

## EAGE 2000 special

## First Break annual review of companies serving the geoscience industry

We feature some of the main companies active in the geoscience area of the E&P industry including exhibitors at the 62nd EAGE Conference and Technical Exhibition being held in Glasgow, Scotland. This annual reference guide is based on information supplied by the companies listed.

### ABEM Instrument

ABEM Instrument started its activities in 1923 and was one of the very first geophysical contractors in Europe. Since 1994 ABEM has been part of the DYN0 group of companies.

Today ABEM manufactures fieldworthy, portable electronic instruments for shallow applications under difficult environmental conditions. The company covers all aspects of instrument development, production, servicing, customer training and marketing from Stockholm, Sweden, and has distributors in more than 60 countries around the world.

ABEM produces instruments that cover a wide range of needs: Terraloc Mark 6 A high resolution seismograph, mainly used for ground engineering surveys and for weathered layer studies; Terrameter SAS 300C resistivity system, used for depth sounding and profile measurements; Terrameter SAS 1000 single channel resistivity and IP system, used for more efficient surveying for environment and engineering; Terrameter SAS 4000 resistivity and IP system with four channels, used for more efficient surveying for environment and engineering; LUND imaging system Terrameter accessory for continuous resistivity and IP profiling; WADI VLF instrument, used for groundwater prospecting; UVS 1500, UVS 1608, and UVS remote vibration monitoring instruments, for the record-

ing of blasting and construction activities; and Vibraloc 3-1.

ABEM manufactures instruments in the near surface geophysical field as well as vibration monitors. The company concentrates on applications for groundwater prospecting, environmental geophysics, mineral prospecting and construction and development.

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### Advanced Geosciences

Advanced Geosciences (AGI), headquartered in Austin, Texas, manufactures fine resistivity and IP imaging equipment. AGI's product line includes: the Sting R1 resistivity meter, the company's resistivity work horse; the Sting R1 IP resistivity/IP meter, R1 with IP capabilities; the new SuperSting R8 IP, a high-power multi-channel resistivity/IP meter capable of collecting data eight times faster; and, the Swift automated electrode system utilizing AGI's 'Dual Mode' electrodes, the only system that allows use of non-polarizable electrodes for automated IP data collection.

The DC resistivity/IP imaging method is especially valuable in areas where ground penetrating radar (GPR) and EM methods do not work because conductive overburden such as clay attenuates the signal. In such areas, the resistivity/IP method is the only real-

ternative for subsurface 2D and 3D mapping of the near surface.

AGI's Sting R1 or SuperSting R8 series meter and the Swift automatic smart electrodes are used to automatically record and store large numbers of data points. Resistivity data is downloaded to a PC type computer, inverted from apparent resistivity into 'true' resistivity and presented as color cross-sections of the subsurface. IP measurements are divided into six windows and the user can then select the number of windows to be used to calculate the chargeability.

Typical applications for AGI's equipment are mineral exploration; groundwater exploration; geotechnical, archaeological and environmental investigations such as pollution plume mapping, fracture, cavity and tunnel detection; and sand and gravel exploration.

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### Advanced Logic Technology

Advanced Logic Technology (ALT) is an engineering and geoscience consulting and software company that provides high technology solutions to the international slimhole logging industry and the E&P industry (WellCAD software). ALT's business includes a diverse array of products and services such as acoustic and optical slimhole imaging

tools, off the shelf software (WellCAD), customised software, consulting, training.

In the WellCAD v 2.50 well data management system, the basic module manages, edits, processes and plots borehole data including well logs, petrophysical data, mud log data, lithological data, free text of comments data, full wave form sonic data, image data and many more. Optional modules such as full wave form processing, image processing, LIS/DLIS import, multiwell module. WellCAD is a Win32 native application and is used for image composite log presentation, core-description, fracture analysis, wellbore imaging, petrophysics.

New software products include WellCAD multiwell module and Dynamic 3D feature and for hardware, the Optical televiewer (OBI40)

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#### Aker Geo

Aker Geo, a global geophysical and reservoir competence company, offers complete services in exploration and reservoir related disciplines.

Aker Geo Seismic focuses on providing high performance marine 3D acquisition and processing services, whilst Aker Geo Petroleum Services focuses on interpretation, reservoir evaluation/modelling/simulation and other reservoir management services.

Maritime Well Service and Genesis are two other companies in the Aker Group. Through advanced synergy with these companies, Aker offers complete integration within the subsurface disciplines to full field development planning.

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#### ARK Geophysics

ARK Geophysics is a UK specialist in gravity and magnetic methods. ARK provides processing, interpretation, software, training and data management to oil and gas exploration companies and to seismic contractors. ARK

has been registered for the ISO9000 quality management standard since 1994.

Recent developments include:

- The launch of ARKFIELD 3D modelling software as an upgrade to the successful ARKFIELD 2D interpretation package. ARKFIELD is tightly integrated with both Landmark's OpenWorks and Schlumberger Geoquest's GeoFrame.
- The launch of the ShARK acquisition QC system which provides real-time quality control on-board the vessel together with early data delivery for interpretation
- A new web-enabled front end to FieldBank, the online global databank for gravity and magnetic data operated by ARK and the British Geological Survey, which allows browsing, selection and retrieval of worldwide gravity and magnetic datasets to subscriber companies.
- New gradient interpretation methods successfully applied in the Gulf of Mexico and the North Sea
- New non-exclusive data offshore Brazil acquired in conjunction with the Schlumberger/TGS-NOPEC regional project now available
- An interpretation of the Brazil data will be available soon
- An updated interpretation of the Gabon offshore area (including deep water) is now available

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#### Beicip-Franlab

Over the past 15 years, IFP Group has worked on integrated modelling solutions that offer flexible workflows for more accurate petroleum system analysis, reservoir characterisation and reservoir simulation.

In 2000, the Beicip-Franlab is introducing a brand new 3D basin modelling package called Temis 3D. This software solution integrates 1D, 2D and 3D modelling capabilities into flexible multi-1D and/or full 3D workflows. The program has been successfully applied to more than 50

exploration studies in the world's major oil provinces.

On the reservoir characterization side, IFP Group proposes integrated solutions for building accurate reservoir models, starting with advanced rock-typing, through seismic attribute analysis, structural modelling, geostatistical reservoir modelling, reservoir simulation grid building, topological upscaling and advance reservoir simulation.

In 2000, Beicip-Franlab is also introducing new concepts to reservoir characterization, in both seismic geo-inversion and geostatistical modelling.

Advanced 3D visualisation and geo-modelling concepts provide the basement for developing InterWell 4.1. They are used to build an innovative geo-inversion solution, with even more accurate inter-well reservoir property predictions. At this point, InterWell 4.1 offers a tight integration with the Reservoir Modelling Line (RML), IFP Group's leading solution for reservoir modeling.

Launched in March 2000, GeoSim is the new module of RML. GeoSim is an advanced stratigraphic grid builder. It generates high resolution cornerpoint geometry reservoir grids, based on the structural framework and honoring the correlation scheme in each geological units (i.e. with a layering consistent with the depositional sequences). Then, Heresim's geostatistical modelling techniques are used to populate these stratigraphic grids, in order to derive geological models that accurately image the reservoir real heterogeneities.

At last, as fracturation can also have a dramatic impact on the flow behaviour and the performance of a reservoir, the IFP Group proposes a specific workflow called FRACA for fracture network characterization and modeling. This solution includes specific upscaling techniques that link the characteristics of the fracture distribution with dynamic parameters such as fracture permeability tensor and block-size dimension to be used in dual media simulation available in IFP Group's proprietary advanced reservoir simulator called ATHOS.

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### Blackwell Science

Blackwell Science is the official publisher for the European Association of Geoscientists and Engineers (EAGE), publishing *First Break* and *Geophysical Prospecting* on behalf of the EAGE.

*First Break* is the news magazine of EAGE aimed at practitioners and researchers within the oil industry. It provides a mix of short authoritative articles covering all of the disciplines within the spectrum of applied geophysics, petroleum geology and reservoir engineering.

*First Break* publishes top-quality submitted and commissioned research articles, together with research articles and product news from around the world and is required reading for all exploration professionals.

*Geophysical Prospecting* publishes the best in primary research on the science of geophysics as it applies to exploration. Drawing heavily on contributions from researchers in the oil and mineral exploration industries, the journal has a very practical slant. Although it provides a valuable forum for communication among workers in these fields, the journal is also ideally suited to researchers in academic geophysics.

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### Bolt Technology

Bolt Technology continues to be a world manufacturer and designer of seismic energy sources since the company invented the marine air gun in 1964. In 1993 Bolt introduced the LONG-LIFE marine air gun which has become a widely used air gun for marine seismic exploration. Bolt has now developed a new marine seismic source based on a revolutionary design, the Annular Port Air Gun. This new gun features a substantial improvement in output as well as dramatic improvement in towing efficiency. Improvements in towing efficiency results from a passage through the

length of the gun which serves to protect air lines and electric cables from high-pressure air blast.

Bolt's marine energy source technology extends beyond the design and manufacture of air guns. The company provides custom array design for every application including shallow water surveys, deep basin hydrocarbon exploration and deep crustal studies. Array designs are computer modelled and optimized using the latest software. Special configurations can be quickly evaluated at Bolt's test pond and new products are characterized in periodic tests at an instrumented deep water facility.

In addition to marine air guns, Bolt continues to supply a wide range of other seismic energy sources. These include compressional and shear wave land air guns, mud/auger air guns used in transition zone surveys, portable air guns for remote or environmentally sensitive areas and the borehole air gun tool for reservoir characterization.

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### British Geological Survey

The British Geological Survey (BGS) was founded in 1835 and has a staff of around 700, of which about 500 have formal geoscientific training. It is the UK national centre for earth sciences, and operates both in the UK and internationally in all aspects of the geological sciences, including hydrocarbon and mineral prospectivity, groundwater resources, land use, geological hazards and training. BGS plays a major role in the key issues of wealth creation, sustainable development and protection of the environment.

Major projects are managed from within two divisions, the first concentrating on mapping and resources and the second very much associated with environmental and hazard-related projects. Most projects form part of the long-term BGS core programme of government-sponsored research, although in many cases co-funding from industry is required to demonstrate the relevance of these programmes. The geological research programme is supported by an

IT division, which is developing web-based databases and a major new project constructing a digital 3D model of UK geology.

Other projects are funded from commissions from the commercial sector, international agencies and governments. The UK government, the European Union and the World Bank also fund major hydrocarbon-related studies. BGS also works in partnership with a range of companies and other research organisations.

BGS has over 30 years experience providing geological and geophysical consultancy in hydrocarbon exploration with specific expertise in both exploration and development geology, including field studies, seismic interpretation, sedimentology, sequence stratigraphy, basin analysis, biostratigraphy, geochemistry, marine geology, environmental studies and data management.

BGS has developed expertise in petroleum geology through a major contract with the UK government to map the UK offshore and provide independent assessments of exploration and development projects. International experience includes commercial and aid-funded projects throughout the world. One current project is to provide advice and promote petroleum exploration and production to the Falkland Islands Government. Recent World Bank projects include a five-year infrastructure strengthening project with the Government of Papua New Guinea, and a contribution to an evaluation of the potential for rehabilitation of mature offshore fields in Azerbaijan. EU research programmes include evaluation of CO<sub>2</sub> disposal beneath the North Sea and the setting up of a web-based database of marine sample information (EUMARSIN). These are part of a growing portfolio of environmental projects that include assessment and sampling of drill cuttings piles, environmental impact studies and a major geochemical study of pollutants in the Irish Sea.

Some of the key projects and research topics relevant to the petroleum industry include: The Rockall Project:

frontier area exploration; The Western Frontiers Association: geohazards and environment; Edinburgh Anisotropy Project: seismic anisotropy studies; Passive Margins Modelling Project (PmmP): 3D potential field modelling; Geomagnetism: interpolation in-field referencing; Seismology; Onshore high resolution airborne geophysical survey (HiRES-1); Reservoir geoscience; and Regional petroleum studies

### Cirrus Logic

Building on its Crystal CS5321 and CS5322 modulator and filter devices for seismic data acquisition, Cirrus Logic is introducing a multi-channel chip set providing increased flexibility, higher performance and lower cost per channel than the current generation of devices. These new devices are the CS5372 dual-channel delta-sigma modulator and the CS5376 quad-channel digital filter device. Optimized to satisfy the stringent requirements of geophysical oil exploration, the new devices also provide a solution for seismology applications (earthquake monitoring equipment), and the emerging application of oil field characterization/monitoring equipment. A complete four-channel modulator/filter solution can be implemented with just three devices providing a small form-factor and cost-effective solution for most seismic survey and seismology applications.

This new chip set will provide customers with the capability to implement the new three or four component seismic data acquisition systems cost-effectively and with the highest performance possible. Different grades of the modulator device allow customers to meet the performance requirements of a particular application, such as 4D reservoir monitoring in the most cost-effective manner possible.

The CS5372/CS5376 chip set features: ultra low power (125 mW for 4-channel ADC system); performance (124 dB SNR with 120 dB SDR @ 411 Hz BW); and high package density (24-pin SSOP dual modulator 64-pin TQFP 4-channel filter).

Cirrus Logic is a manufacturer of high-performance analogue circuits and

advanced mixed-signal chip solutions. The company's integrated circuits, also sold under the Crystal brand, enable system-level applications in audio, mass storage, industrial (precision data conversion and test/measurement) and communications (T1/E1 and Ethernet) markets.

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### The R.T. Clark Companies

The R.T. Clark Companies is a full service, international brokerage company servicing the geophysical community since 1983. It is a large 'used equipment broker' in the geophysical industry, and also sells new equipment, leases a multitude of geophysical acquisition and geotechnical equipment, and conducts appraisals of assets and holdings to satisfy its clients' accounting, financial and legal needs.

The R.T. Clark Companies provides a full line of used/second-hand land, marine, transition equipment for geophysical/geotechnical applications including seismographs and telemetry recording systems, cables, geophones, vibrators, test equipment, magnetometers, gravity and resistivity meters, ground penetrating radar equipment, computers, plotters, workstations, and parts and supplies for all land, air and marine applications.

The R.T. Clark Companies has assisted innumerable seismic contractors, oil and geophysical companies, universities and research institutions in the procurement and sale of used/second hand surplus assets. Companies and individuals consign equipment with the company, yet retain possession of the equipment while it is consigned. No fee is charged for advertising and marketing of consigned assets. When the equipment is sold, the seller is charged a prearranged commission varying from 6% to 25%.

In the interest of gaining the most value for every client, The R.T. Clark Companies advertises extensively in the international market and participates in the EAGE, SEG and AAPG Exhibitions.

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### Compagnie Générale de Géophysique (CGG)

Compagnie Générale de Géophysique (CGG) has been a leading supplier of geophysical services and products to the worldwide oil and gas industry for nearly 70 years. Geophysical Services cover land and marine seismic acquisition, seismic data processing and reservoir studies in addition to data management and processing software development. Geophysical Products are developed and marketed by Sercel, the manufacturer of land and marine geophysical equipment, and by Flagship, the specialist in interpretation software dedicated to oil and gas exploration and production.

#### CGG Land Services

CGG has an operating capability of over 30 land seismic acquisition crews equipped with Sercel telemetry systems and Field GeovecteurPlus, CGG's in-field processing software package. Crews work on all the continents in difficult or environmentally sensitive areas ranging from jungle rain forests to deserts, mountains, polar regions, urban areas and land-sea transition zones. A wide range of complementary services based on seismic (high-resolution seismic) and non-seismic (gravity) methods are also available, allowing CGG to offer integrated solutions to clients in the oil and mining industries.

