



Geophysical Society of Houston

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NEWSLETTER

FEBRUARY 1998

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Technical Luncheon

Chair - Phil Hosemann,
713-655-9838, 713-655-7301

Date: Tuesday February 17, 1998
Time: Register and cash bar, 11:30 AM ; Luncheon and Talk 12:00 Noon
Location: NEW Hess Building, 5430 Westheimer Formerly the Carlyle Restaurant located on the north side of Westheimer between Chimney Rock and Yorktown.
Cost: \$20 for pre-registered members; \$25 for walk-ins and guests
Reservations: Call (713)-917-0218 and use the reservation code 6-0-1. Or email reservations@hgs.org No later than 11am, Monday, January 19, 1998
Speaker: Geoffrey Dorn, Director in Exploration Research at ARCO
Topic: Modern 3-D Geophysical Interpretation

Abstract:
 Modern seismology is becoming increasingly dependent on detailed interpretation of large 3-D volumes of data. A typical volume consists of five to six billion data points arranged in a regular Cartesian grid. With both the size and number of volumes increasing rapidly, 3-D visualization is an essential tool for efficient and effective interpretation of these volumes in both exploration and development.

Both 3-D surface and volume visualization techniques have

application in this interpretation. Elements of human perception of three-dimensional information provide a basis to understand the application of computer visualization to this problem. Trade-offs between various rendering algorithms guide the choice of applications used to accomplish the interpretation task.

Volume rendering of seismic data allows a rapid preview of the data prior to interpretation. Interactive control of transparency of the seismic data allows events to be viewed in three dimensions. Interpreted surfaces can be viewed in the three-dimensional data volume to understand relationships to the rest of the data.

Surface visualization is key to detailed reservoir interpretation in the data. An almost unlimited number of attributes of the data can be created and subsequently interpreted for indications of the structure, lithology and fluid content of the reservoir. Relationships that are difficult to detect on map displays become strikingly apparent when the data are viewed in three dimensions.

Lighting and motion convey more information to the interpreter. Interactive control of the position of the light source and the observer's viewpoint are essential. These techniques can highlight subtle faulting and texture changes on interpreted surfaces which may be related to lateral variations in geologic surfaces. They may also highlight temporal relationships between structural elements, and are useful in interpreting areas of poor data or pick quality.

Biography

Geoffrey Dorn received his B.S. in Astrophysics (1973) and his M.S. in

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email: reservations@hgs.org • website - http://www.seg.org/sections/gsh/gshhome.html

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Editor's Notes

To insure your information reaches all GSH society members in a timely fashion it must appear in the appropriate newsletter issue. Please check our deadlines and plan your function's publicity strategy accordingly. The newsletter editor must receive materials on or before the corresponding content deadline date.

Remaining 1998 GSH Newsletter Deadlines

Issue April, 1998
Deadline February 19, 1998

Issue May, 1998
Deadline March 19, 1998

Issue June, 1998
Deadline April 16, 1998

Content deadlines occur approximately six weeks prior to publication, usually on the third Thursday of the month.

Technical Luncheon continued from page 1

Geophysics (1978) from the University of New Mexico, and Ph.D. in Exploration Geophysics (1980) from the University of California, Berkeley. He has held positions in acquisition and interpretation research in ARCO Oil and Gas Co. since 1980, including four years as director of interactive interpretation techniques research, and four years as an Exploration Research Advisor. He is currently a Director in Exploration Research at ARCO. His interests include 3-D seismic interpretation, interactive interpretation techniques and system design, 3-D visualization techniques, and reservoir geophysics. Geoff is a member of the SEG, AAPG and EAGE. He was general chairman of the 1993 SEG Research Workshop on 3-D Seismology and has co-chaired workshops on Scientific Visualization, Emerging Workstation Technology, and Seismic Stratigraphy.

Technical Breakfast

Chair - Scott Sechrist, 713-961-1804, fax 713-961-9773, email: acoustic@neosoft.com

Technical Breakfasts are scheduled monthly, on the Wednesday of the second full week of each month: Dec. 10; Jan. 14; Feb. 11; Mar. 11; Apr. 15; May 13; June 10 (possible).

Please contact Scott for further breakfast information or to suggest potential topics and speakers.

