreover, the interpreter participated actively in the development of all the velocity models.

Who Should Attend?

- The interpreter excited by the prospect of participating actively in the velocity model building process.
- The interpreter who wishes to pursue aggressively the additional advantages offered by using the velocity model in interpretation.
- The manager and supervisor seeking familiarity with velocity-related tools for developing a geological model.

Course Presenter

Philip S. Schultz is a senior consulting geophysicist with Spirit Energy, a division of Unocal. He was most recently Vice President for Development at Advanced Data Solutions in Houston. He spent eleven years with Schlumberger, nine of which were overseas engineering management assignments in Tokyo, London, and finally Paris, where he headed the development of their Reservoir Modeling Workstation. Prior to Schlumberger, he was a research geophysicist with Digicon in Houston, where he was involved in the early development of depth migration technology, and was the project manager for the extension of the Disco processing system to 3D.

An early member of the Stanford Exploration Project (SEP), directed by Jon Claerbout, Dr. Schultz's thesis on the subject of "slant stacks" has the distinction of having the last single-digit SEP volume number. He is a recipient of the "Outstanding Presentation" award of the SEG, and has served as Associate Editor, Data Processing, for GEOPHYSICS.

He resides in Houston with his wife Sandy and their three children, and he enjoys a good game of tennis.

Registration form for Distinguished Instructor Short Course:

December 10, 1998
Houston Marriott Westside
NW Corner of Katy Freeway IH-10 and Eldridge Parkway
13210 Katy Freeway Houston, TX 77079 USA
Hotel Phone: 281-558-8338 Fax: 281-558-4028
Hotel Info. http://www.fairfieldinn.com/marriott/HOUWS/
Registration is limited to 200

Name: _____

Company Name: _____

Street Address: _____

City: _____ State: _____ Zip: _____

Phone: _____ Fax: _____

Email: _____

Membership ID's: SEG: (from membership card) _____

GSH: (from newsletter mailing label) _____

Cost: (Check ONE)

___ I am both an SEG and GSH member - Lunch cost only: $25.00

___ I am not a member of SEG, I am a member of GSH - $70.00 will apply toward Associate Membership in the SEG and an application will be sent for Active Membership:..... $95.00

___ I am not a member of GSH, I am a member of SEG - $20.00 will be applied toward GSH membership, effective when your application is approved by the GSH Board: $45.00

___ I am not a member of either the SEG or GSH - cost will apply toward both memberships: $115.00

TOTAL ENCLOSED: $_____

Make check payable to Geophysical Society of Houston
Send to: GSH, 7457 Harwin Drive, Suite 301, Houston, TX, 77036-2160

Payment by credit card:

CARD: _____ Mastercard _____ Visa _____ American Express

PRINTED NAME AS IT APPEARS ON CARD: _____

ACCOUNT NUMBER: _____

EXPIRATION DATE: _____ Signature: _____ DATE: _____

BILLING ADDRESS: _____

If paying by credit card, you may fax to: 713-785-0553

Notice to Members:

The Houston Geological Society has given its approval to provide an option on the HGS web page to allow people to look for other society members.

The HGS database will be available on the Internet and allow people to use a search engine to locate members. For each member identified, the following information will be displayed: Name, Company Name, Title, Company Phone and email address.

No other information (including address) will be available on the Internet, and searches will be limited to display of this information. No batch downloading will be available to avoid use as a bulk contact list. Since this member database includes both HGS and GSH, and there are already links in place between the HGS and GSH websites, members of the GSH can easily be included in this search option. The GSH Board would like to approve allowing this option for the GSH membership.

Since some people may not want even the information listed above available on the Internet, the HGS plans to put a notice in their Bulletin giving members an option to have their membership information flagged as not available from the Internet. The GSH members are being given the same option.

The process to remove a member's info is to write or email:
Bill Osten
P.O. Box 1967
Houston, Tx 77251-1967
email : lwosten@ppco.com
mailto:lwosten@ppco.com
(HGS Computer Applications Committee, HGS Web Manager)

This option will not affect the maintenance of the database for Society Business or inclusion in the published directory.