#### CGG Offshore Services

CGG Marine has a dedicated high-capacity 3D fleet including its flagship, the new CGG *Alizé*, which is equipped for 16+ streamer capability (100 km) and has confirmed its operating reliability since its launch in April 1999. The entire CGG fleet has full on-board processing capabilities with GeovecteurPlus, CGG's own processing software, and operates with the latest techniques developed by its R&D Division.

CGG Non-Exclusive Surveys continues to extend its data portfolio, last year acquiring a further 14 000 km<sup>2</sup> of 3D

data in very promising areas in the Gulf of Mexico (Mississippi Canyon and Green Canyon) and in the Brazilian deep offshore market.

CGG BSD (CGG's Borehole Services Division) offers well seismic techniques and has a worldwide network of operating bases and processing centres. This division implements the new SST 500 Masterseis tool for simultaneous recording of up to 12 levels (4 components) and Pipeseis ultra slimhole equipment for data acquisition in problem or (sub) horizontal wells. CGG BSD is active in the use of vertical seismic profiling for the calibration of time-lapse 3D seismic. CGG Osiris-Topnav, which is CGG's positioning subsidiary, provides positioning and geodesy services as well as hydrographic services, mainly to the oil industry worldwide.

#### *CGG Processing & Reservoir Services*

A comprehensive range of data processing services is available via CGG's five main data processing centres in Paris, London, Oslo, Houston and Calgary and a network of regional centres. All CGG centres have computing configurations adapted to accommodate the ever increasing complexity of the latest, high-performance technologies such as multi-component processing, depth imaging, and lithological prediction.

CGG is recognized as a technology innovator in the processing of 4-component data. The successful completion of a converted wave pre-stack depth migrated 3D, 4-component survey is probably a first in the industry and establishes CGG's position in this frontier market. Among the many integrated tools used by CGG processing, GeovecteurPlus is a key element installed in all processing sites (land crews, marine vessels, regional or main centres) guaranteeing processing quality, consistency and productivity. The latest annual upgrade, GeovecteurPlus 7.1, includes substantial improvements such as redesigned user interfaces, enhanced speed and new geophysical algorithms.

To meet the demands of the expanding inversion and imaging market, CGG continues to expand its reservoir service

capabilities and strengthen its team of specialists, throughout its worldwide network of centres. CGG's reservoir resources are supported by two centres of excellence located in Europe and the United States. Through the integration and further development of its recognized skills in advanced seismic data processing, reservoir characterization and reservoir services, CGG has become an established provider of reservoir solutions.

CGG also provides integrated studies to its clients. These services integrate computer products and technical skills in geophysics, geology and reservoir management. IT & Data Management services are also offered for the management of stored seismic data which goes beyond conventional data transcription and includes a bar-coded archiving system to monitor and maintain the integrity of a company's entire media library.

#### *Interpretation software (Flagship)*

Flagship's software solutions address critical issues in the process of discovering and developing oil and gas reservoirs. Leveraging proven technologies licensed from leading international oil companies, Flagship products are delivered with an efficient user interface. An international network of regional and local offices provides training, consulting services and operational support to ensure maximum return on investment. Flagship's suite of advanced software products includes *Stratimagic*, a seismic characterization package that incorporates the patented SISMAGE technologies developed by Elf Aquitaine, *NexModel* and *FastQC* that complement baseline interpretation packages and *IntegralPlus*, the integrated geoscience database and application suite.

#### *Geophysical equipment (Sercel)*

The SERCEL Group develops, manufactures and markets seismic equipment for Land, Shallow and Marine operations: land data acquisition systems (SN388 and 408UL), real-time quality control (SQC-Pro), marine data acquisition systems (Seal, Syntrak), OBC and streamer products, vibrators and vibra-

tor electronics, etc. The launch of the land data acquisition system 408UL and the merger with Syntron at the end of 1999 strengthen Sercel's position on the seismic acquisition equipment market with more R&D and extended worldwide customer support.

CGG's training organisation CEFOGA has centres in Paris, London and Houston to train geophysicists and technicians in all fields of geophysics. The CGG Group considers safeguarding the environment and preserving the health and safety of its employees, contractors and neighbouring communities as a paramount business objective. CGG continues to implement a Health, Safety and Environment Management System (HSE MS) based on a series of quality loops.

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#### **Concept Systems**

Concept Systems has been a supplier of advanced IT systems and services to the oil exploration and production industry since 1984. Concept's integrated range of products enable efficiency improvements and cost savings throughout the survey acquisition cycle and include applications for survey design and planning, geophysical analysis, in-field acquisition and post-survey data management.

Concept's suite of navigation and positioning products including the SPECTRA integrated navigation system have become an industry standard for 2D and 3D marine streamer operations. The company has extended its range of in-field acquisition products with the development of an integrated navigation system to meet the specific control and data management demands of ocean bottom, reservoir and shallow water operations. For land and transition sectors, Concept has developed a wide-area command and control system which emulates the improvements already made in marine survey efficiency.

Concept has expanded the company's markets into the geophysics and GIS arenas with a range of survey design and deployment products and services for optimising quality and costs

during subsequent acquisition. Products include GIS based survey planning and mapping packages and seismic QC tools for marine, land and transition zone seismic surveys. A seismic QC package developed in conjunction with a major oil company provides automated seismic attribute computation and analysis for optimising acquisition parameters in survey design and monitoring data quality in the field. More recently, Concept has developed a breakthrough ray tracing technology, which will enable geophysicists to resolve sub-surface illumination issues in minutes rather than hours or days.

To support and complement its standard products, Concept offers a comprehensive range of services including offshore personnel, data processing and QC, survey planning and mapping, consultancy and general survey services. Concept also provides custom solutions for survey data management and archiving applications based on its extensive GIS experience combined with a range of in-house software products including industry standard geodetic libraries and robust GIS engines.

Concept Systems is based in Edinburgh, Scotland, employs around 85 staff and in 1997 was awarded the Queen's Award for Export Achievement.

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### Continuum Resources Corporation

Continuum Resources Corporation (CoRe) was formed in 1998 when the Energy Innovations Group merged with Walden Visualization Systems. With corporate headquarters in Houston and two wholly owned facilities in London and Perth, Australia, CoRe offers global solutions to visualization of data in remote sensing, mining, architecture and the oil and gas industries. The three CoRe facilities boast rear projected, large scale viewing environments capable of collaboration in real time between geographically discreet locations.

The enabling software chosen by CoRe to run its visualisation centres

was created by MuSE Technologies. The software is instructed by voice and driven by a joystick rather than keyboard and mouse for intuitive navigation of data. Data attributes are viewed in three dimensions, in full stereo, and can be 'mapped' with voice or sounds allowing the viewer to use multiple senses in the evaluation of data volumes and attributes.

The three large-scale theatres were designed and installed by MechDyne and are configurable from power wall (flat screen) format to full 4-wall cave capability (London and Houston only). Available from the theatres is 3D model design, geo-technical consultation, software development, management presentations, access to third party applications, human scale, stereo visualization, and collaboration with London, Houston, Perth and other MuSE enabled centres worldwide.

CoRe provides industry with three-dimensional, navigable models of sub-surface, surface and supra surface data. The models produced thus far have given invaluable insight at a glance to the data and inherent problems. In each circumstance, CoRe's clients have either changed the business model and/or the scope of work based on the knowledge gained therein. Projects range from detailed subsurface oil and gas models to fully interactive architectural facilities. CoRe has produced over 30 of the models to date with three projects currently active.

CoRe is a leader in fully commercial, independent visualization facilities. Though the CoRe centres are large scaled systems run by powerful computers and projectors, CoRe is very focused on personal advanced computing systems. The technological advancements of the Internet and in the NT computing and projection industries have opened the door for advanced desktop visualization. CoRe has worked with vendor companies to find the right personal solutions available at reasonable entry-level prices and believes that these are the solutions of the very near future for providing enterprise-wide, integrated visualization database solutions to its clients.

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### Desmond Fitzgerald and Associates (DFA)

Desmond Fitzgerald and Associates (DFA) specialises in software and services for potential field geophysics. The company is based in Australia, with offices in Melbourne, Perth, Europe, North America and South Africa.

DFA and partners employ more than 15 geophysicists, geologists and programmers and a range of professional and management support staff. The combination of practical geophysics and software makes DFA a resource for software, processing services and training.

In 1998, in conjunction with the Australian Geological Survey Organisation (AGSO) DFA began reprocessing the entire Australian maritime magnetic, gravity and bathymetric data resource. This involved the development of innovative levelling techniques and specialised processing methods to cater for the wide range in type and quality of the archived data.

In late 1999, AGSO decided to support tenement releases in the Great Australian Bight (Southern Margin Frontier) area and requested that DFA prepare a range of enhanced interpretation products including magnetic, gravity, bathymetry, depth, methods (magnetic and gravity), Naudy and Euler modelling and profile modelling.

Because of the interest in basin structure, particular attention was paid to structural/profile modelling and gravity datasets. Reprocessed gravity data had a Bouguer correction applied (using the bathymetry data) and then a marine terrain correction. Moho models were derived and used to produce isostatic corrections. Finally seismic and well data were used to control sediment layer stripping.

Gravity data was then used, in conjunction with magnetic data and seismic control, to model major features. The interpretation products were developed with tight integration between geophysicists and geologists. AGSO geologists used GIS themes covering geology

and known structure to integrate with the new geophysical products and to prepare reports covering regional interpretation and basin architecture and regional prospectivity

This exercise illustrates the value that may be found in archived data. Revisiting old data using up to date methods can produce a consolidated and standard resource that is easy to use and of sufficient quality to enable a range of derived interpretation products to be developed. This entire process can be undertaken quickly and in a cost-effective manner.

Potential field data and derived products can be used to develop geological insights and prospectivity analysis. They are, for example, important when evaluating tenements in 'greenfield areas' or planning seismic acquisition. These products are available on CDROM.

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### Destiny Drilling Overseas

Destiny is a full service, front-end seismic company. Services include survey, seismic clearing, shothole drilling and line clean up. The company's speciality is turnkey or term operations in remote or difficult acquisition areas. It offers a full range of specialized equipment to meet every job challenge. Areas of operation include jungles, mountains, swamp/marshlands, transition zones, deserts, forests and highland areas.

Experienced crews have diversified backgrounds with cultural and language skills as well as broad operational knowledge. Through affiliated companies Destiny also provides several downstream services such as oilfield construction and maintenance, pipeline and facility construction, abandonment and reclamation services.

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### dGB

dGB (de Groot-Bril Earth Sciences) is a software and services company specialising in quantitative seismic interpreta-

tion. It develops and markets dGB-GDI (Geology-Driven-Integration), executes studies with the product and provides seismic object detection services as well as processing of *TheChimneyCube* and *TheFaultCube*.

The main software product dGB-GDI is used for 2D, 3D and 4D seismic prediction and pattern analyses. It offers free-format integration of stratigraphy, lithology, logs, seismic data and engineering data. Non-linear relations can be studied using supervised and unsupervised neural networks. The system supports a unique pseudo-well simulator for generating realistic, high-resolution stratigraphic columns with attached well logs. Real and or simulated wells can be used to train neural networks, to explain clusters of seismic waveforms, to analyse AVO effects, or to explain the seismic measurements by way of stochastic inversion. dGB-GDI runs on Sun-Solaris and PC-Linux operating systems. The software is sold in three logical parts, or the entire portfolio can be leased. All license holders are offered a seat in the GDI consortium whose aim it is to steer the future development of dGB-GDI.

The seismic object detection services, exclusively offered by dGB uses a world-wide, patent-pending method developed in co-operation with Statoil. The method combines multi-attributes and neural networks to generate new volumes of data in which desired objects are highlighted. *TheChimneyCube* is an example that reveals vertical hydrocarbon migration paths. The cube is used in prospect evaluation and geohazard interpretation. *TheFaultCube* is used to facilitate fault interpretation.

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### DMT GeoTec

GeoTec is a division of the German company Deutsche Montan Technologie (DMT). Activities concentrate on geophysical and geological investigation in surface construction, underground engineering, on mining, geo-information technology, and on the development and production of geophysical measuring and surveying

equipment. Services include planning, measuring and surveying, consulting, data processing and interpretation, supervision and monitoring, development, training and quality management.

With some 100 specialists GeoTec division is a large European geoscientific company. Its tradition reaches back to the early years of this century, when Ludger Mintrop, the co-founder of modern geophysics, developed the seismic exploration tool and application to explore deposits. Based on this beginning, the Institute for Geodetics/Mine-Survey and the Institute for Applied Geophysics were created. Today these are enclosed in the DMT GeoTec Division.

Equipment developed includes SUMMIT, a 24bit seismic data acquisition system; DMT CoreScan Colour, a digital core imaging and storage system; RESECS, a DC-resistivity measuring system; Borehole Shuttle, a geophysical measuring system for deviated and horizontal boreholes; GYROMAT 2000, a fully automated precision gyroscope.

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### DPTS

DPTS specialises in providing services and solutions for exploration and production data management. These include transcription and remastering of all types of recording media; reformatting and recovery of data from old recording media; correction and verification of data formats to current industry standards; hard copy scanning for either image-based archives or vectorisation; and storage of hard copy and tape-based exploration data.

DPTS has offered transcription services since 1976 resulting in support for a range of media types and associated data problems. In addition to modern media services such as square cartridges (3480/3490/3590), DLT, DAT and Exabytes, DPTS can still recover data from older media such as Analogue, 7 and 21-track tapes and optical discs. The company's experience with 9-track tapes has led expertise in stiction treat-

ment and data recovery. DPTS can read and decode most formats used in E&P data recording. In the last year DPTS has remastered over 350 000 tapes for inclusion in data banking and management solutions worldwide.

Hard copy services include the scanning and vectorising of seismic sections, well logs, maps, observer reports and other associated exploration documentation. Scanned images can be archived by DPTS to any database.

To compliment its bureau service, the software used by DPTS is also available for sale. Diploma is a complete PC-based data remastering and management system. Diplomat can be configured to suit all exploration data transcription, digitising and management requirements.

#### *Woodlands-DPTS*

Woodlands-DPTS is a joint venture company established by DPTS from the UK and The Woodlands Geophysical Group from the USA. Woodlands-DPTS specialises in the loading and management of exploration data to interpretation workstation systems.

Formats to which Woodlands-DPTS can load data are Landmark, GeoQuest IESX and Charisma. In addition to SEG Y data loading, Woodlands-DPTS has considerable experience in converting projects between proprietary workstation formats. Consequently, both current and older versions of these workstation systems are maintained. Woodlands-DPTS also performs project management services at clients' offices.

Quality of service is the key to the success of Woodlands-DPTS. Experienced geoscientists perform all work. Cost estimates and turnaround estimates are consistently met. Projects are delivered to clients accompanied by a full loading report detailing exactly how each project has been loaded and with full instructions for the client on how to restore the project to their workstation. A recent project succeeded in loading 300 million traces (1.5 Terabytes) of data to SeisWorks inside a six-week deadline.

In addition to quality, Woodlands-DPTS provides an innovative approach

to workstation data management. A data 'mastering' and correction service is offered, whereby seismic data are checked and amended to make them fully compliant with any workstation or data bank, while maintaining the data in standard SEG Y format. Using Woodlands-DPTS' sophisticated editing tools PCUT (a polygon definition tool) or DataEditor (a powerful editing utility), data can be selected according to client requirement or entitlement. Selected data may then be output as SEG Y or to proprietary formats as projects.