Breakfast Date: Wednesday, February 11, 1998
Location: West Houston area at Amoco's 501 WestLake Park location along the inbound service road of I-10 West, one mile east of Hwy 6.
Time: Breakfast from 7:00 - 7:45 a.m.; Speaker from 7:45 to 8:15 a.m.; Meeting ends by 8:30 a.m.

Cost: Free
Host Company: GSH members wish to express their appreciation to Amoco management for once again graciously providing both the location and a continental breakfast to all attending at no charge.

Reservations: Reservations should be made with the GSH office by 4 pm on Monday, February 9th

Subject: "The Size and Shape of the Chicxulub Impact Basin: Evidence from Recent Seismic Experiments"

Speaker: Dr. Buck Sharpton of NASA's Lunar and Planetary Institute

Abstract: Scientists have long sought the cause(s) of the Cretaceous-Tertiary (K-T) boundary. Popularly known as the point in time associated with the end of

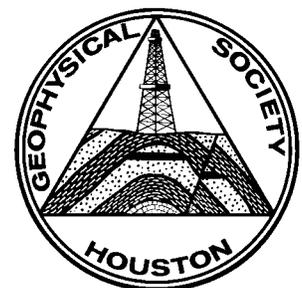
the Dinosaurs, many other species and ecological niches were ended or fundamentally changed. Current understanding of the most likely cause of such a highly destructive event is the impact of a meteorite with an approximate diameter of five to ten kilometers. Humanity has been fortunate to have never experienced catastrophic events of a similarly massive scale.

The Chicxulub Impact Basin is the focus of study for the possible cause of the Cretaceous-Tertiary (K-T) boundary. Located just offshore of the Yucatan Peninsula of Mexico, this apparent meteorite impact location has been studied during the Autumn of 1996 by a Multi-National Research Consortium. A grid of 600 line km. of wide angle 2D reflection and refraction seismic data were collected, including multi-component P and S wave OBC sensors.

Dr. Sharpton will share images of drill core data and the reflection seismic profiles across the area during his GSH Technical Breakfast presentation. He will discuss the current status of the understanding of the timing and nature of the Chicxulub Impact event, and its implication for further research and observations.

BIOGRAPHY:

Dr. Buck Sharpton has been a Staff Scientist with NASA's Lunar and Planetary Institute at the Johnson Space Center for the past ten years. He received his Ph.D. in Geophysics from Brown University in 1984, and did post-doctoral research with the Geological Survey of Canada, studying impact craters and related phenomena. Dr. Sharpton was one of the Co-Investigators of the Multi-National Research Consortium which collected the Chicxulub Impact Basin data, and is currently involved in the analysis and integration of this data at LPI.



SIG Announcements

Interpretation SIG

SIG Chair - Larry Godfrey, 281-499-6068, email lgodfrey@intertex.net

The Interpretation SIG will announce four meetings throughout the coming year on topics concerning Technology for Interpretation. Larry is actively seeking volunteers to serve on the Interpretation Committee. These volunteers could help to organize meetings, contact and schedule potential speakers, arrange venues, etc. If you are interested in helping out, please contact the SIG Chairman, Larry Godfrey.

February Meeting

Date: Tuesday, Feb 10, 1998
Time: 4:30 PM
Place: Texaco Bellaire, 4800 Fournace St, Room E725
Cost: No Charge
Speaker: Burnet Oliveros
Topic: Understanding, Using, and Interpreting Seismic Attributes

Abstract:

Hidden within seismic data lies a wealth of information valuable to interpretation which can be extracted, displayed, and exploited in a variety of ways. The speaker will explore the meaning and behavior of basic attributes derived directly from seismic traces including instantaneous amplitude, phase, frequency, dip, discontinuity, and bandwidth, plus response attributes. Examples of how these insights can be used to more intelligently accomplish tasks such as auto-tracking, resampling, and dip-filtering. Tuning effects on attributes will also be examined.

The profusion of seismic attributes which have been defined in the past decade challenges the intrepid interpreter with many logistical problems inherent in working with multiple displays of the same data volume. Pseudo color techniques used in satellite image processing can be applied to seismic attributes to create combination displays which are both more informative and more concise

than the more traditional display methods. This presentation will show several combination displays of 3-D volumes.