GSH Reservoir Geophysics Seminar Information

We don't plan any seminar for the month of December since most of us will be busy wrapping up projects and relaxing at Christmas parties. However, in the first half of next year, we will have one seminar for each month, and here are the seminar topics:

Jan. 1999: Seismic pore pressure prediction

Feb. 1999: NMR logging for fluid imaging

Mar. 1999: Seismic detection of anisotropy and fractures

Apr. 1999: Thin-layer reservoir detection and characterization

May 1999: Seismic physical modeling

Jun. 1999: Poststack dim-spot and AVO dim-spot reservoir detection

We are in the process of inviting speakers for these seminars. Please help me to make these seminars more attractive and useful by recommending speaker candidates (including yourself) to:

Dr. Quincy Chen, GSH Reservoir Geophysics SIG Chairman
Western Geophysical • 10001 Richmond Avenue
(713)689-5778 • quincy.chen@waii.com

Official Portrait of the 1998-99 GSH Executive Board:

Back Row: L to R:
Dan Ebrom, (Texaco), First VP; Jock Drummond, (Anadarko), Second VP; Bob Tatham, (Texaco), President; Pat Starich, (Exxon), President-Elect;

Front Row: L to R:
Stephen Johnson, (Amoco), Treasurer; Ingrid Swendig, (Western), Secretary; Jess Kozman, (SEI), Editor

Technical Article:

An Environment to Develop Concurrent Seismic Software

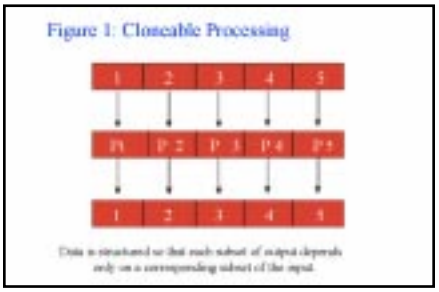
Faten Afifi - PGS Tensor

The rapid shift toward parallel and distributed computer systems has increased the demand for reliable, portable and efficient concurrent software in the seismic industry. The development of portable concurrent geophysical software requires parallel programming expertise and the knowledge of the underlying hardware architecture. These requirements can often not be met by scientists and industrial programmers with limited programming skills. To solve this problem, PGS and others have developed environments in which seismic programmers can develop highly reliable concurrent seismic modules in a simple and natural fashion. This environment hides most of the complexity of developing parallel software by providing libraries, utilities and tools for parallelizing geophysical code.

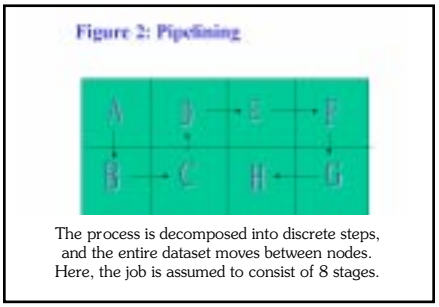
PGS's Seismic Environment (SE) is designed to use a typical hardware architecture that consists of a set of interconnected nodes. PGS has successfully run the seismic applications generated using this environment on different hardware architectures, including intelI860, Paragon, Sp2 and SGI.

The parallel techniques provided within SE are based on space sharing, pipelining and data decomposition. To demonstrate the parallel techniques that have been used, we will assume a conventional seismic processing job consisting of three operations: 1) reading the data from a secondary storage device, 2) processing the data and, 3) writing the processed data back to storage.

Using the new environment we can parallelize this job in different ways, depending on the relationship between input and output domains. As an example, if the output and input domains can be partitioned into disjoint subsets such that each subset of the output domain depends only on a corresponding subset of the input, the job can be cloned by the tool. In the cloning method the tool will create n clones and map the clones into the n nodes such that each clone will process a subset of the data. This mode improves the job performance linearly (figure 1).

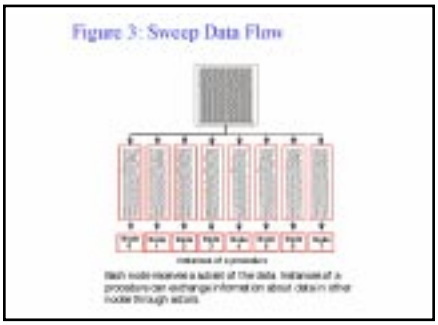


In the pipelining method, the job is split into different stages. Each stage is run in a separate node and the data flows between the nodes. This method is also called a functional decomposition, with different functions in different nodes (figure 2).