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#### **Draka Geophysical**

Draka Geophysical is a member of the Draka Holding Group which has more than 40 companies worldwide with some 7000 employees involved in all aspects of cable design and production. With such a large organisation Draka Geophysical has the backing and support of a wide range of cable expertise and can use all of Draka's research and test facilities. This in conjunction with more than 50 years' combined experience in the seismic industry of the company's personnel helps to ensure optimal product performance.

Draka Geophysical designs, develops and manufactures cables and cable systems and is an approved supplier for Sercel SN368 and SN388, I-O System II and DMT Summit systems. Other recording system cables include Geo-X ARAM-24, Japex GoDaps and Fairfield BOX. All cable takeouts are manufactured with the takeout cable conductors stress relieved and with the takeout stress double moulded to guarantee water tightness. Connectors as fitted to some of the recording system cables undergo continuous design review and improvement.

Each year many hundreds of km of two and three core geophone leader is manufactured, available with or without pick-up loops. Although more than 150 Seistec geophone testers have been produced since it was introduced more than 10 years ago, the Seistec 2000 has been regularly updated.

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#### **Dynamic Graphics**

Dynamic Graphics is a software development company offering EarthVision software that provides geologists, geophysicists and engineers with 3D modelling and visualization of structurally simple to highly faulted geologic environments. Dynamic Graphics pioneered the building of 3D models and has served the market for over 30 years. The new WorkFlow Manager offers a geologically oriented process flow which simplifies model building procedures for even the most complicated structures and intrusions. The WorkFlow Manager has streamlined the model building process reducing project time by as much as 10-fold.

EarthVision integrates interactive 3D well path positioning tools with geologic models to provide the most precise well planning and analysis procedures available. EarthVision also provides important geosteering tools, including real time MWD and LWD displays, rapid model updating, and synchronized visualization capability between rig site and office location for shared decision-making. Dynamic Graphics offers this innovative synchronized viewing on Windows NT to coordinate and update the structural model from remote locations, using handy PC laptop systems. To reduce the cost of ownership, the full suite of EarthVision Version 6 modules will be available spring 2000 on NT and Linux operating systems, as well as on the Unix platform.

EarthVision and its WorkFlow Manager provide these sophisticated geologic modelling and well planning capabilities in a single integrated easy to use program to help clients reduce risks, improve decisions and increase profits. EarthVision's petroleum suite offers interfaces to popular subsurface, seismic and reservoir management software for enhanced performance.

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### Earth Resource Mapping

Since 1989, superior products coupled with a responsiveness to customers that is unmatched in the industry have supported ER Mapper's steady growth, which includes the expansion of its reseller network to 300 companies. Founded by Stuart Nixon, the company is committed to making image processing easier so that professionals at all skill levels and disciplines can effectively utilize the power of geoprocessing and remote sensing technologies.

Earth Resource Mapping is totally committed to open software standards for imagery. ER Mapper's future direction will continue to be dictated by the needs of the industries that depend on innovative and efficient image processing products.

Earth Resource Mapping has regional offices in Perth, Australia; London, UK; and San Diego, California in the United States.

Web: [www.earthetc.com](http://www.earthetc.com)

### Earth Science Systems

Earth Science Systems operates a rental pool of geophysical equipment in Europe and is a major sales agent for many equipment manufacturers from around the world. These include Geonics, specialising in Electromagnetics (EM), inductive conductivity instrumentation and time domain EM and Seistronix, which produces a range of in-hole temperature measurement equipment working in conjunction with the Mount Sopris Borehole logging systems.

The company also represents Sensors & Software, with low and high frequency ground penetrating radar (GPR) systems; ABEM, which manufactures resistivity, seismic and VLF equipment; Interpex and its range of geophysical interpretation and display software and GEM, providers of high quality Magnetometers for detection of subsurface magnetic material.

The company develops instrumentation for specific applications such as liner leak detection and soil type mapping systems. Its customer base is varied with activities encompassing applications from the inspection of concrete

(cm) through to geological research and mineral investigations (100s m). Between these depths of exploration lies the field of environmental geophysics and ground water investigations. This sector of geophysical investigations has seen the company's largest growth over recent years. Through strong contacts with manufacturers, research organisations, contractors and consultants coupled with in-house experience of geophysical surveys and applications, Earth Science Systems is at the forefront of knowledge and innovation within this industry.

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### Encom Technology

Encom Technology has provided innovative software solutions, services and training for the petroleum and mineral exploration industries for 16 years. Encom's free SEGView software has been widely taken up by industry during the past year and a free forward 3D magnetic/gravity modelling option will also be offered on the company's website in the near future.

Encom's ModelVision and Noddy software ranges provide both interactive and automated solutions for the modelling and 3D visualization of the magnetic and gravity responses of simple or complex geological structures. AutoMag, based on work by Naudy and Zhiquan Shi, makes automated depth interpretation easily available to users of large sets of aeromagnetic data. The integration of AutoMag with ModelVision allows interactive testing and fine-tuning of AutoMag depth solutions. Version 3.10 of ModelVision is ready for imminent release.

EM Vision software contains several powerful interactive modelling tools for displaying and interpreting ground TEM data. EM Flow is a new and unique software product for rapid conductivity-depth processing and display of TEM or FEM airborne data.

Imminent releases of geophysical software from Encom include GEMeX, for profile based visualization and pow-

erful interpretative batch processing of airborne electromagnetic data, and IP Vision, a new project management, display and interpretation tool for induced polarization data. Discover is an award winning GIS extension that increases the power and flexibility of MapInfo Professional for explorationists.

Encom's geologists, geophysicists and computing professionals have international geoscience consulting experience in petroleum and mineral exploration projects, and in all aspects of interpretation, processing and enhancement of exploration data. Encom Technology enjoys close working relationships with CSIRO, CRCAMET and VIEPS whereby the commercialisation of geophysical and geological software developed by these research organisations is undertaken.

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### Energy Innovations

Incorporated in 1986, Energy Innovations (EI) has provided geophysical consultancy services in one or more aspects of over 450 seismic projects worldwide in over 50 countries. The expertise covers a wide scope of services in pre and post mission work and field operations for all types of seismic operations. In addition, Energy Innovations offers state of the art HSE consulting and training services including use of the Continuum Resources visualization facilities, and offers specialized services in geodesy and navigation data verification.

Senior staff comes mainly from oil and gas technical service groups, with additional personnel from contractor technical and R&D programs. The majority of staff are professional geoscientists with experience in many areas of 3D projects, including survey planning, acquisition, processing and interpretation. Services are offered in land, marine, transition zone, OBC, rig moves and data processing areas.

The EI philosophy is to offer a corporate rather than individual service and to provide field personnel with the products necessary to allow better decision-making in near real-time. EI be-

believes that this approach provides ultimate protection of the client's best interests in the quality of the final product, health, safety and environmental issues, and cost savings and financial controls.

The field QA systems used by EI allow integrated quality control of both survey and seismic data. Quality attributes may also be evaluated in an areal sense by examination of the spatial variation of measured and computed quality attributes. This provides the field geophysicist with the means of evaluating or establishing data acceptability in a true 3D sense. Included in the scope of spatial services offered by EI is permitting, surveying (both conventional and GPS, cellular and fibre), environmental hazard studies, and pre-construction geo-technical services.

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#### Engineering Seismology Group Canada (ESG)

ESG offers turnkey microseismic monitoring services from installation of sensors through to acquisition and real-time event processing and visualisation supplemented with complete consulting services from microseismic array design, innovative processing and interpretation. The cornerstone of the product line is the Hyperion seismic monitoring system which has seen worldwide application for hydraulic fracture mapping and reservoir imaging in the oil and gas industries, reservoir monitoring in the liquid petroleum gas storage industry, underground excavation monitoring in the nuclear waste storage industry and mine monitoring for safety and rockmass stability.

January 2000 saw the launch of the FRACMAC commercial service providing real-time fracture diagnostics via microseismic acquisition and processing. Results are transmitted via network link to petroleum engineers at the frac site or remotely to their offices in the form of interactive 4D computer generated maps. Engineers are able to view the geometry and growth of the frac and make informed decisions about the

treatment parameters. The service has also been used by clients to constrain numerical frac simulations and to optimise future simulation designs.

ESG also offers complete reservoir monitoring microseismic services. Passive microseismic monitoring can provide imaging of active faulting and fracturing in the field for applications including reservoir compaction, fault mapping, reservoir imaging, well fracturing, cap rock integrity, waterflood conformance, waste injections and thermal recovery. ESG provides comprehensive pre-monitoring design studies, adaptive processing capabilities and full microseismic and reservoir engineering interpretation services.

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#### Enigma Data Systems

Enigma Data Systems was formed to develop disk and data management solutions that assist oil companies address difficulties in dealing with the exponential growth in on-line data and the disk farms contain it. Enigma methods and standards-based technologies embrace client's systems, people and processes – all the ways which transform data into strategically important knowledge – to preserve that knowledge while controlling costs. Enigma provides a flexible combination of information management hardware, software, services and support. It delivers value three ways:

Custom methodology. The Enigma team works closely with clients and their organisation. It studies workflow, data structure, disk utilization and storage conventions. It delivers and deploys a robust storage infrastructure and user interface tailored to the ways people work, right down to the nomenclature they use.

Breakthrough technologies. Project Archival and Retrieval System (PARS) performs interpretation project archival and retrieval at the click of a mouse button. PARS Migrator frees up disk by enabling Enigma systems to automatically migrate entire project simply. Linear Disk provides a tape library full of disk space. All of this is possible at ex-

tremely high speed through the Intelligent Data Store.

Single-source accountability. Enigma can address all storage challenges or any part. It partners with leading companies such as Ampex and VERITAS to deliver the most advanced, scalable, highest-performing systems for preserving and rapidly accessing data in a cost effective manner.

Enigma supplies either turnkey systems, or uses client's current infrastructure to provide the ideal solution.

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#### Ensign Geophysics

Ensign is an international seismic data processing contractor, providing 2D, 3D and 4D processing services. The company also provides expert 3D pre-stack time and depth migration capabilities. Ensign employs one of the most stable and experienced teams in the industry – the key people average nearly 20 years of experience in seismic data processing and analysis.

Ensign's head office is in the UK and the main processing centres are located in London and Houston. Local, electronically linked centres are located in Aberdeen and Stavanger. The company's LFP Seismic division, specialising in prospect/reservoir geophysics, is located near London. Ensign also provides full 3D processing services on board Aker Geo Seismic's *Aker Amadeus*.

A substantial upgrade and addition to the computing capacity took place at Ensign's London and Houston processing centres during April 2000. Following an in-house evaluation of several manufacturers' products, orders were placed with IBM for the supply of two 18 node Winterhawk2 SP clusters. Each node contains four 375 MHz Power3 CPUs, resulting in a total available performance for each machine of 94 Gflops. This impressive compute rating is complimented by 72 GB of memory and 4 TB of RAID disc storage. Similarly configured systems are installed at both main processing centres.

Ensign has been an acknowledged leader in parallel seismic processing us-

ing distributed memory since 1986, when the first seismic algorithms were developed for the groundbreaking Transputer chip. Since those early days, the full range of parallel algorithms, from field data reformat to 3D pre-stack depth migration, have been coded, allowing Ensign to take immediate advantage of emerging developments in cost-effective parallel systems. The latest installations will benefit from the economies of maturing commodity cluster technology, while maintaining efficiency and continuity through the use of IBM's established performance and system management tools.

The new machines provide the massive compute capability required for Ensign's depth imaging projects, as well as the input/output flexibility to process rapidly even the largest 3D surveys using the most sophisticated time imaging schemes. The complete range of processing applications include many proprietary techniques, such as WAR for shot interpolation, MARS and PRIME for multiple attenuation, and EFFD for enhanced time migration.

Ensign's processing departments liaise closely with the LFP Seismic division to ensure that the seismic properties are calibrated to the rock properties. Ensign has processed and analysed data from most areas of the world for all the major oil and gas companies, with repeat business forming a major part of the workload.

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### **Eotvos Lorand Geophysical Institute**

Eotvos Lorand Geophysical Institute (ELGI) is one of Hungary's most significant research centres in the field of geoscience. Its activity includes research both in the pure and applied parts of geophysics as well as geophysical exploration and prospecting. It embraces the application of seismic methods in investigations spreading from the shallowest engineering problems to the deepest Earth's crust and upper mantle projects.

ELGI applies almost all non-seismic methods, e.g. gravity, magnetic, electrical and electromagnetic including

tellurics and magnetotellurics, in structural studies, geological mapping, engineering and environmental investigations.

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### **ESRI**

Geographic information system (GIS) software by ESRI can help petroleum companies see information in new and innovative ways resulting in better management decisions. GIS delivers solutions through spatial representation of data such as land/lease management, exploration, production, transmission, facilities management, and corporate information technology. By integrating spatial and tabular data through mapping, a company can better manage its assets and corporate information, which can directly affect its bottom line.

ESRI is a full-service company with the experience necessary to help petroleum companies achieve success using GIS technology.

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### **Eurotech Computer Services**

Eurotech Computers Services provides storage experience to the oil and gas industry. This year there are many new developments within storage that will have an impact on throughput and connectivity. These include fibre attachment for what is generally known as storage area network and new tape storage products including linear tape open. Eurotech's tape product experience includes IBM 3590 through the different media utilised from 3480, 3490E, Exabyte, DLT, AIT to 9 track.

The company is agent for current 9 track drives for which it has designed a drive to assist with stiction recovery and is a business partner for IBM, Sun, Auspex, Adic-Grau, Metastor, Qualstar and a wide range of hardware manufacturers. The company combines Unix and NT skills with storage integration experience. It has been supplying hardware, maintenance, installation, con-

tracting and a wide range of support skills for many years to the industry. The company has offices in the UK, USA and Norway.

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### **Exploration Consultants (ECL)**

ECL was founded in 1969 to provide the oil industry with a source of geological expertise. In 1972 the Seismic Operations Division was introduced and signified the beginning of ECL's complete consultancy service concept. Over the succeeding years ECL has consistently striven to maintain and expand its range of consultancy services. The introduction of the Environmental Consultancy division in early 1999 is a clear indication of this continuing philosophy.

To date ECL's services cover the entire spectrum of exploration and include; the design, management and quality control of complex geophysical surveys, through to geological and geophysical interpretation and data integration, basin modelling, thermal history reconstruction, petroleum engineering and environmental studies.

These services are delivered worldwide by over 150 highly experienced consultants and co-ordinated by ECL's Houston (USA), Henley-on-Thames (UK) and Perth (Australia) offices and further supported by a global network of agents and representatives.

Technological advancement and innovative thinking are promoted throughout all facets of the consultancy services. A strong work ethic of team support and co-operation is fostered, which crosses all internal disciplines and is extended towards both clients and contractors alike. ECL's clients include oil companies, mineral houses, government institutions and international aid agencies.

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### **Fairfield Industries**

Fairfield, a fully integrated international geophysical service company, of-

fiers BOX acquisition systems, acquisition services, processing services, non-exclusive data sales and information services.

Fairfield's expertise lies in transition zone and shallow water 3D seismic surveys and the advanced technological processing of all types of seismic data. Fairfield, private and independent since 1974, was formed as a marine seismic data acquisition and telemetry instrument manufacturing company. In 1987, Golden Geophysical was acquired and became the data processing division of Fairfield.

The Systems Division provides instrumentation uniquely suited to the challenges of modern geophysical prospecting. BOX – The Seismic Data Net gives individual field units the capability to function in real-time radio, cable, or stored data mode forming a seamless 'seismic data net' to cover all terrain – land, transition zone, out to the edge of deep marine.