Speaker Biography:

Burnet Oliveros has been a Texaco geophysicist for almost 30 years. She is currently with Texaco Exploration in Bellaire, applying attribute technology to seismic surveys from around the globe. This technology grew out of a research project which she engaged in during 1991-1993 while at Texaco E & P Technology Department in Houston. Prior to her seismic attribute research, she published work on resolving 2-D misties.

After receiving a BA in Mathematics from the University of South Florida, she began her career with Texaco in 1968 in Bellaire developing seismic processing software. She has extensive experience in seismic software development, processing, acquisition, and interpretation. In addition to being located in Houston, she has worked in London from 1990-1991 and in Copenhagen, where she served as Chief Development Geophysicist while seconded to Maersk Oil from 1983-1985.

Data Processing SIG

SIG Chair - Young Kim,
713-966-6156, 713-966-6333,
young.c.kim@exxon.sprint.com

The Data Processing SIG has scheduled nine monthly meetings for the coming year with themes for each of the meetings as listed below. The meetings are scheduled from September 1997 through May 1998, with two speakers at each meeting. The selected dates and topics are:

2/18/98
Time lapse (4-D) seismic
Jozica Gabizsch*, Chengbin Peng

3/18/98
Anisotropy
Chengbin Peng*, Richard Verm

4/15/98
Multiple attenuation
Jerry Kapoor*, Richard Verm

5/20/98
Traveltime calculation
for depth migration
Ilkka Noponen*, Karl Schleicher,
Jerry Kapoor

* denotes the primary organizer

February Meeting

Date: Wednesday,
February 18, 1998
Time: Social 4:30 p.m.;
presentations 5:00 to
7:00 p.m.
Location: Shell Auditorium,
Bellaire Technology
Center, 3737 Bellaire
Blvd., Houston, Texas
77025
Directions: Shell Bellaire Lab is
located at 3737
Bellaire Blvd., between
Stella Link and Buffalo
Speedway. Parking is
available outside the
facility.
Cost: NO COST
Topic: 4D Seismic
Organizers: Jozica Gabizsch*,
Chengbin Peng
Speaker 1: Keith Hirshe - Western
Geophysical
Title: Seismic Monitoring of
Gas Floods in
Carbonate Reservoirs;
from Rock Physics to
Field Testing

Abstract:

From 1987 to 1990 the Alberta Research Council and Western Atlas conducted a major research program to assess the feasibility of monitoring hydrocarbon miscible floods in carbonate reservoirs with time-lapse seismic techniques. The results of this study, based on ultrasonic velocity measurements, indicated that saturation-induced velocity contrasts are significantly larger than Gassmann predictions in the majority of carbonate reservoir types. Seismic modelling, based on these results, suggested that injected gas should be seismically detectable in many carbonate reservoirs.

While these results are encouraging there are major uncertainties in relating the velocity changes observed at the high frequency laboratory scale to the low frequency seismic scale. We have recently conducted several theoretical and experimental investigations to relate the velocity changes at core scale to the seismic scale. These newer findings tend to suggest that it should be possible to track the movement of injected gas in many carbonate fields using time-lapse seismic methods. This conclusion was indirectly supported by a detailed modelling study and a 2D test line acquired over a solvent injection well during 1987. Continued injection during the past 10 years has increased the thickness of the gas bank from 10 m. to 30 m. This test line has been recently recorded again, in March 1997, to test these concepts.

Authors:

Keith Hirsche* (Western Geophysical); Mike Batzle (Colorado School of Mines); Rosemary Knight (University of British Columbia); Zhijing Wang (Chevron); Larry Mewhort and Rick Davis (HUSKY) and George Sedgwick (Alberta Research Council)

Author Biographies:

Keith Hirsche is Senior Geoscientist working in Western Geophysical's R&D group in Calgary. Mike Batzle is Associate Resident Professor at the Colorado School of Mines.

Rosemary Knight is Associate Professor at the University of British Columbia in Vancouver.

Zhijing Wong is Senior Research Scientist with Chevron Petroleum Tech. in La Habra

Larry Mewhort is Senior Staff Geophysicist and Rick Davis is Senior Staff Geologist with Husky Oil in Calgary

George Sedgwick is Senior Research Scientist with the Alberta Research Council in Edmonton.