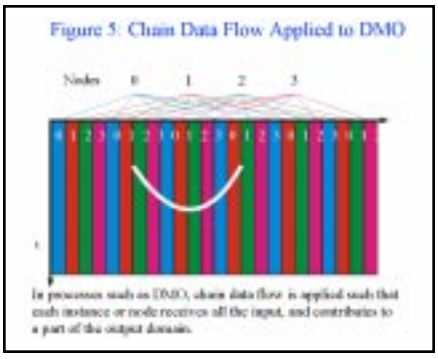
Pipelining can be very inefficient unless special care is taken to balance the load between the nodes. Since data must pass through every stage of the pipeline, any node which has an excessive amount of computation to do will become a bottleneck. Thus attention must be paid to the performance of individual procedures so that the slowest procedures are installed in their own nodes while the fastest procedures are grouped together, if possible in a single node. There is also the possibility of sporadic imbalance. This occurs when a procedure which is otherwise quite fast must do an occasional extra task which temporarily slows it down, for example disk paging

In cases that involve large data structures, the data can be decomposed across the nodes. Each node receives a subset of the data and all the procedure instances are synchronized to output the data simultaneously when the process completes. F-K domain migration is an example of an algorithm that can use this sweep data flow parallelization method (figure 3).



Another method that is available is to pass all the data to all the module instances. Each module instance will use all the data to compute a subset of the output traces (figure 4).

DMO, MZO and Kirchoff migration are modules that use this chain parallel or load balancing method (figure 5).



Knowledge of these methods and the use of the SE environment allow seismic programmers to better utilize parallel architectures to improve data flow.

Faten Afifi is system development and support supervisor in the Technology Department at PGS Tensor.

1998 GSH/HGS Shrimp Peel

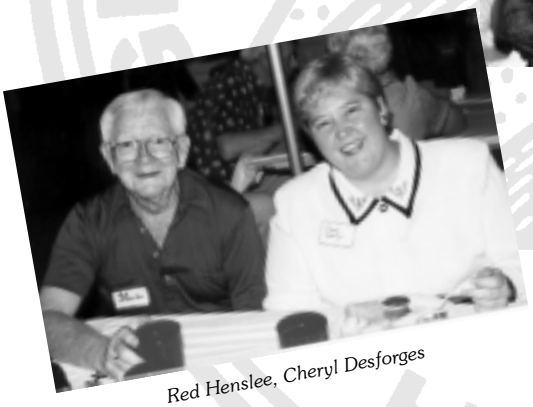
photos by John Freeland

The following GSH and HGS members and guests were captured enjoying the festivities at the Annual Shrimp Peel at the St. Arnold's Brewery in October:

Eduardo Gutarra, Wulf Massell, Adrianna Valez, Cheryl Stevens

Larry Walter, Susan Walter, Bill Gafford, Georgeann Massell

Eduardo Gutarra, Wulf Massell, Adrianna Valez



Red Henslee, Cheryl Desforges

Patrick Starich, Marie Starich

Deborah Barrett, Dave Barrett, Rosa Roncartz

Susan and Larry Walter

Data Processing SIG:

DECEMBER MEETING

Topics:	C-waves, Technical and Business Challenges
Speakers:	Xianhui Zhu (PGS) Jack Caldwell (Geco-Prakla)
Organizers:	Chengbin Peng (Shell) Ilkka Noponen (PGS)
Date:	Monday, December 7, 1998 We have moved this DP SIG from the traditional, third Wednesday slot to fit one of the speaker's schedules. I hope this does not disturb anyone.
Time:	4:30pm - 6:30pm
Location:	BTC Lecture Hall Shell E&P Technology Company 3737 Bellaire Blvd
Directions:	3747 Bellaire Blvd, between Buffalo Speedway and Weslyan/Stella Link. Parking is available along buildings(from street address 3737 to 3747). Additional parking is also available in the church across the street. Enter the building through Gate-2.
Cost:	NO COST
Speaker I:	Xianhuai Zhu, PGS Recent Advances in Converted-Wave Imaging

ABSTRACT

The activity of converted-wave seismic data acquisition and processing has been increased recently in North Sea and the Gulf of Mexico, using ocean-bottom cables. We believe that the converted-wave (C-wave) can be used to improve the structural imaging in areas with gas chimney and salt dome, and reservoir imaging for sand/shale identification, DHI and fracture detection.