The Data Processing Division has processing centres located at the company's headquarters in Houston, Texas, and in Golden, Colorado. These centres utilize Fairfield's ProGOLD software in processing non-exclusive and client proprietary projects. Fairfield and PetroVietnam have a joint venture processing centre located in Ho Chi Minh City, Vietnam.

From its offices in Houston and New Orleans, the Data Licensing Division markets and licenses an expanding 3D Gulf of Mexico database of high quality data, acquired by Fairfield's Data Acquisition Division.

The Data Acquisition Division operates three transition zone 3D crews in the Gulf of Mexico. Fairfield has provided acquisition services in over 20 countries worldwide and is seeking new additional international opportunities. Fairfield currently has a spec program in Brazil, as well as other foreign countries.

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### Fastnet Geophysical Laboratories

Fastnet GeoLabs, a Dublin-based geophysics research and development company established in 1998, brings emerging research ideas and innovative services to the petroleum and mineral exploration industries worldwide. During this period the company has worked with major oil companies in some of the most seismically difficult and complex areas available for exploration.

At present, the technology offered consists of numerical simulations which are combined with real geophysical data in order to determine the true quality and reliability of currently available seismic images in areas which have problems with highly heterogeneous layers. The results of these simulations aid future processing and acquisition rounds. The specific problem of sub-basalt imaging has been the main focus of our work up until now, however, these viscoelastic full wavefield finite-difference high performance numerical forward modelling simulations can be used as a deterministic modelling tool to aid interpreters in any area.

The effects of various masking geometries, in, for example, sub-basalt regions can be investigated for both real and synthetic source functions. Sweeps of source frequencies, source-receiver configurations and streamer versus OBC data can be investigated. Fully processed 2-D synthetic seismic sections can be produced in both homogeneous and heterogeneous materials. The heterogeneous models, which include topography and realistic geostatistics, can be based on current geological interpretations provided either by the client or from analogous geological situations.

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### Flagship

Flagship is an independent software publisher for the E&P industry. The company has been providing solutions in the field of seismic reservoir characterization, modelling and mapping techniques since 1997. Each product is

designed to apply robust analytical and interpretative processes to data to improve insight into geological variations. The most popular package is Stratimagic, sold to over 160 client locations around the globe.

Flagship products connect to the main project databases such as OpenWorks and GeoFrame, facilitating easy access to data and minimal replication of information. Each package incorporates leading-edge technologies under licence from major oil companies such as Elf Aquitaine, Agip and Unocal. These technologies have proven their capability, e.g., at improving asset team productivity, improving reservoir prediction, ensuring exploration success in new ventures, etc.

Flagship has a worldwide network of 11 local representations directed out of three regional hubs (Houston, Cambridge and Jakarta). These offices provide support to the client base. In addition, training classes can be arranged at Flagship facilities or at the client's location. Consulting services help clients put new ideas to work, and improve their insight into the full capabilities of the software. For clients wishing to apply the technologies out of house, project services are available to perform turn-key studies of client data.

### Fugro-Geoteam

Fugro-Geoteam, part of the worldwide Fugro Group, operates within the fields of marine seismic and seabed surveying; seismic data acquisition, interpretation and processing; and navigation and positioning.

Within the Fugro Group, Fugro-Geoteam has worldwide responsibility for marine seismic exploration. The company's 30 years' experience has enabled it to become a major player in the 2D and 3D proprietary and non-exclusive seismic markets. Focusing on flexibility and co-operation with clients, it promises optimal data quality, fast turnaround and innovative, yet low cost projects. All data is acquired by the company's own fleet of five dedicated 2D and 3D seismic vessels. In addition to its traditional areas of Norway and the UK, it has extensive experience of

2D and 3D exploration projects in the Mediterranean, Caspian, West Africa, Gulf of Mexico, Caribbean, and South America.

A further five survey vessels are specially equipped for high resolution geophysical activities. This area of the company has its main focus on drilling hazard surveys with vessels adapted for cable and pipeline route surveys, deepwater surveys and multiple streamer operations.

The company provides sub-metre positioning accuracy for marine and land activities using the Fugro Group's worldwide STARFIX-MN8, Seastar and OmniSTAR DGPS systems. Typical projects include the positioning of seismic vessels and vehicle tracking, as well as aerial and sub-sea positioning.

Safety and quality control are of paramount importance to Fugro-Geoteam, and its commitment in this area is reflected in the number of safety awards received.

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### GeoCenter

From its beginning in January 1980, GeoCenter has been guided by real world requirements arising from a true production environment. Early on, the company identified a vital need in the oil and gas industry for more applicable processing technology and has designed an interactive system that has proven revolutionary in its flexibility.

Today, GeoCenter maintains this real world philosophy. It contracts seismic data processing services to major oil companies, large independents and numerous smaller companies. Its projects encompass surveys from most of the significant geologic provinces in the world.

Rich experience gained from a wide variety of imaging problems presented by many different depositional and structural environments profoundly influences the ongoing design and development of GeoCenter's seismic interactive processing system SeisUP.

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### Geocon

Geocon is an international earth science consultancy. It provides comprehensive management and consultancy services in all aspects of exploration, engineering, information technology, safety and the environment.

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### Geofizyka Kraków

Geofizyka Kraków (GK) has been acting for over 44 years as a contractor of wide independence and self-determination in geophysical explorations. With its experience in seismic modelling and design, acquisition, processing and interpretation together with a full range of well logging and project development at clients' requests, GK has contributed to the discovery of 75% of hydrocarbon deposits in Poland.

The most challenging regions of operations have been in the Polish Lowland, Carpathian Foredeep and the Carpathians market by high complexity of geological structure, difficult terrain access and urban areas with extensive industry infrastructure. A full range of seismic data acquisition has been performed for numerous companies, such as Amoco Poland, Apache Corporation and Medusa Oil & Gas. Services have been carried out abroad in the Ukraine and currently in Pakistan where GK has a branch office. Wireline logging services using a wide spectrum of Halliburton log tool applications together with wellsite post-processing and data processing/log interpretation has been rendered for Texaco, Elask, Wielkopolska Energia and Schlumberger Logelco.

Large scale 2D/3D seismic turnkey projects are carried out with explosives/vibrators sources, continuously upgraded equipment and highly experienced, overstrained survey teams to withstand the most rigid demands of both domestic and overseas clients. Strict preservation and full compliance with HSE regulations and norms are a high priority in GK's

policy. To help achieve these goals and match technology to the demands, telemetric equipment of I/O System Two and recently purchased I/O System 2000 recording units, vibrators and maintenance and real time GPS positioning devices are utilized with hardware/software computer facilities.

A seismic data processing centre is equipped with IBM SP2 and RS systems, all connected to fast switched Ethernet network. Standard processing covers in-field QC, interactive analysis, DMO and pre- and post-stack 3D migration and can provide VSP, seismic inversion and AVO for specific geological objectives.

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### Geofizyka Toruń

Geofizyka Toruń (GT) offers a wide range of geophysical services to the oil and gas exploration industry. Its core business activity involves 2D/3D seismic data acquisition, 2D/3D data processing, 2D/3D fully integrated interpretation and well logging. GT has long experience, expertise and capacity to carry out large-scale 2D and 3D projects. It has completed over 25 3D surveys (from designing and acquisition through data processing to reservoir evaluation) in the past seven years. The company is well equipped with the latest MARK IV Vibrator systems (optionally explosive source can be used), integrated GPS for positioning and modern 24 bit I/O telemetric systems with capability up to 2000 recording channels.

GT offers a complete range of 2D/3D/VSP land and marine data processing /reprocessing including wavelet processing, 2D/3D pre-stack depth migration and 2D/3D velocity model building, using a powerful network of multiprocessor computers and Landmark software.

GT is a specialist in advanced 2D/3D seismic interpretation based on extensive experience, the Landmark interpretation software it applies and close co-operation it maintains with its clients. The company also offers its pro-

fessional services in well logging. Halliburton logging equipment allows conducting logs in deep open and cased holes and production wells. The acquired data are processed preliminarily on site and then subject to final in-house processing.

GT employs over 200 full time specialists who have a long history of involvement in domestic and international projects. With the background of more than 30 years of geophysical experience, GT is recognised by many clients in almost 10 countries. Geofizyka Toruń is a Polish company founded in 1966 as a state enterprise. In July 1998 it was transformed into a limited liability company, Polish Oil and Gas Company being its sole shareholder. The company is a member of the IAGC.

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### Geological Society

The Society was founded in 1807 as the Geological Society of London and is the oldest geological society in the world. It received its Royal Charter in 1825 for the purpose of 'investigating the mineral structure of the Earth'. The Society is Britain's national learned society and professional body for geology with a membership exceeding 8800. It has countrywide coverage and approximately one fifth of its membership resides overseas. The Society is responsible for promoting all aspects of the geological sciences and the profession. The Society has its own publishing house to produce its international journals, books and maps, and is the European distributor for materials published by the American Association of Petroleum Geologists, the Geological Society of America, the Society for Sedimentary Geology (SEPM) and the Geologists' Association. The Geological Society publishes the 'Geological Society Special Publication Series' books per year, as well as 'Memoirs', 'Special Reports' and 'Engineering Geology Special Publications'. Its journals are *The Journal of the Geological Society* and the *Quarterly Journal of Engineering Geol-*

*ogy*. The Society also jointly publishes *Petroleum Geoscience* with the EAGE.

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### Geological Survey of Finland

The Geological Survey of Finland (GTK) was founded in 1885. Today it is one of the leading geological organizations in Europe, providing both consultancy services and basic geological information.

Governed by the Ministry of Trade and Industry's technology group, the fundamental mission of the GTK is to maintain, update and distribute geoinformation on the land and coastal areas of Finland, and to research and develop new exploration technology and know-how. It also provides information to promote the sustainable and balanced use of geological resources, with an emphasis on the needs of the mining and construction industries, land use and environmental issues.

Services provided by the GTK relate to resource exploration and assessment (including minerals, groundwater and peat), geophysical surveys and interpretation, geological mapping, geochemical surveys, laboratory services, nuclear waste disposal research, marine geological surveys and preparation of thematic maps. Applied geology, especially environmental applications, has recently become an important service area. Specific request and most integrated projects can be conducted, with the use of external partners when necessary. The GTK also conducts work elsewhere in Scandinavia, and in Russia especially in the Karelian Republic and in the Kola Peninsula, as well as overseas. In recent years the GTK has been active in a number of countries in Europe, Eastern and Southern Africa, Central Asia, Southeast Asia and Pacific, and Latin America.

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### Geometrics

Geometrics, now in its 30th year, manufactures a leading range of geo-

physical instrumentation for a diverse range of exploration activities including petroleum and mineral exploration, environmental and groundwater surveys, archaeological and civil engineering. Its instruments are in use worldwide and are supported by a wide distributor network. Current market leading products include seismographs – the StrataVisor NX is a state of the art land or marine seismograph available in up to 240 channels. A/D performance and a Windows NT operating system gives a highly intuitive user interface to allow operation with minimal training. Many innovative online QC functions are available including an optional real time Brute stack. The company's magnetometers and gradiometers include the G-880 and G-881 marine Cs Vapour magnetometers which give low noise performance which, when combined with high spatial resolution and ease of use, makes them high performance magnetometers. Both the G-880 and G-881 can be combined with leading side-scan sonar fish, or configured as gradiometers to improve data quality even further, and ease interpretation. G-858 land Cs vapour magnetometer and gradiometer, a high performance true simultaneous magnetic gradiometer allows use in the highest noise environments.

For conductivity imaging the company offers StrataGem which gives rapid imaging of subsurface conductivity to depths of 300–500 m. Applications include groundwater, geothermal and deep site investigation. The OhmMapper capacitively coupled resistivity system allows productivity increased of up to 20 times over conventional resistivity systems. Applications include environmental, civil engineering, ground water and archaeological surveys.

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### Geonafta

The Geological Bureau Geonafta was established in 1962 as a planning bureau for the Polish oil and gas industry.

Now Geonafta is a research and operating bureau within the structure of Polish Oil and Gas Company (POGC).

The mission of the company includes operator's activity in the Polish and international markets; preparation, evaluation and supervision of exploration projects; analysis and interpretation of geological and geophysical data; development and management of the central geological and geophysical database of the POGC.

The bureau has its headquarters in Warszawa (Warsaw) and incorporates in its structure two regional divisions for the south and north of the country and an operations division in Islamabad (Pakistan).

Geonafta employs more than 500 specialists in the fields of: geology, geophysics, mining, drilling engineering, management and accounting, educated at the university level.

Geonafta is active in Poland and internationally with operations in Pakistan, Syria, India, Azerbaijan and Kazakhstan.

The Bureau's teams perform integrated geological analysis for sedimentary basins, exploration blocks, separate structures and discoveries. The spectrum of investigation varies from large-scale tectonics to micro-scale petrological analysis.

The Geological Bureau 'Geonafta' performs 2D and 3D seismic projects and interpretation; interpretation of well-logging; applied petrology; applied sedimentology and basin analysis; gravimetric surveys projects and interpretations; coal geochemistry; geological mapping and economic evaluation of the exploration and production projects.

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### Geophysical Data Systems

Established in 1991, Geophysical Data Systems of Moscow, Russia operates its business in the areas of processing and interpretation of geological, seismic and well data with a purpose of digital volume reservoir model creation; 2D/3D interpretive processing of the seismic

data including interactive statics corrections with ISA 2D/3D; depth velocity model building and prestack depth migration; delivery of equipment for geophysical work in oil and gas: computers; field acquisition systems; and vibrosources.

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### Geophysical Survey Systems (GSSI)

Geophysical Survey Systems (GSSI), founded in 1970, designs, develops, manufactures and sells commercial ground penetrating radar (GPR) systems worldwide. In the simplest explanation, GPR is very similar to conventional radar, but it looks downward into the earth or other materials to non-destructively detect anomalies.

Commercial GPR systems have many uses, including detection and mapping utility pipes, mapping archaeological features prior to digging, detecting rebar and pipe in concrete, measuring thickness of concrete and asphalt, monitoring highway bridge deterioration, measuring the depth of bed-rock and water tables, ice and snow thickness and mapping other geological features under the ground. Data is presented in real time using Windows NT operating system software. Single channel and multi-channel systems are available.

GSSI also manufactures an electromagnetic induction (EMI) instrument for rapid, NDT reconnaissance and use in such fields as archaeology and mapping environmental pollution.

The company was awarded a second contract by NASA to design the electronics for a GPR system for a future Mars Rover project. The objective of landing a GPR system on Mars is to 'look' beneath the dusty plain that covers the planet and help locate ancient creek and river bottoms where remnants of life might be found. The first contract, now completed, focused on the design of a GPR antenna compact enough to fit payload requirements.

GSSI employs over 50 people full-time people and has sales representation in 35 countries. Over 200 universities around the world own GSSI equipment.

It is used to teach student engineers the benefits of GPR instruments, compared to other methods and technologies used to explore sub-surface terrain and infrastructures non-destructively.

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### Geophysik GGD

Geophysik GGD is a geophysical prospecting company engaged in work for the oil and gas exploration, mining and building industries as well as the environmental sector. With divisions in seismics, potential methods and geotechnics, Geophysik GGD is the German enterprise which offers an almost complete spectrum of geophysical services worldwide.

The company started in 1951 as Geophysikalischer Dienst. Two years after the reunification of Germany, the present Geophysik GGD was founded by privatization. Geophysik GGD employs 70 people, runs up to 10 survey units, a computing centre for seismics, potential methods and GIS plus a laboratory with facilities for petrophysical investigations. With the background of nearly 50 years of geophysical experience, the company preserves a great variety of methods, utilizes state of the art equipment, applies leading edge processing techniques and hence is able to provide a complex methodical approach and a profoundness of geological interpretation.