Speaker 2: Jack Caldwell - Geco-Prakla, Houston
Title: Seismic Time-Lapse Monitoring ("4D Seismic"): Where is the Industry Today?

Abstract:

The basic concept of seismic time-lapse monitoring (STLM) is that the seismic data have a "visible" reaction to the fluids occupying the pore spaces in reservoir rocks. As a reservoir is produced and fluid saturations and fluid types in the pore spaces change, then some attribute(s) of the seismic data will also change. Hence, by doing repeat seismic surveys, the potential is that the changes seen in one or more seismic attributes will allow us to infer the movement of fluids in the reservoir. The risk in this is that there might be other factors causing changes in the seismic response, such as weather, placement and positioning of sources and receivers, etc. These factors are lumped under the issue of "repeatability", which is the single biggest concern of industry.

STLM has acquired the name "4D", which, strictly speaking, is not totally correct since the technique can use 2D surface seismic data, VSP data (whether 2D or 3D), crosswell seismic data, and single well seismic imaging data. It must also be kept in mind that STLM is not done in a vacuum, but in conjunction with all other data available, hopefully including well log, core, outcrop, production, engineering, and other geophysical data.

Right now, the industry is wrestling with the idea of whether STLM will be able to indicate quantitative changes, or only qualitative ones. There is no doubt that both types are being tried, and the issue of repeatability between seismic surveys done with some calendar time separation between them will have a larger effect on quantitative approaches than on qualitative approaches, in general. Improvements in data processing, and perhaps new strategies in data processing/data analysis are needed to eventually be effective in the derivation of quantitative answers. Advances in data analysis and our understanding of the underlying rock physics are needed, and then those advances need to be cycled back into new processing approaches.

There are different acquisition strategies being explored today, as the technical feasibility of STLM is being evaluated. The pros and cons of permanent emplacement of the seismic sensors for repeat surveys versus the conventional way of acquiring data are

being studied. Virtually untouched at this point is the question of cost-effectiveness of STLM, but within the next year or two there will be data sets that begin to address this issue as well. Totally new data types, such as marine shear wave data, are being assessed, at least partially with an eye toward reservoir monitoring. Several case histories in the public domain (about a dozen in number) begin to illustrate the power of STLM, and it does appear to hold great promise.

Speaker Bio

Jack received a bachelor's degree in mathematics from Davidson College (1971), and a Ph.D. in geophysics (earthquake seismology and tectonophysics) from Cornell University (1978). He immediately entered the oil industry as a Research Geophysicist at Texaco's research lab in Houston where he worked on the overall problem of extracting lithologic information from seismic data. From 1980 until 1987, Jack held various positions in Marathon Oil Company. He joined Schlumberger Wireline in 1987, and moved over to sister company Geco-Prakla in 1992, and currently is Manager, Reservoir Characterization & Monitoring, North and South America, a position he has held since January, 1997. The common thread which runs through most of his assignments is that he has been involved in developing, introducing, or marketing technologies oriented toward extracting lithologic information from seismic data.

Potential Fields SIG

SIG Chair - Chuck Campbell of Accel Services (713-993-0671 or email at campbell@neosoft.com)

The Potential Fields SIG plans to have 1997-98 meetings every other month, from September to May (September, November, a holiday party in December, January, March, and May). Meetings typically consist of a social hour, dinner, and technical presentation. Anyone interested is invited to attend. For information about

meeting times, locations and speakers, please contact the SIG chairman, Chuck Campbell.

No February meeting is scheduled for the Potential Fields SIG.

Near Surface Geophysics SIG

SIG Chair - Tom Dobecki, with Fugro-McClelland (713/778-5505)

No February Meeting is scheduled for the Near Surface SIG.

March Meeting

Date: Wednesday,
March 18, 1998
Time: Social 5:30 pm;
Presentations 6:30-
7:30 pm
Location: Fugro Building, 6100
Hillcroft (corner
Hillcroft and Gulfton),
Room 160
Cost: NO CHARGE
Topic: Archaeological
Applications of Near
Surface Geophysics
Speaker 1: Joe Austin, Earth
Measurement
Corporation
"Geophysical Search
for the Lost Water Well
at the Alamo, San
Antonio"
Speaker 2: Tom Dobecki, Fugro-
McClelland
(Southwest), Inc.
"Geophysical Surveys
of the Great Sphinx
and Pyramids of
Egypt"

Contact Tom Dobecki for additional meeting information.