Several important issues will be addressed for the 2D/3D C-waves in the marine environment:

1) Orientation and rotation of the geophones at the ocean bottom;
2) Vp/Vs ratio analysis;
3) Non-hyperbolic NMO/DMO;
4) Shear-wave statics; and
5) Prestack time/depth migration.

We will demonstrate the C-wave imaging capability with field data examples from North Sea and the Gulf of Mexico.

BIOGRAPHY

Xianhuai Zhu received a doctorate (1990) in geosciences from the University of Texas at Dallas. He worked for the Research Institute of Geophysical Prospecting for Petroleum in China from 1977 to 1985 and Union Pacific Resources (UPR) in Fort Worth, Texas from 1991 to 1997. He was a visiting scientist with the COCORP project at Cornell University in 1985-86. He is currently the Reservoir Imaging Manager for PGS in Houston, conducting the applied research on reservoir processing and monitoring using multi-component seismic data, 3D AVO and time-lapse 3D.

Speaker II:	Jack Caldwell, Geco-Prakla Current Status of Marine 4-Component Seismic Technology

ABSTRACT

Marine multicomponent seismology has seized the geophysical industry's fancy since it made its semi-commercial emergence in the North Sea in the autumn of 1996. This technology involves the recording of S-waves, in addition to the conventional P-waves, by deploying on the seafloor sensor packages containing hydrophone plus 3-component geophones. New processing algorithms have had to be developed to properly process these data. The major use of this type of data have been (1) to image beneath gas clouds and chimneys, (2) to better infer lithologic and pore fluid information some distance away from wells, and (3) to image beneath high velocity bodies such as salt and basalt masses. The future looks bright for this technology, for reservoir characterization, for seismic time lapse monitoring (4D), for reservoir management, and perhaps even for exploration.

On the order of 100 4-component marine surveys have been acquired since September 1996, the vast majority of them being 2D. However, the first handful of 3D 4C surveys have just had the processing phase completed, and the information content of these data sets has been very high and very useful. These surveys have been conducted in the North Sea, the Far East, offshore West Africa, and in the Gulf of Mexico. The overall experience is that the data quality in all locations is relatively high, the systems couple reasonably well to the seafloor, and the bulk of the mode converted S-wave energy derives from P-wave mode converting to S-wave at depth, not at the seafloor.

Four fundamentally different acquisition systems are used in the industry today to acquire the P- and S-wave data: three different cable-based systems, as well as one node-type system. There are at least three different modes of deployment of the cable systems: dragging the cable into place, draping it under tension, and draping it not under tension. The node-type system is emplaced by a remotely operated vehicle (ROV). While data quality certainly is not uniform across the industry at the present time, it is not clear yet how system construction and deployment directly affect the data quality. More analysis and research is needed in this area, and is forthcoming no doubt.

The cost to acquire 3D marine multicomponent data is 3-6 times more expensive than conventional towed streamer 3D, but that is expected at this stage of the development of the technology. The cost will decrease fairly dramatically in the future as capacity and production rates increase.

Data Processing continued on page 11

Data Processing continued from page 10

BIOGRAPHY

Jack Caldwell has a B.A. in math from Davidson College, Ph.D. in geology/geophysics from Cornell University. He has worked in geophysical research for Texaco and Marathon, in exploration, technical service, and senior staff positions for Marathon, and has been chief geophysicist for the Canada Division and for the Marine Department within Geco-Prakla. In a variety of positions within Schlumberger, he has served as a manager in borehole seismics, technical marketing for various seismic technologies, and in the introduction of seismic time-lapse monitoring (4D) and marine 4-component.

One common thread that ties most of his career's work together is that of trying to extract lithologic information from surface seismic data. That propelled him into research in full waveform sonic logging, VSP, rock properties, and seismic stratigraphy. Jack has played a key role in the introduction of marine 4C technology into the industry over the past two years. For the last 12 years one of his primary missions has been to demonstrate how seismic techniques can contribute to improved reservoir management, and seismic time-lapse monitoring (4D) has been one of the linchpins of this endeavor.