The surveys and analysis by Geophysik GGD are performed for the exploration of oil, gas, potash, lignite, ground water and raw materials, for the investigation of underground storages and in engineering geophysics. Beyond that, the company investigates foundations for buildings and traffic alignments and executes tasks in environmental protection.

In oil and gas exploration emphasis is laid on 2D/3D seismic interpretation with GeoFrame or SeisWorks, including reservoir characterization with Hampson Russell, and on 2D/3D seismic processing and reprocessing with ProMAX. Seismic data acquisition of shallow targets, 2D/3D workstation

based field processing, quality control, complex studies of weathering zones for seismic surveys, VSP and log processing as well as gravity and magnetic surveys, including 3D modelling and a joint interpretation, are further important activities in the field of oil and gas exploration.

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### GeoRadar

GeoRadar manufactures a stepped-FMCW Ground-Penetrating Radar. A stepped-FM ground-penetrating radar operates by transmitting a sweep of frequencies instead of a pulse, much like a vibroseis substitutes for dynamite as a seismic energy source. The system has a number of advantages for some applications. The primary advantage is that stepped-FM systems can use antennas not suitable for pulse radar. For example, the cavity-backed, log-spiral antennas are very directional, illuminating the ground with a narrow spotlight of energy instead of a broad beam. As a result, images tend to look more like the actual object instead of hyperbolas. The images are easier to interpret and closely-spaced objects can be resolved.

Since the receiver is tuned narrow band, the system is immune to external RF interference and the low-power transmitter does not interfere with other radios. There is no significant ringing and little processing is required, eliminating the migration and deconvolution used to clean up pulse radar images. The system operates indoors and close to metal objects. Both the real and imaginary components of the signal can be recorded to image processing.

The company was founded in 1995 to commercialize this formerly secret system developed by one of the founders working on a government research program.

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### Geoscience

GeoScience is an independent, UK-based consultancy which was formed in 1985. The company provides services in fractured reservoir characterisation, borehole rock mechanics and formation water evaluation to the international oil and gas exploration and production industry. These services are provided by a multi-disciplinary team with a long pedigree in investigating and characterising sub-surface systems. The company has particular strength in evaluating the geology and flow properties of fractured rocks and in the measurement and evaluation of in-situ stress conditions.

Fractured reservoir characterisation establishes the geological controls on storage and productivity from integration of well data, outcrop and reservoir structure. The service ranges from single-well fracture studies through to construction of geological models from multi-well studies. It includes fracture network modelling where appropriate, and evaluation of the role played by in-situ stress in controlling reservoir permeability and flow properties during drawdown. The service evaluates reservoir heterogeneity and contributes directly to planning of well locations and drilling directions to maximise productivity, reservoir simulation, and reserve estimation. Training courses are also provided.

GeoScience's services in borehole rock mechanics focus on the analysis of *in-situ* stress conditions at the wellbore and in the reservoir, and their application to a range of operational activities. The focus is on borehole stability analysis, which uses available data to model wellbore stresses and calculate appropriate mud density profiles. It is used by many operators to reduce risks and uncertainties in their drilling programme, and has demonstrated significant cost savings. Other geomechanics capabilities offered by GeoScience are cuttings reinjection design, sand production assessment, and training.

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### Geosoft Europe

Geosoft is a software and services company that serves the international earth science community through a growing worldwide network of offices, distributors and strategic partners. The company develops solutions for geoscience applications, including many advanced technologies for storing, manipulating and visualizing large-volume spatial data. This reflects a commitment to delivering consistent software value and maintaining a high level of personalized technical expertise and support.

Geosoft addresses client needs with one-stop software and service solutions based on OASIS montaj, a powerful interface for working with spatial data. Solutions can be tailored to deliver the products, custom development, systems integration and services that satisfy the business and technical requirements of each customer.

Geosoft has offices in Canada, United Kingdom, Brazil and Australia. In addition to providing worldwide support, Geosoft adds value via strong technology partnerships with groups such as Northwest Geophysical Associates (NGA)

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### Geostuff

Geostuff manufactures wall-lock geophones and rollalong switches. Its wall-lock geophones are widely used for downhole measurements of P and S wave velocities for tomography, shallow VSP, earthquake site response and foundation investigations. The motor-driven clamp mechanism is robust and reliable, and operates in cased or uncased boreholes. Models are available with automatic orientation mechanisms to rotate the geophones to the azimuth of your choice. Multiple geophone strings are also available, as well as surface controllers. Borehole diameters can vary from 50 mm to over 400 mm.

Rollalong switches for CDP surveys are available for seismographs with 24, 48, 96 or 120 channels. The units are

compact and lightweight, suitable for portable applications.

Geostuff was founded in 1991 specifically to manufacture specialized geophysical accessories where the volume is too small to interest larger firms, but where the availability of such products provides a needed service to the industry.

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### Geo Sys Leipzig

Geo Sys Leipzig designs, develops and produces geophysical measuring equipment and accessories for the oil and gas industry, state research institutes, universities and engineering and consulting offices. The company was established from the equipment building section of the commercial enterprise VEB Geophysik. Its engineers have more than 20 years of experience in developing and producing measuring equipment especially for field applications.

The product range comprises acoustic equipment and systems, open hole and cased hole logging instruments and equipment, borehole television, cables and connectors, electrical resistivity instruments and equipment, recording cabins, full service logging trucks and hydraulic winches.

In 1997 Geo Sys started to develop and to design its own Full Service Logging Truck called GSW (Geo Sys Windenfahrzeug). End of 1998 Geo Sys won a first huge contract for 10 Logging Trucks from one of its major Russian customers. Another contract for 10 Logging Trucks came in from the same customer at end of 1999. Geo Sys now has its own design and manufacturing facilities to produce field service vehicles, skid units and recording cabins completely by themselves.

Standard Geo Sys products include its full service logging truck GSW. Based on any truck chassis, it is equipped with a hydraulic controlled winch and a complete measuring laboratory, including kitchen unit and sleepers. It can be designed and built as specified by the customer.

Acoustic borehole logging tools include USBA 21 ultra sonic logging station designed for cement-bond logs and full-waveform logs in cased holes as well as for continuous velocity logs in open holes and the ABF 14 acoustic borehole televiewer which produces images of the borehole wall by sending out acoustic beams which are received by the same transducer which generates the acoustic beam. The tool can be used in water and oil-based muds as well as in gas-filled holes.

Geo Sys offers standard geoelectric equipment GM 100, as well as modern multi-electrode systems GMS 125 A and GMS 150 for evaluations of site contamination and geoelectric surface prospecting.

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### GETECH

With offices in the UK and Houston, GETECH is a geophysical contractor providing gravity and magnetic data and services to the international oil and mining industries.

GETECH's core business is the archiving and supply to the industry, of gravity and magnetic data from almost every country in the world. It has recently expanded its services offer Training, databasing software and management services, non-exclusive marine gravity processing, non-exclusive and proprietary interpretation studies.

Current projects include: non-exclusive comprehensive gravity and magnetic coverage of the Brazilian Continental Margin and all onshore petroleum basins within Brazil; training courses (in-house and public) in the role of gravity and magnetics in today's oil industry; GETdbase database software solution for gravity and magnetic data; non-exclusive interpretation study (SAMBA) of the offshore Brazilian and West African continental margins, (with reconstructions of the South Atlantic); non-exclusive study of the Senegal Basin – Offshore West Africa; new datasets available for: Turkey, India, Iran, Iraq and Libya; exclusive market-

ing rights for high resolution digital gravity and magnetic data for Russia and the CIS; north Arabian Basins Hydrocarbon Potential Study (NABS) covering Iran and Iraq; Iran aeromagnetic data and depth-to-basement study; and proprietary and speculative marine gravity processing services

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### Geo-X Systems

Geo-X Systems is a Canadian independent processing company and manufacturer of geophysical equipment with almost 30 years in the industry. Following nearly 10 years of running large crews in Canada during the 1980s, Geo-X Systems decided that there should be a more efficient way to approach difficult seismic acquisition. The company developed its own 'affordable' land telemetry system offering advanced features to enable higher productivity, improved data quality and higher reliability. ARAM24 accounts for some of the largest and most difficult 3D surveys, land and shallow marine, all over the world. The company continues to develop innovative features for ARAM24, including the latest Windows NT based central unit with its massive variety of integrated user software.

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### Golder Associates

Golder Associates, an international group of companies, provides comprehensive consulting services to a wide range of industries. Founded in 1960, Golder Associates operates globally from more than 80 offices and employs over 2200 professionals.

Golder's services to the oil and gas industry include fractured reservoir characterisation; VSP processing for fracture imaging; offshore geotechnics; pipeline surveys and environmental assessments.

Golder is active in processing and re-processing multi-component VSP data to image and position fractures, frac-

ture/fault systems and other geological features in 3D space. Projects have been completed where fractures have been imaged to distances of 2 km from the well in areas where seismic data quality excludes the interpretation of such features. Such interpretative processing extends well derived data away from the well bore enhancing geological information critical to the accurate interpretation of well test data. These data sets can also be utilised to investigate anisotropy and examine birefringence.

The results of VSP imaging forms an input to fractured reservoir modelling codes such as Golder's FracMan suite. FracMan is a fully integrated set of tools for discrete fracture network (DFN) analysis of fractured and non-fractured heterogeneous rock masses. The suite includes tools for discrete feature data analysis, geological modelling, spatial analysis, visualisation, flow and transport and geomechanics. The codes have been used extensively since their development and applications include reservoir simulations, mining, water resources radioactive waste management and civil engineering.

In addition Golder offers a full range of land geophysical survey techniques for site investigations, environmental and engineering applications.

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#### **Granite Rock**

Granite Rock is an innovative and technologically driven company based in the heart of Aberdeen, Europe's oil capital. Established in 1996, Granite Rock spent its formative years providing a vertically integrated business specialising in upstream oil and gas, exploration and production services.

Early in 2000, the company became part of the Just2Clicks.com group of companies, new business to business portal operator providing internet based vertical markets to all industries. Since then Granite Rock has focused on the delivery and operation of an independent oil and gas market place. This market place includes a robust and secure trading platform, project manage-

ment and knowledge utility. Through this transformation the company has effectively strengthened its position as an innovative service provider and utility to the upstream oil and gas industry.

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#### **Grant Geophysical**

Headquartered in Houston, Texas, Grant Geophysical and its subsidiaries provide land and transition zone seismic services with experience in over 100 countries and most major oil and gas provinces in the world. In addition to data acquisition, our service line includes seismic data processing and the company is aggressively investing and growing its new seismic data library that contains a considerable volume of data which is less than two years old.

Grant is currently conducting seismic data acquisition projects throughout North America, Latin America, Canada and the Far East. Such projects include shallow water, marsh and swamp, land and mountain surveys. Worldwide, Grant has 35 000 recording channels utilizing I/O RSR/MRX, Sercel and Geo-X ARAM recording systems coupled with 5000 km of the latest in geophone and cable technology. In addition to dynamite and air gun sources, Grant has recently invested in 15 up-to-date 62 000 lb peak force buggy mounted vibrators.

Grant uses a combination of sources, receivers and cable/radio telemetry acquisition methods to produce consistent, high quality seismic results. By combining RSR and MRX technology, greater operational flexibility is achieved. These innovative approaches are necessary when operating in areas of complex geology or with sensitive environmental issues to consider.

Through centres in Houston and Dallas, Grant provides a full range of land and marine seismic data processing services including AVO, inversion and 3D Kirchhoff pre-stack time migration, which gives a more accurate image of the subsurface. Grant has the capacity to successfully process large volumes of 3D seismic data, recently completing

two, onshore 800 km<sup>2</sup> surveys along the Texas Gulf Coast. Grant processes data from around the world including recent successful surveys in North Africa, North America, Latin America and Europe. Applying technology such as Dune Statics to data from North Africa increases the data quality delivered to the clients. Involving the data processing staff early on in the design phase of a seismic survey clearly gives clients advantages in obtaining the best quality data, correct design is critical to the success of the processing.

With 65 years of operating experience, Grant Geophysical will continue to operate innovative and sensitive operations resulting in the best quality seismic data available for its clients.

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#### **Green Mountain Geophysics**

Green Mountain Geophysics (GMG) develops high quality geophysical software applications for acquisition planning, acquisition project tracking and pre-processing operations. It is continuing to develop advanced tools for model-building, ray tracing analysis and even near surface velocity calculations.

For over 20 years, GMG has been providing the petroleum industry with geophysical software that today is used by every leading energy company worldwide. It employs software engineers and geophysicists who are experienced in dealing with the issues and challenges encountered in oil and gas exploration.

GMG was founded in October 1979. Since then, the company has grown from only a handful of employees working in one office in Boulder, to over 30 employees with offices in Colorado, London, Beijing and Moscow. In 1997, GMG became an INPUT/OUTPUT, company, merging with a world leader in seismic acquisition imaging technology for land, transition zone and marine exploration and production. The company specializes in driving to market technology that creates value for the energy industry in the areas of

2D, 3D, 4D and multi-component seismic data including 3D seismic survey planning (MESA); model-based survey design (MESA GRIP); acquisition project management (Alpine); field QC and refraction statics solutions (GeoScribe II and Fathom); and 3D survey design consulting/training (GMG Energy Services)

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### GX Technology

GX Technology is a provider of advanced seismic imaging solutions, centred especially on prestack depth imaging. Equipped with the very latest in clustered supercomputing and staffed with a large and experienced team of imaging consultants, GXT service centres are prepared to handle the largest and most challenging imaging projects and to complete them in a fraction of the time possible with other technologies. Its collaborative, team-based approach and commitment to quality are key to producing the most accurate images of the earth's subsurface, significantly reducing the risk and cost associated with drilling for oil and gas.

GX Technology's new BLink e-services enable clients to interactively share project data, interpretations and ideas with GXT's imaging consultants, all without leaving the office. Blink enhances client communication, collaboration and convenience, improving team productivity and project turnaround.

At the core of GX Technology's success is a continued commitment to the rapid development of innovative technology. EarthWave, its prestack depth imaging and modeling technology, has recently been extended to include a comprehensive suite of time imaging capabilities, including 3D prestack time migration. With the addition of these new services, GX Technology now provides a complete range of integrated seismic imaging solutions.

GX Technology was founded in 1989, is headquartered in Houston, Texas, and has additional offices in

London, Paris, Jakarta, Calgary and Beijing.

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### Hampson-Russell

Hampson-Russell is a software and geosciences services company headquartered in Calgary with regional offices in London and Houston. The company specialises in UNIX and PC software used in projects requiring reservoir description and delineation. The company's software products offered include AVO for 2D and 3D specialist seismic processing, fluid replacement modelling and pre-stack offset synthetics using Zoeppritz and elastic algorithms; eLOG, a complete well log editing, correlation and synthetic seismogram package; EMERGE efficient analysis of seismic attributes for reservoir parameter prediction. The tool uses linear (regression) and non-linear (neural network) methods and has extremely powerful cross-validation techniques to build and apply reliable relationships; GEOSTAT map-based geostatistical analysis (co-kriging) of seismic of seismic and log data; GLI3D, a market leading product in the calculation of 2D and 3D refraction statics using and inversion methodology with ray-tracing and tomographic techniques; and STRATA 2D and 3D seismic inversion using band-limited, blocky, sparse-spike (includes linear programming) and neural network methods. The program has been fully re-written during 1999-2000 and has a great deal of new functionality geared towards validating which inversion method is most suitable for client data.