Reservoir Geophysics SIG

SIG Chair - John Eastwood - Exxon Production & Research Co., P.O. Box 2189, 713/966-3196, 713/965-7309(fax), john.eastwood@exxon.sprint.com.

Contact John Eastwood for meeting information.

Notices

Immediate Opening for Geophysical Technical Advisor in Tulsa, Oklahoma

SEG is seeking to fill the full-time position of Technical Advisor. His/her principal responsibility is to provide technical direction and advice to the SEG Business Office in Tulsa. Though the Advisor will offer expertise in a variety of technical areas to the SEG staff, particular focus will be placed on geoscience education.

The Advisor must successfully encourage SEG members to volunteer their time to actively participate in developing and implementing programs that advance the geophysical sciences; and initiate activities that communicate the importance of the role of geoscience education to society at all levels. The Advisor will report directly to the SEG Executive Director and will work with the membership individually and through committees and with the staff to initiate, develop, and implement these and other programs.

Qualifications include a B.S. or M.S. in geophysics or a related scientific area, proven ability to stimulate and persuade others to achieve desired results, excellent oral and written skills, and the ability to communicate at all levels. Some experience in geoscience education is desired. This position is located at SEG Headquarters in Tulsa, Oklahoma.

Interested candidates should send a letter telling why you are interested in the job, a resume and salary history to:

Society of Exploration Geophysicists
Attn: Human Resources
8801 South Yale Ave. Suite 500
Tulsa, Oklahoma 74137
Fax: 918 497-5560
E-mail:jpauill@seg.org

Additional information is also available on the SEG website at:

<http://seg.org/job-list/Seg.html>

1998 Worldwide Technology Forum

Landmark Graphics Corporation announces its 1998 Worldwide Technology Forum. This year's conference "Vision in Action" will focus on global business issues facing the petroleum industry, and is scheduled for February 23-25, 1998 at the Adam's Mark Hotel in Houston.

In addition to technical papers and case studies related to exploration and production, this year's program will include keynote addresses, executive sessions, an in-depth track on data management, advanced training mini-sessions, and more than 40 exhibits. The conference has been designed to facilitate the exchange of ideas and to accelerate the transfer and application of information technology to meeting the specific business needs of Landmark's industry customers.

Keynote speakers include Bob Peebler, Landmark President and CEO, and John Gibson, Landmark Executive VP, Integrated Products Group. A special keynote speaker will be Dr. Gary Hamel, well-known author of the widely-read book, "Competing For the Future." He will address breakthrough strategies for oil and gas companies as they compete for the markets of the future.

To receive more information or to register on line go to Landmark's Worldwide Technical Forum webpage at <http://www.lgc.com/wwtf>, or call 1-800-823-1542 (in the U.S.) (847) 384-7730 (outside the U.S.).

Dobrin Memorial Lecture

This year's Dobrin Memorial Lecture will be held at the Hilton Hotel on the campus of the University of Houston at 5:30 pm on Wednesday, February 11, 1998. The speaker will be Dr. Thomas L. Davis, Professor at Colorado School of Mines. His subject will be Multicomponent time-lapse seismology; a tutorial on determining dynamic reservoir characterization.

Dr. Davis holds a BE degree from the University of Saskatchewan, M.Sc. from the University of Calgary, and a Ph.D. from Colorado School of Mines. He was the SEG Distinguished Lecturer in 1995 and Technical Program Chairman for the Denver SEG Annual Meeting in 1996.

Abstract:

Multicomponent Time-Lapse Seismology and Dynamic Reservoir Characterization

Multicomponent (3-C) time-lapse (4-D) seismology enables more accurate determination of rock/fluid property characteristics, their geometry, and changes over time. Time-lapse surveying compares one survey with a repeat survey taken in the same geographic locations at a later time. A higher degree of resolution can be obtained by differencing measurements (where one measurement is subtracted from the other). Multicomponent seismic imaging records one vertical and two horizontal components (3-C).