December 4
Victor Mocanu,
University of Bucharest

Seismic Tomorgraphy of the Carpathian Arc
Geosciences Seminar Series

The Department of Geosciences at the University of Houston offers its seminars at 3PM on most Friday afternoons during the fall and spring semesters. Unless otherwise noted, all seminars are held in room 634 in the Science and Research (I) building on the campus.

http://www.uh.edu/academics/nsm/geosc/seminarlist.html

Upcoming Events:

PETRO-TECH STUDY GROUP
JANUARY MEETING
Tuesday, January 12, 1999
COMMUNICATION STYLES: UNDERSTANDING SELF & OTHERS
by Susanne Devich,
Management Consultant
J. W. Marriott
5150 Westheimer
(corner of Sage & Westheimer - West of 610 - outer loop)
11:30 a.m. - 1:00 p.m.
Speaker and Luncheon
www.spegcs.org or
713-779-9595

January 14-15, 1999
Basin Research Institute - LSU
Oil & Gas Technology Conference
New Orleans
http://www.bri.lsu.edu/brinotices.htm

Book Review:

By Ernest E. Cook

ADVENTURES IN THE OIL PATCH, by Richard Bateman

Not since Michael Cheney's "Big Oil Man From Arabia" was published forty years ago has there been such a hilarious collection of anecdotes from the international oil scene as Richard Bateman's tales of oilfield adventure. Those of us who have spent part of our careers working in out-of-the-way places will probably have encountered a few situations and a character such as he describes. However, who among us has taken the trouble over a thirty-five year career to record these encounters?

Bateman began his career in Colombia as a Schlumberger trainee. He has also worked for Amoco, Halliburton, and several other companies. He is currently with CGC in Buenos Aires. Most of his career has involved extensive travel, which has included some of the more remote spots in the world of oil.

One of his shorter tales describes the wife of an oil finder staying in a hotel in Jakarta while house hunting. After taking a massage in the Health Club she confided to a friend that they had worked on parts of her body that her husband didn't even know existed.

He also tells of the King of Tonga who was invited to inspect the first seismic boat to dock at the island. However, he proved to be too large to go through the doorways on the boat and so was unable to view the technical equipment.

This is a delightful book and I thoroughly recommend it to old exploration hands and novices alike.

Ernest E. Cook - October 8, 1998

(Adventures in the Oilpatch is available from the author at Parana - 4 Piso - 1018 Buenos Aires, Argentina, for US$19.95 plus postage and handling of $7.05)

GEOPHYSICAL SOCIETY OF HOUSTON

13 th ANNUAL SPORTING CLAYS TOURNAMENT

RESCHEDULED Saturday December 5, 1998

Just when you thought it was safe, the GSH Sporting Clays Tournament has AGAIN been rescheduled due to weather and flooding, pretty much guaranteeing the arrival of a major storm system on the new date:

December 5th!

Again, previous registrations will be honored -

For more information, contact:

Chris.Tutt@waii.com

GEOPHYSICAL SOCIETY OF HOUSTON
13th ANNUAL SPORTING CLAYS TOURNAMENT
DECEMBER 5, 1998

NAME: _____ TEL: (RES) _____ (WRK) _____

ADDRESS: _____ COMPANY: _____

PREFERRED SHOOTING TIME: (circle one) 8:00 9:45 11:30 1:15

— Please arrive 30 minutes before shooting time —

SHOOTING GROUP (including self)

1. Mr. Ms._____ 12/20
2. Mr. Ms._____ 12/20
3. Mr. Ms._____ 12/20
4. Mr. Ms._____ 12/20
5. Mr. Ms._____ 12/20

(CIRCLE GUN TYPE)

GSH/HGS Members or Guest $55.00

DISCLAIMER:

I acknowledge that neither the Geophysical Society of Houston nor the American Shooting Centers will be held responsible for injury or accidents during this event. ***PRACTICE SAFETY!!***

NAME: _____ GUEST: _____

DECEMBER 1998

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
		1	2	3	4 UH Geosciences Seminar	5 Sporting Clays Tournament
6	7 HGS NA Expl Dinner Data Processing SIG	8	9 HGS Env/Eng Dinner Meeting	10 DISC	11	12
13	14 HGS Dinner	15 GSH Technical Breakfast	16	17 NEWSLETTER DEADLINE	18 HGS Christmas Party	19
20	21	22	23	24	25	26
27	28	29	30	31		

GEOPHYSICAL SOCIETY OF HOUSTON

7457 HARWIN DRIVE, SUITE 301
HOUSTON, TEXAS 77036
(713) 785-6403

ADDRESS SERVICE REQUESTED

DATED MATERIAL:
PLEASE DELIVER BY DECEMBER 1

Periodicals
U.S. Postage
PAID
Houston, Texas