In addition to software, the company's geoscience services business provides consultancy work with its products and software training.

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### Hart Publications

Hart Publications is arguably the largest publisher of energy related titles in

the world, publishing a wide range of energy magazines and newsletters. Hart's E&P is a large circulation monthly oil and gas magazine covering all aspects of offshore exploration and production. Launched in October 1999 it is a leading source for global business and technology news.

Hart also publishes a number of newsletters covering the European offshore sector, the Asian and African oil and gas markets, along with the Middle East petroleum scene and deepwater technology. As news and editorial quality is the focal point of the company's products the portfolio is completed with a daily service entitled E&P Daily that brings up-to-the-minute news via fax or email. The whole E&P franchise is complemented by website that encompasses all the products and gives details on the industry in general.

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### Hays Information Management

Information is at the heart of business and never more so than in the E&P industry today. Without efficient access to it, the business probably cannot function effectively and without data storage that information cannot be managed.

Hays Information Management (HIM), part of Hays, is a provider of information and data management solutions with over 25 years experience of supplying services to the specialist energy sector.

Hays' strategic focus is on enabling the improved access to information by linking the hardcopy and electronic or digital domains. Considerable investment in the development of an enhanced suite of technologies and services has resulted in a more modular and 'pluggable' suite of service options to suit client needs. These fully support the company's secure data storage, digital remastering and onsite service delivery models for improved library and information management.

The current version of Hays' Open RSO uses latest web technology to offer improved searching capability with

Intranet connectivity. The new Spatial module provides a user-friendly spatial search capability and forms searching to pinpoint specific E&P data assets. The next release of RSO due later this year will offer full internet and cross platform functionality. To further compliment the suite, Hays introduces the Integrated Data Management Architecture (IDMA) which integrates GIS, near-line library-digital data images, hardcopy, technical and corporate information, connectivity with external tools and electronic or physical data delivery.

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### IHRDC

IHRDC is a fully integrated training, publishing and consulting organization serving the worldwide petroleum, natural gas and power industries. IHRDC's commitment to technology transfer began with its founding in Boston over 30 years ago. With offices in Boston, Amsterdam, Cairo and Moscow, IHRDC has developed an extensive line of products and the capability to provide technical, operations and business management training programs and business workshops; a broad range of text, video and multimedia training and reference publications in oil and gas technology; Web based learning systems in the upstream and downstream areas of the oil, gas and power industries; and consulting services in manpower planning, training needs analysis, management consulting, and the development of learning systems

After several years of development, IHRDC has released the newest Web version of IPIMS.ep, the International Petroleum Industry Multimedia System. IPIMS is a learning and reference system designed to provide extensive knowledge and challenging learning plans in the upstream petroleum sector, making each company accessing IPIMS.ep a continuous learning organization. IHRDC is currently producing additional IPIMS systems that will cover the power, gas, operations and downstream sectors of the industry.

With 36 full-time personnel and a network of international representatives, IHRDC continues to provide its clients worldwide with training solutions, technical and marketing support.

The IHRDC network also includes 200 worldwide associates who provide highly specialized writing, consulting and instructional services.

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### Industrial Vehicles International

Industrial Vehicles International (IVI) is a manufacturer of geophysical vibrators. It has been in business for over 30 years and has its products operating in over 30 countries worldwide.

Its wide range of source products includes the 'minivib', 'minivib II', HEMI 50 and HEMI 60. The 'minivib' is a very high resolution source intended for engineering, environmental, and shallow oil and gas projects. It is capable of either P-wave or S-wave output and has a frequency output range of 10 to 500 Hz. The 'minivib II' has twice the output of the 'minivib' and has a frequency range of 10 to 300 Hz. The HEMI 50 and HEMI 60s are 50 000 and 60 000 pound output high production vibrator systems. All these sources have a proven record of reliability in both extreme hot and cold conditions. All our products are available in both off-road buggy versions and highway truck configurations.

A new product just becoming available is the TRI-AX. This source product is a transforming 3-axis vibrator. It is capable of transforming its output from P-wave to crossline shearwave to inline shearwave. This product will have the effect of dramatically reducing the field acquisition costs of a 3C survey.

*Web: www.indvehicles.com*

### The Information Store

The Information Store provides e-solutions to improve business decisions. Its Petrotrek solutions enable petroleum and service companies to better conduct their business through improved utilization of the intranet/internet, and access

to internal and external information. They dramatically improve professionals' access to E&P information, streamline the processes for planning, acquiring, managing and selling data, and prepare an organisation for e-business and e-commerce. From its offices in Houston and Windsor, UK, the company has implemented solutions in petroleum and service companies in North America, South America, Europe, the Middle East and Africa.

The company offers e-solutions for E&P information browsing, procurement & planning; a well information and production reporting modules, and discussing new services; InfoPet for web-access to continually updated license, field and well information in key basins; The Information Exchange which is a one-stop shop for selling and purchasing E&P information; and A&D Web services for acquisition and disposal of assets.

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### Input/Output

Founded in 1968, Input/Output (I/O) designs seismic data acquisition system technology and is an independent manufacturer providing a complete portfolio of equipment for seismic surveys. I/O's products – recording systems for use on land, in the transition zone and offshore, and associated energy sources, receivers, cables and connectors – are deployed throughout the world, where geoscientists record seismic data to locate potential oil and gas deposits.

I/O's vision is to provide industry-leading seismic products, solutions and services that leverage information age technologies, enabling better, more cost-effective exploration and field development decisions. I/O continually focuses its technology on improving the quality and resolution of the image obtained from seismic data, decreasing the environmental impact of seismic data gathering, decreasing the cycle time from first investment by an oil company to first revenue generation, and preserving the value of I/O equipment as technology progresses.

I/O is adding to its tradition of delivering customer value through technology by focusing its research and development efforts on increasing channel count capabilities, integrating radio and cable telemetry, developing lightweight sensing equipment, integrating seismic design for multi-component imaging, and integrating pre-processing and post-processing software capabilities in the data acquisition workflow.

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### **Institute for Energy Technology (IFE)**

IFE is an independent foundation established in 1948 with departments at Kjeller and in Halden. With a staff of 600, IFE is Norway's national research centre for nuclear and energy technology.

IFE's research and development activities are directed at:

- Profitable and environmentally acceptable technologies for oil and gas production, power generation and supply, and energy use.
- Maintaining and strengthening national expertise in nuclear reactor safety, radiation protection and isotope- and irradiation technology.
- Basic research in physics.

IFE offers research-based and exclusive specialized services, especially towards the petroleum industry. Central keywords are:

- Reservoir and exploration technology (basin modelling, petroleum geochemistry, tracer technology, reservoir modelling etc.)
- Process and fluid flow technology (multiphase flow experiments, multiphase flow modelling, process simulation, flow assurance issues etc.)
- Materials and corrosion technology (corrosion studies, corrosion inhibitor studies etc.)
- Environmental technology (chemical and radiochemical analysis, radioactive scale, pollution studies, platform decommissioning etc.)
- Man-machine systems research (control room design and operations, virtual reality modelling etc.)

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### **INT**

INT is a developer and supplier of high performance graphics tools for the geoscience industry. With 10 years experience in the geoscience market, INT provides easy-to-use toolkits, Carnac for C++ and J/Carnac and J/View3D for Java, that enable programmers to improve performance and cross-platform functionality of their graphics applications while reducing development times and maintenance costs.

INT's product line also includes the GeoToolkit, an easy-to-use supplemental library that permits programmers to fast track their development of graphics applications for the C++ platform. The underlying technology, Carnac, is an object-oriented product that simplifies the construction of complex graphical displays within cross-platform environments. INT also has the J/GeoToolkit available for the Java platform.

INT's services include INT TechSource, a consulting team that handles design, programming, education and training, and operations assessment for any size project. INT TechSource offers a complete line of 2D and 3D graphics solutions in Java and C++. The TechSource staff has proven competence in object-oriented technologies and component architecture, graphics, GUI, and web-based technologies.

INT has also developed a dedicated java graphics website, [j-extreme@int.com](mailto:j-extreme@int.com), to make its Java 2D and Java 3D products available for developers. These toolkits are free to download and carry the option of purchasing the source code as well as support contracts.

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### **International Association of Geophysical Contractors (IAGC)**

International Association of Geophysical Contractors (IAGC) is an international non-profit trade association.

Membership includes geophysical acquisition and processing companies, geoscience consultancy companies, geophysical equipment manufacturers, geophysical data brokering companies, service and supply companies and integrated geoscience departments of operating companies.

IAGC was founded in 1971. It has offices in Houston, USA, and Sevenoaks, UK. There are active chapters in North America, South America, Europe, Africa and Middle East (EAME), Australia, South East Asia. Current membership is about 200.

IAGC provides a forum for discussion of topics of mutual interest to its members, including government legislation, regulatory requirements, health, safety and environmental matters, competency and training of personnel. As a trade association, IAGC does not support discussions of a commercially competitive nature.

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### **IRIS Instruments**

IRIS Instruments provides a wide range of high technology geophysical equipment to the groundwater, environment, civil engineering, mining, and geothermal exploration industries.

As a joint venture of BRGM and OYO groups, the company is very active in R&D, so as to continuously update and expand its range of products. The keypoints of all its products are their ease of use, accuracy and compactness.

The IRIS line includes resistivity meters (SYSCAL JUNIOR, SYSCAL R1 PLUS, SYSCAL R2 with multi-electrode imaging capability), induced polarization systems (VIP 3 to 10 kW power transmitters, ELREC 6 to 10 channel receivers), VLF receivers (T-VLF 3 coil system with electric line), electromagnetic systems (MELIS and TX 3000 line and loop source CSAMT system), and magnetotelluric systems (SAMTEC 1 scalar resistivity meter, SAMTEC 2 tensor system).

Recently developed products include SYSCAL KID, a shallow imaging resistivity meter; SYSCAL JUNIOR Switch

48, featuring a complete resistivity imaging system in one single unit; SYSNET, a parallel network resistivity imaging system; CORIM, a continuous profiling resistivity system for shallow exploration; NUMIS PLUS, a modular proton magnetic resonance system for direct detection of groundwater; VIP 5000, a 5 kW induced polarization transmitter; PROMIS 4 and 10, multi-frequency and multi-spacing EM profiling systems; and SLIM BORIS, a 3D Slingram type borehole EM probe for mining exploration.

Beside geophysical equipment, the company is also involved in environmental instrumentation such as groundwater monitoring systems (MADOFIL and MADOSOLO for water level and conductivity recording, MADOSIX datalogger for physico chemical monitoring), geotechnical monitoring systems (SM6 for blast monitoring, PLIP for inclinometry monitoring, OSIRIS for multi parameter monitoring).

IRIS Instruments is the exclusive representative agent of OYO in France for geophysical and geotechnical instruments.

IRIS Instruments provides training and after sales services from its office in Orleans, France, and is supported by a network of agents throughout the world.

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### **japectraining**

*japectraining* is an independent non-profit making organisation, formed originally as JAPEC (UK) in 1980 to provide a training service for the petroleum industry. The main activity of *japectraining* has been arranging short courses to meet the specified needs of the industry, complementing existing commercial course programmes on both general and specialised exploration and development related topics. In-house courses and specially tailored programmes have also been arranged.

*japectraining* also contributes to the broadening of university teaching in petroleum geology and geophysics by pro-

viding subsidised course attendance for some academics. Over its first 19 years *japectraining* arranged a total of 195 courses and seminars and more than 6800 participants have attended. The courses are given predominantly by British instructors. *japectraining* also underwrites conferences, symposia and associated publications by providing financial assistance.

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### **Jason Geosystems**

Jason Geosystems is a fast growing company. The company's core product, the Jason Geoscience Workbench provides a wide range of innovative solutions for 3D reservoir modelling and characterization. These solutions are based on an integrated, 3D, high-tech approach, using quantitative techniques such as seismic inversion, geological modelling, velocity modelling, and stochastic modelling (geostatistics) and even more innovative algorithms that combine stochastic modelling with inversion.

The Jason technology is primarily developed through in-house research, and in some cases in co-operation with international oil companies' research labs. The technology is marketed worldwide to client companies as a software product, as a turnkey project service, or as on-site Jason – client solution centres. Jason has offices in Rotterdam, London, Houston, Calgary, Singapore, Dubai, Perth and Jakarta.

Jason's vision is that the traditional way of qualitatively and separately interpreting seismic and borehole data, as implemented in today's interpretation workstations, will disappear and will be replaced by methods based on integrated, quantitative technology. The reason: today's 'electronic colour pencil' workstations can be used to extract only a very limited amount of information from the available input data. The ideal engines for quantitatively extracting all information in a consistent, integrated fashion are inversion and geostatistics and the combination thereof, as long as such methods are

driven by an underlying 3D geological model. It is for these capabilities that the company and its staff is recognised throughout the world at the largest majors, at small independents and at national oil companies alike.

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### **JEBCO**

Since its inception in 1976, JEBCO has grown into one of the largest independent geophysical contractors. With offices in London, Houston and Moscow, JEBCO's core area of non-exclusive surveys and third party data represents a source of information from both mature and frontier exploration regions of the world.

JEBCO high quality 2D and 3D seismic data has to a large degree been built upon the ability to acquire and process data in logistically and geophysically 'difficult' data provinces, ranging from transition zone OBC seismic to acquisition in some of the most heavily congested waterways in the world.

With excellent contacts within the Former Soviet Union (FSU), JEBCO's databank of over 250 000 km of seismic data, extensive well and other exploration information represents the ultimate FSU data source available to western companies.

In recent years JEBCO has expanded the array of information available to the international exploration community. This includes many high resolution aeromagnetic surveys, over two million high definition worldwide satellite images, GIS databases of frontier regions in addition to extensive environmental and petroleum assessment reports.

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### **LaCoste & Romberg**

LaCoste & Romberg is a 60-year-old company that manufactures gravity meters. Its instrumentation has made measurements on the tops of the world's highest mountains, the bottom

of the deepest oceans, and most locations in between. An L&R meter even went to the moon on Apollo 17. All its instruments use the patented L&R zero-length spring suspension system, developed in 1939. This is sensor technology capable of routine and rapid high sensitivity gravity measurements.

Virtually all the world's geophysical boats use L&R instrumentation in their multi-sensor surveys. The current product line includes the new E-Meter, its versatile land and underwater static meter; Air-Sea System II, the latest generation dynamic meter; and DPD I, a new full deviation borehole logging tool. The E-Meter is an all-in-one fully automated portable gravity meter. This new meter is digitally controlled with auto self-levelling. Air-Sea System II is more compact than previous generations of air-sea meters and fully capable of marine or airborne survey work. DPD I is a deep porosity-density tool capable of any well deviation, from the company which has successfully fielded borehole gravity logging tools for more than 30 years. The new logging service takes advantage of the company's field expertise in obtaining *in situ* bulk densities. The technology is capable of locating pay zones behind casing at a distance from the wellbore. It is also useful for production monitoring, exploration for pinnacle reefs or near salt.

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### Landmark Graphics Corporation

Landmark Graphics Corporation is a wholly owned business unit of Halliburton Company. Founded in 1982, Landmark is a leading supplier of integrated E&P decision-making software and services that transform vast quantities of oilfield data into knowledge-based computer models of hydrocarbon reservoirs. As a result, Landmark customers can better optimize their exploration, development and production decisions.

In addition to providing leadership technologies that impact technical decision-making processes, Landmark's leading-edge software enables energy

companies to integrate their technical-to-business (T2B) processes, which significantly improves capital investment efficiency.