Seismic anisotropy can give us information on porosity, permeability, fluids, and flow pathways. Seismic anisotropy, for instance, attenuation of split shear waves, gives us a potential measure of permeability anisotropy within a reservoir. Reservoir production will be enhanced if we can see if reserves are bypassed by channeling around lower permeability parts of the reservoir. Injection patterns can then be changed to sweep the reservoir more efficiently.

In 1995 a 4-D, 3-C seismic survey was undertaken in the Central Vacuum Unit, Lea County, New Mexico over a CO₂ huff-n-puff operation to determine if fluid viscosity/saturation changes and frontal movements of a CO₂ bank in the San Andreas carbonate reservoir at a depth of 4300 feet could be monitored. Two surveys were acquired

with three source components recorded by three component receivers approximately 8 weeks apart during which 50MMSCF of CO₂ was injected into a well and allowed to soak.

Shear-wave data showed an anisotropy anomaly associated with high CO₂ concentrations. The anisotropy anomaly is interpreted to be caused by a zone of higher permeability that responded to changes associated with elevated reservoir pressure, and viscosity/saturation changes. The CO₂ injection involved a fluid pressure increase of 500 to 800 psi that opened microfractures or changed the pore aspect ratio of elongate or crack-like pores. The effect increased attenuation and decreased velocity of the S₂ shear wave polarized orthogonal to the dominant fracture set or pore structure orientation. Under the pressure and temperature conditions, injected CO₂ becomes miscible with the oil during a soak period and the viscosity drops by a factor of 10 to 1 as the oil swells, causing a fluid volume change of 10-20%. This swelling and viscosity change affects the stiffness or compliance of the pore/fracture system.

At Vacuum Field the northern half of the reservoir in the survey area is more compliant to shear wave propagation than the southern half. The north side has a higher and more continuous permeability than the southern part. The 4-D, 3-C seismic survey at Vacuum Field has helped determine the better areas for CO₂ flood development.

Geophysical Society of Tulsa - ANNUAL PICNIC

The Geophysical Society of Tulsa will host its annual Picnic on May 2, 1998 from 11:00 am to 5:00 pm at Wolaroc Park (located on Highway 123, 12 miles southwest of Bartlesville, OK). The day will include food, games, and other festivities providing fun for the entire family. The price is : \$13/person age 12 and older, \$7/person age 6-11, and age 5 and under are free. For more information or to register contact Rob Jefferson, Phillips

Petroleum Company, 590 Plaza Office Building, Bartlesville, OK 74003; email rjeffer@tycho.pcco.com; phone 918-661-1266; and fax 918-661-5250. Please register in advance so we will have an accurate count for plenty of food and drink for everyone. We hope to see you there!

A Little Help from Her Friends

Shortly before Christmas, Joan Henshaw, the GSH Office Manager, lost all her belongings in an apartment fire. The GSH and it's membership has always been known for their unflinching generosity, especially when it comes to assisting "one of their own". Along these lines, a fund is being administered by the HGS for Joan.

Anyone wishing to contribute to the fund can write a check to the "HGS Joan Henshaw Fund." The check should be sent to:

HGS/GSH
7457 Harwin Dr., Suite 301
Houston, TX 77036
Thanks for your help.

GSH Ladies Auxiliary Calendar of Events

March....., 1998

"The view from within"

Tour+Lunch; Inside access to downtown Houston.

April 19, 1998

Museum of health evening with the director, includes Dinner, Video, and Guided Tour.

ALL SEG MEMBERS, SPOUSES AND GUESTS are invited at an auxiliary price to attend any function - contact Donna Parrish at 281-785-7115

Annual Auxiliary Membership Dues \$10

FEBRUARY 1998

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
1	2	3	4	5	6	7
8	9	10 Interpretation SIG	11 GSH Technical Breakfast Dobrin Lecture U of H	12	13	14
15	16	17 GSH Technical Luncheon	18 Data Processing SIG	19	20	21
22	23 Worldwide Technology Forum	24 Worldwide Technology Forum	25 Worldwide Technology Forum	26	27	28
29	30					

GEOPHYSICAL SOCIETY OF HOUSTON

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



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