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### L and R Instruments

L and R Instruments was formed in 1997 to provide rugged and dependable geophysical instruments. The first instrument offered is an earth resistivity and induced polarization meter: the MiniRes. The second instrument is a 2 m earth conductivity meter, the MiniEM. Other instruments are under development.

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### Lookout Geophysical Company

Lookout Geophysical provides PC-based field software for acquisition quality assurance and for on-site processing for both land and marine seismic surveys.

New developments include the Wavelet Wizard and other tools for enhancing high-resolution seismic data.

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### Lynx Information Systems

Lynx Information Systems provides services and systems to help explorationists manage, convert and manipulate their precious but difficult to use exploration hard copy (seismic sections, well logs, maps, reports, charts, graphs, photographs etc.) into industry standard digital formats (SEG-Y, LIS/LAS, UKOOA/SEG-P, GIS/SHP files etc). Once captured in this way, the data sets can be image enhanced, vectorised, reconciled, processed and then loaded to workstations for detailed review, interpretation and analysis.

For Explorationists wishing to get up to speed quickly and work effectively in new areas, or to gather additional information in active areas, Lynx

provides pre-built digital exploration data packages from its Exploration Adviser series of GIS and information databases. These are managed in ESRI's ArcView GIS software. Each package consists of a wide variety of hydrocarbon orientated maps linked to well and field databases, well-logs, geological cross-sections, seismic sections and technical reports. The digital products cover areas from around the world such as Iran, Libya, Iraq, Algeria, Egypt, Syria, Venezuela, West Africa, South East Asia and Western Siberia.

Lynx has a network of regional offices throughout the world; Europe, North and South America, the Far East, Asia, CIS/FSU, Middle East and Africa but is always looking for business opportunities with partners and groups in new and exciting locations.

Lynx services/systems include: scanning and vectorising of Exploration hard copy with digital output; Exploration Advisers GIS, digital data packages and databases from various countries and regions; ArcInfo/ArcView customisation and consulting services; sale of non-exclusive, speculative digital seismic data packages; WinPICS; a fast PC based, low cost 2D and 3D seismic data interpretation system; Archivist exploration data management system, data manipulation toolkit and viewers; and UK Onshore Geophysical Library (UKOGL).

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### Mark Products

Mark Products is in the seismic exploration equipment industry offering an extensive line of geophones, hydrophones and ocean bottom cables that meet the highest industry standards for quality and reliability. In addition, it offers a selection of land cables for all major recording systems, including Sercel, I/O, Aram, G-Daps, Opseis and others, all manufactured to meet the most rigid manufacturers' specifications.

One of Mark Products' latest technology development is its multi-axis four component sensor for ocean bottom cables. This industry-proven, versatile and stable multi-axis sensor offers

a remarkable improvement over single-axis gimbaled sensors. Ideal for use in transition zone, ocean bottom and reservoir characterization operations, the sensor utilizes three gimbaled geophones and a robust hydrophone surrounded by an acoustically stealth shroud. The gimbal contains technically advanced UM-2 geophones in a vertical/longitudinal/transverse configuration.

Established in 1965, the company provides complete design, manufacturing, and testing services to its customers. The company also maintains a facility in Calgary, Canada, for geophone string rental and manufacture of cables for a variety of applications. Over the years, the company has broadened its core lines of business, developing specialized products and services to meet changing customer and industry requirements.

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#### **MALÅ GeoScience**

MALÅ GeoScience provides products and specialist services within the geoscience sector. Based on a range of radar and related products, its products cover application areas ranging from shallow archaeology to deep glacial studies. In addition to its manufacturing activities in Sweden, the company offers consultancy services relating to high technology product development as well as a worldwide instrument hire service and borehole geophysical logging services.

The company's more than 60 years' experience in the geoscience sector has led in recent years to the development of lightweight, portable systems that can speed up ground surveys with a reduced level of man power.

Today the product range has been concentrated towards impulse radar technology with the RAMAC/GPR product as the base component. The radar systems manufactured today cover the whole spectrum from GHz-systems for shallow layer analysis, utility detection systems and deep geological mapping systems all based on the concept of

a light-weight, portable, high-speed data acquisition system.

In 1997 the company established a subsidiary company, MALÅ GeoScience in Manchester NH, to cover sales and support on the North American continent.

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Home page: [www.malags.se](http://www.malags.se)

#### **Marine Arctic Geological Expedition**

Marine Arctic Geological Expedition (MAGE) provides comprehensive geological/geophysical services for exploration and acquisition off the shelf and in the world ocean under Russian Federal programs and projects with foreign customers.

Three hundred employees conduct marine seismic surveys in every marine environment from shallow water bays to deep waters. The seismic surveys encompass 2D, refraction, wide angle deep seismic profiling, magnetic gradientometry, marine gravity, bottom sea sampling and high resolution seismic.

MAGE was founded in Murmansk in 1972 to explore new hydrocarbon provinces of the Arctic shelf. In 1994 it became a joint stock company. Nowadays MAGE is a base organisation of the Ministry of Natural Resources for geological mapping of the shelf.

MAGE has sophisticated geological and geophysical data about the Arctic basin (the Barents, Kara, Laptev seas), the Atlantic, Pacific, Indian and Arctic Oceans and the Antarctic (the Ross, Weddell seas). The company owns three research vessels: *Geolog Dmitriy Nalivkin*, *Professor Kurentsov* and *Geofisic* and its emphasis is on technology and service, matched by a commitment to safety and concern for the environment.

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#### **Midland Valley**

Midland Valley specialises in identifying, quantifying and resolving risk in structural interpretation at reservoir and basin scale. The resultant improve-

ments we can help bring to the structure model feed through to reservoir engineering at one end and to basin exploration at the other end of the spectrum of upstream workflow. The company's experience and technology has helped its clients to identify new reserves, improve their field models and drill more cost effective wells. The technology is used by most of the majors and larger state companies. This is often in support of their in-house technology teams as well as working directly with the business units and asset teams. The company seeks out and works on high value or high risk projects where its technology can have maximum client benefit.

Expertise is delivered through software tools, direct project work and through technology transfer and training as appropriate to each individual client. Software products comprise 3DMove, 2DMove, 3DStress and the latest addition, QuickMove. QuickMove brings 3D restoration to the PC as well as workstation and is a workflow-driven validation tool for risk analysis, particularly aimed at the interpreter.

The company has also introduced the Fracture Generator, a 3D stochastic modeller that uses attribute data to determine location, density, propagation and intersection of fractures. This tool is part of a planned suite of new analysis functionality. If the interpreted model is correct, all analyses and choices made on that model will be significantly improved.

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#### **Mitcham Industries**

Mitcham Industries, a geophysical exploration equipment supplier, offers for lease or sale, new and 'experienced' equipment to the oil and gas industry, seismic contractors, environmentalists, government agencies and universities. Headquartered in Texas, with sales and service offices in Calgary, Canada and associates throughout Europe, South America and Asia, Mitcham conducts operations on a global scale.

Mitcham's principals and staff, offering combined experience of more than 150 years, fully recognizes the importance of providing immediate solutions to client's needs. It continually strives to maintain up-to-date equipment availability for its customer's specific exploration requirements, at competitive prices.

As in any service industry, strong customer relations are crucial and are the focus of much of the company's efforts. Its knowledgeable sales force understands that premium service is a must and they are available around the clock. The company's vast equipment and product inventory from leading manufacturers offers a diverse array of technologically advanced equipment for use in land, transition zone and shallow/deep water operations. One-stop shopping is offered with continued support after the sale. Providing time and cost efficient results for each and every customer is the company's goal.

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### Mount Sopris Instrument Company

Mount Sopris Instrument Company, a manufacturer of borehole geophysical instrumentation for over 30 years, has added new features to its MGX II logging system. In addition to the standard line of downhole probes, the MGX II can now operate the ALT Fac40 acoustic televiwer and the ALT OBI40 optical televiwer. Using new Mslog Windows software, the logger can provide real time images from these state of the art tools. Data from these probes is processed using the well known ALT WellCAD software.

Mount Sopris has also launched its 2SAA-1000 full wave acoustic probe. Unlike other standard acoustic probes, the 2SAA-1000 was designed as a modular probe, so the user can configure it for one or two transmitters and up to 8 receivers. A revolutionary new transmitter design allows the user to change frequency from 1 to 30 kHz, as well as operate in monopole or dipole mode. The dipole mode allows the

user to log shear waves directly, even in soft unconsolidated sediments. The probe can also be configured by the user for variable sampling rates and real-time data stacking.

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### Netherlands Institute of Applied Geoscience TNO – National Geological Survey

The Netherlands Institute of Applied Geoscience TNO – National Geological Survey is the central geoscience institute in the Netherlands for information and research to promote the sustainable management and use of the subsurface and its natural resources. The institute has some 400 staff and an annual turnover of about 70 million guilders.

Within the area of exploration and production of hydrocarbons and related fields the NITG-TNO performs contract R&D, technical consultancy and transfer of expertise.

Projects are executed by multidisciplinary teams of specialists ensuring a proper integration of disciplines like geophysics, petrophysics, production geology, reservoir engineering, information technology and instrumentation. The Institute is active in the fields of:

Geophysics:

- 2D and 3D seismic acquisition, processing and interpretation
- Development of advanced interpretation systems for e.g., 3D lateral prediction
- Development of 4D seismic monitoring techniques

Petroleum engineering:

Many petroleum companies have benefited from TNO's services in the disciplines:

- Basin modelling
- Log analysis, geological modelling, reservoir simulation, reserves evaluation, appraisal strategy, field development planning and economics
- Exploration geology
- Environmental impact studies
- Information systems oil and gas:

A combination of expert knowledge of both computer science and applied geoscience ensures maintaining their high standards for:

- Data modelling and data access standardization (TNO is an active member of POSC/PPDM)
- Execution of large scale software engineering projects for exploration and production oriented information systems
- Information and organizational planning.

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### NORSAR

NORSAR is a research company specializing within the fields of seismic exploration and seismology. NORSAR develops and markets commercial software packages for seismic modelling.

NORSAR's R&D in exploration technology is mainly connected with seismic modelling. The company's record comprises research projects, consulting services and software development for the petroleum industry over the last 20 years. Key projects have been: 2D and 3D seismic modelling and wavefield simulation; seismic velocity inversion and tomography; ray theoretical depth conversion; seismic survey planning and seismic noise studies.

NORSAR is developing and marketing the software product 'NORSAR Seismic Modelling' including a 2D and a 3D modelling system. A model can include complex structures like faults, pinch-outs and domes. By means of ray tracing and wavefront construction the user can produce synthetic seismics and various illumination and amplitude maps for primaries, multiples, general P-to-S conversions, and diffractions. Various kinds of survey configurations can be simulated, including VSP and zero offset.

Large surveys consisting of thousands of shots in realistic 3D models may be simulated overnight, and illumination maps may be generated at selected horizons. The software also includes depth conversion and estimation of interval velocities.

The product has input and output facilities for grids, triangle meshes, surveys and SEG-Y files. In addition the software is tightly integrated with the Charisma interpretation system, the Nucleus source modelling and analysis package, the GOCAD model building package, and the VelRock petrophysical modelling package.

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#### **Northwest Geophysical Associates (NGA)**

Northwest Geophysical Associates (NGA) has been processing, modelling, and interpreting gravity and magnetic data for more than 18 years. Since its inception, geophysicists at NGA have been developing state-of-the-art, user-friendly computer software for geophysicists. Through years of careful design and development, our software, GM-SYS, has evolved into the standard for 'grav/mag' modelling on UNIX, Linux and Windows operating systems.

GM-SYS is an interactive program that integrates gravity, magnetic, and seismic data into the interpretive process. It allows the user to construct 2-D or 2½-D models, compute gravity and magnetic responses, and quickly revise models to rapidly test geological hypotheses; invert on block parameters and model geometries. Calculated responses change instantaneously as the model is changed. Models and data can be entered from popular formats such as DXF files or by hand.

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#### **Ødegaard**

Ødegaard provides consultancy services and software to the oil industry. The company offers integrated projects ranging from well log evaluation, seismic interpretation, rock properties studies, seismic inversion for lithology and fluid prediction, timelapse studies (4D) to interpretation of seismic inversion results and geological model building.

The integrated projects are offered through (1) ISIS global seismic inversion and AVO inversion software package for estimation of acoustic impedance and shear impedance: lithology prediction, use of dip in low frequency model and inversion, variable wavelet, 3D multitrace, and global optimization, and (2) OSIRIS precise modelling – full waveform modelling software package: all multiples included, all mode conversions, accurate AVO response, OBC studies, and far offset studies.

Ødegaard, known for introducing innovative new technologies to the oil industry, is represented in Copenhagen, Aberdeen, Houston, Beijing and Cairo.

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#### **OmniQuest International**

OmniQuest International with headquarters in Hengelo, The Netherlands and affiliate offices in USA, Germany, Bulgaria, Austria and Russia offers the geoscience industry an overall broad spectrum of products and services through a highly motivated team of geoscientists.

OmniQuest International is the authorized distributor for major leading geoscience products manufacturers from the USA and Europe and provides competent technical support, including extensive after-sales services to warrant, guarantee and maintain a high level of quality services. It sells hardware and software for data processing, interpretation and reservoir-engineering/simulation and geophysical-geological database, hardware and software systems for data acquisition, equipment for engineering and environmental geophysics.

The company represents among others Pelton Company (vibratory control systems and QC software); IVI (large and mini-vibrois systems including on/offroad vehicles); Bolt Technology (land/marine airguns and downhole sources) and A-G Geophysical Products (marine connectors/cables for guns etc.); DMT-GeoTec (data-acquisition systems and borehole equipment); and MalÅ (Ground Radar Systems). It also

has an extensive inventory of used equipment available for either sale or lease, such as Sercel SN 368, 388, 408 and I/O System II, vibrators, geophones, cables.

Substantial contracts have been procured and completed during the past year with foreign national oil companies and geophysical contractors for on/offshore projects in Germany, Greece, Bulgaria, Russia, Romania, Turkmenistan, Uzbekistan, Kazakhstan and many others.

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#### **Ovation Data Services**

Ovation Data Services is an information management and technology company with offices and affiliations worldwide. Ovation offers a total turnkey solution – PetaSTAR – for the management, archiving and retrieval of all types of E&P information, including configuration, integration and installation. The PetaSTAR solution utilizes 'best of breed' hardware and software from Sun Microsystems, Sony Electronics, LSC, Panther Software and Ovation Data Services. Ovation also specializes in the copying, conversion and archiving of seismic data as well as imaging of specialized E&P data and image/document management using GeOasis software.

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#### **OYO Corporation**

OYO Corporation, headquartered in Japan, supports various geological investigations and geophysical exploration services for engineering, environment and disaster prevention and supplies geological, geophysical and geotechnical instruments in the worldwide market.

The main products that have been newly launched are the engineering seismograph, McSEIS-SX12 (12 ch) and SX48 (48 ch), for static correction in the oil industry. The McSEIS-12 (12 ch) is a sister version of McSEIS-SX24 for conducting refraction exploration jobs for disaster mitigation. Its expanded unit, McSEIS-SX48 with the internal

ZIP drive for data storage, is the optimal equipment for refraction such as high resolution refraction exploration or reflection jobs in a wider area. Its downsized package and lower power consumption makes it easy for transportation.

OYO Corporation also functions as the international business headquarters of its corporation's companies abroad, most of which manufacture geophysical products.

OYO Geospace Corporation (seismic products), Geometrics (engineering geophysical instruments), Geophysical Survey Systems (ground penetrating radar), Klein Associates (Sidescan sonar), Kinometrics (earthquake monitoring products), OYO Center of Applied Geosciences (geophysical research and services), Robertson Geologging (borehole logging products) and IRIS Instruments (geophysical and geological products) are the worldwide group companies of OYO Corporation.

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#### **OYO GEOSPACE**

OYO GEOSPACE consists of a number of companies that manufacture instruments and equipment for oil and gas exploration, with its headquarters located in Houston – Concord Technologies (marine streamer recovery devices, birds and accessories); Geo Space (geophones, hydrophones, land and connectors, cables); Geospace Engineering Research (solutions for reservoir characterization and borehole); OYO Instruments (thermal imaging plotters and digital field cameras); and OYO GEOSPACE EAME (sales and service centre for Europe Africa Middle East).

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#### *Concord Technologies*

The company offers among other products automatic flotation devices including the SRD-500 streamer recovery system, the newly developed Concord navigator streamer depth control system, quick latch mounting collars, slip

rig assemblies, plus engineering and manufacturing services.

*Fax: +1 713 984 0646*

#### *Geo Space*

Geo Space geophones provided reliable data to seismic recording crews. Established as Hall Sears in 1957, the company developed and manufactured the first digital-grade miniature geophone and the first extra-low-distortion geophone for use with today's 24 bit recording systems.

New products include the Sea Array 4, a fully gimballed, 4-component geophone/hydrophone module that is used for multi-component and time-lapse applications. The slim-line unit accommodates a choice of four geophone models: the economical GS-20DX, the close tolerance GS-30CT and GS-32CT, or the X-phone, which provides tight tolerances, low distortion and high spurious response in a single unit. Connection options include integral, offset and pigtail.

The newly introduced Seismic Nail is a compact, 3-component unit with swap-out case tops for easy conversion in the field from land to marsh use. Its fluted case with pointed bottom allows efficient planting and provides improved coupling. Geophones accommodated by the unit are the same as those for the Sea Array 4. Geo Space high sensitivity hydrophones provide operational depths to 1000 metres. Both the MP-24 and MP-25 hydrophones are available with a stainless steel stress relief cable for reliable retrieval after ramming.

In 1999, Geo Space launched a cable manufacturing facility that is now in full production. This facility produces telemetry cable for all major seismic acquisition systems as well as a full line of leader wire and speciality cables. By late 2000, Geo Space will offer a full line of armoured cable for industrial and oil-field applications.

*Fax: +1 713 937 8012*

**GEOSPACE ENGINEERING RESEARCH**

**GEOSPACE ENGINEERING RESOURCES** supplies equipment and

services for high definition seismic reservoir characterization. The new HDSeis seismic acquisition system is providing a catalyst to the development of high-resolution seismic exploration techniques including new downhole seismic methodologies and systems for permanent installed seismic reservoir monitoring.

Downhole seismic services include: 3DVSP, multi-well crosswell imaging, hydraulic fracture microseismic monitoring and uniwell services. Permanent seismic reservoir monitoring include survey planning, system design and manufacture, equipment installation and complete high definition recording services.

*Fax: +1 281 494 8310*

#### *OYO Instruments*

Oyo Instruments has provided quality thermal printing devices for the seismic industry for nearly two decades. The new 600 × 1200 thermal film plotters are designed with a single substrate print head that eliminate the line gaps and inconsistent densities associated with multi-head plotters.

*Fax: +1 713 937 1161*

#### *OYO GEOSPACE EAME*

OYO GEOSPACE EAME is the local sales office for the Europe, Africa and Middle East regions. It also provides local support for the maintenance of many of the systems manufactured by the group companies. Consumables such as electronic parts, film and paper are stocked for immediate delivery. Rental systems for a variety of engineering applications are available for short and long term jobs. This office also represents OYO Corporation for the sale of its geophysical equipment.

*Fax: +44 1582 846010*

#### **Paradigm Geophysical**

Paradigm Geophysical provides geoscience knowledge solutions for the oil and gas industry. It offers integrated, consistent, and scientifically advanced productivity solutions for reservoir description with leading edge products and services. Its innovative, open technology continues to establish new levels

of productivity for the industry, which positions the company in the oil field services sector.

The company's focus on research and development coupled with exceptional system integration and workflows has contributed to the technology and strong market share.

The company responds to challenges through responsive customer support, extending its technical capabilities, and applying know-how and skills for innovative new applications. All are aimed to position its customers well ahead of the competition.

Paradigm's solutions include ECHOS, an integrated suite for seismic processing and inversion. It features enhanced productivity through seamless workflows offering interpretive options using a shared earth model. ERGOS is a comprehensive and integrated software suite dedicated to seismic data interpretation, model building and mapping. It offers a one source solution from data to decision making with fast intuitive, proven technology that is compatible across the full range from Unix to the new high performance Windows NT version.

POROS is the new reservoir characterization product suite which closes the gap between geoscience and reservoir engineering. It helps professionals build geological models from seismic data attributes, using a shared earth model for macro and micro reservoir property description.

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#### Parallel Geoscience

Parallel Geoscience has been providing state-of-the-art seismic software solutions since 1988. Its Seismic Processing Workshop (SPW) includes a complete library of standard 2D and 3D processing algorithms available on Windows and Macintosh platforms. The new Windows version (NT/98) consists of four components (SeisViewer, Tape Utilit, FlowChart and Executor) which may be licensed individually. The client-server design of the product allows the execution to run on a single PC system,

or a high-end server and receive processing jobs from multiple front-end PC systems via the FlowChart.

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#### PEDR (Algeria)

Petroleum Exploration Data Recovery (PEDR) provides the E&P industry with data collection (data inventory for a specific block or permit, collection of seismic sections, well logs, maps, tapes, paper reports, etc); well log digitising (plot, sepia, input documents; many standard output formats – LAS 2.0 as adopted by CWLS, SEG-Y, GQS, TLOG, etc – Exabyte Unix or Diskette Dos output media); seismic scanning and vectorising (input: variable area or variable area/wiggle, tracking or interpolation of wiggle as required, QC, output to industry standard SEG-Y: 32 IBM fl pt, navigation data: user-defined or standard UKOOA format, appropriate media); tape transcription (treatment system for sticky tapes, cleaning, demux seismic field tapes: SEG-A, B, C & D, photocopying field documents: observer report, stacking chart, etc, output on SEG-Y or SEG-D, reformat and concatenate well log tapes, read from and write to standard media: 9 tracks, 3480, 8 mm, 4 mm); worldwide data delivery (express DHL).

*Fax: +213 181 1793*

#### Pelton Company

The Pelton Company, established in 1969, introduced the solid state electronic vibrator control system, the Advance I System. Its technical staff was composed of individuals that had pioneered the VIBROSEIS System at Conoco. Most all of these technicians are still contributing to the organization, keeping alive the basic theory and continually adding ideas to the total experience. Today the Pelton not only stands for a 'standard' in vibrator control but is an energy source control company.

With the recent introduction of the Pelton Advance III Vib Pro System, and the Shot Pro System, and the continual

expansion and capability in the use of GPS, Pelton has in place the technology and expertise to provide increased value to all the components of seismic data collection and processing.

Pelton foresees rapid growth in the use of the multiple directional vibrators, three-component sensors, and a continued increase in the versatility and flexibility of 3D recording. Co-operation has been sustained with most of the industry's leading suppliers to accommodate a seamless source control into the total instrumentation system. The company believes diversity will be key to overall success. Its goal is to be able to switch effortlessly as possible from one source to another and between the various data acquisition applications. Pelton has already made significant advances towards adapting one system that is easily adaptable to any source or a combination of all.

GPS has made an outstanding contribution to the seismic application. Pelton sees the requirement for GPS more demanding than ever. The improvement GPS provides in increased efficiency, safety, and in protecting liability makes it a priority requirement. Greater emphasis will be on crew management and, in particular, on controlling inventory/assets. The resulting improvement in performance will provide a greater return on investment while benefiting the entire industry.

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#### Petroleum Computer Technologies (PCT)

Petroleum Computer Technologies (PCT) was established in Hamburg, Germany in 1989 as a geophysical consulting and software development company. PCT is celebrating its 10 year anniversary this year. It provides software development services (software porting, data conversion, interfacing, and customized workstation development) on workstation and large mainframe platforms, as well as both marketing and software maintenance services in Europe, Middle East and North Africa.

PCT's fully equipped Hannover office was opened in July 1994. Using commercially available processing and interpretation packages, PCT offers conventional and specialized processing and interpretation services. These services include wavelet processing, surface consistent time amplitude and phase corrections, tomographic near surface and refraction statics corrections, accurate time and depth migration and velocity analyses using the latest technology.

PCT is also specializing in tape data transcription and archiving, with emphasis on quality and service. With 30 years experience in demultiplexing/reformatting software development, there are only a few formats that our proprietary software cannot handle. Other than 7TRK and 21TRK, all output media up to and including DVD are supported.

Fax: +49 511 541 5819

E-mail: [pctgmbh@t-online.de](mailto:pctgmbh@t-online.de)

### Petroleum Geo-Services (PGS)

PGS was born in 1991 with two big ideas. First, through innovative technology, the creation of a step change in efficiency, productivity and cost in marine 3D seismic. Second, PGS created a fundamental shift in the seismic data market by establishing multi-client data as a mainstream business. PGS' expansion into oilfield development and production services came in 1997, though plans were already in place when the company was formed.

The seismic fleet has grown to eight vessels and 84 streamers – one of the dominant players. Ramform, introduced in 1995, brought colossal seismic production rates to the industry, smashing all records, and sparking fleet renewal programmes in other seismic companies. PGS owns six Ramform vessels.

In 1991, 3D multi-client activity was unknown outside of the Gulf of Mexico. PGS introduced the concept worldwide. As it grew, further G&G expertise was added to ensure the technical integrity of multi-client investments as the company expanded into new areas. Today, clients select top-

quality, modern 3D seismic data from a portfolio of over 250 000 km<sup>2</sup>, offering an availability and cost advantage that was unthinkable until recently.

By the mid 1990s, the company had developed leading-edge abilities in reservoir description and characterization. A move into production services combined marine and reservoir technologies in tariff-based field production contracts. All four FPSOs now owned by PGS are high-technology, double-hulled vessels capable of service in deep-water and harsh environments.

Within the Seismic/FPSO linkup there lies a profound advantage. PGS' geophysical and reservoir imaging technologies offer insight into the production potential of oil and gas reservoirs. FPSO contracts allow PGS to apply its skills in geophysical applications technology to optimize reservoir performance.

PGS has introduced many new technologies to the industry during its short history, including sub-salt imaging techniques, Ramform technology, S-wave recording, full-offset onboard processing – and many others. Technology has been a constant theme. Today, PGS has a capability to innovate throughout the full E&P value-chain.

Web: [www.pgs.com](http://www.pgs.com)

### Petrosys

Petrosys provides a family of technical software, with particular emphasis on the requirements of the petroleum exploration and production environment. Its products are Petrosys Mapping and dbMap which run under both Unix and Windows environments.

Petrosys has built up a large client base worldwide. There are currently in excess of 390 users of Petrosys software distributed across more than 140 sites. Petrosys staff experience with geoscientific software dates back to the early 1970s, and includes extensive work with interactive graphics, cartography, GIS, relational databases, gridding and contouring, graphical user interfaces and communications. Staff at the company's Adelaide head office provide software development and support backed up by support and market-

ing staff in Houston, Scotland and Calgary.

Strategic decisions to base Petrosys' software development on the use of 'C' with in-house low level libraries for graphics and user interfaces have allowed Petrosys to continue to provide up to date systems that are portable to currently favoured computing platforms. Petrosys is committed to being an 'open' applications vendor, with strong interfaces to most of the other popular applications used in upstream activity. A number of strategic relationships with software vendors and industry groupings such as POSC and PPDMM have allowed Petrosys to be an active member of the petroleum computing community.

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Web: [www.petrosys.com.au](http://www.petrosys.com.au)

### PetroVentures

Access to timely, accurate information is an essential ingredient in the development of forward planning strategies in the upstream petroleum industry. PetroVentures is an international guide to petroleum exploration and development opportunities around the world that offers up-to-the minute, succinct, accurate information about farm-out deals and government acreage releases – as they come to the market. Wolfgang Fischer, managing editor, PetroVentures has over 25 years of local and overseas experience in the upstream petroleum industry with a particular focus on running new venture groups and doing farm-outs.

Started in 1993, PetroVentures has grown rapidly and now provides coverage right around the world. With its international subscriber base constantly growing, PetroVentures has expanded to open representative offices in Europe and North America. It is an industry 'first stop' opportunities bulletin board, compiled and edited by a team with extensive experience in all aspects of the upstream petroleum industry – technical, financial and commercial – with a clear grasp of the information required to screen investment opportunities.

Fax: +61 2 9252 1083

*E-mail:**enquiries@petroventures.com.au**Web: www.petroventures.com.au***Phoenix Data Solutions**

Phoenix Data Solutions specialises in the conversion of paper seismic sections to digital (SEG-Y) format.

Phoenix takes paper seismic sections – in virtually any condition – scans them and then digitizes the traces, using its proprietary SEISTRAC software. The full waveform of the original trace is automatically digitized to provide an extremely accurate digital version of the original data. Applications for this technique include loading paper data to an interpretation workstation; further processing of paper based seismic data (e.g. migration, FK filtering, phase matching, etc.); assisting the assembling of regional montage sections, invaluable for basin evaluation; and the harmonization of display scales, display parameters and processing, across a mixture of vintages of data – as might be found in a typical licence round promotional data package

SeisVU, the company's free Windows NT viewer for SEG-Y files can be downloaded from its website.

Phoenix offers comprehensive post-stack seismic processing services for either existing digital data, or for scanned and digitized seismic data. Similar services, using Phoenix's SEISTRAC software (Windows 95/NT/2000), are also provided by Robertson Research in Jakarta, by CSN in Paris and by Petrodigit in Cairo.

A map scanning and digitizing service is also offered for the digital capture of seismic location data, contours, well locations or other map features. The recently formed Document Management Division specialises in the high volume scanning and electronic archiving of geotechnical documents of all types, whether these be reports, maps, well logs or seismic sections.

*Fax: +44 20 8749 3701**E-mail:**info@phoenixdatasolutions.co.uk**Web: www.phoenixdatasolutions.co.uk***Platte River Associates**

Platte River Associates (PRA) is a developer of petroleum systems modelling software. Established in 1985, PRA has developed one-dimensional and two-dimensional petroleum systems modelling software that allows users to efficiently and cost-effectively identify and analyze prospects with significant hydrocarbon potential and economic viability. PRA's mission is to put technology once reserved for research labs on the desks of the general explorationist, and to make flexible, easy-to-use software that can advance with new technology.

*Fax: +1 303 448 0434***Plotters Plus**

Plotters Plus is an authorised Hewlett Packard (HP) reseller of Designjet plotters and wide format printers plus HP PCs and mobile PCs, servers and networking, information storage, printers, scanners and service support packages. The company supplies a complete range of plotter and printer media and consumables and is able to demonstrate the latest HP technology in plotting and wide format printing at the customers' site connected to their system. Plotters Plus is able to provide HP technology finance products including exchange rental, purchase plan and finance lease purchasing HP products and when purchasing a mix of hardware and software from any mix of vendors. The company has been a supplier of plotters and medial to the oil industry, manufacturing industries and the government throughout the UK for 25 years.

*Fax: +44 16977 48288**E-mail: plotplus@aol.com***PrismTech/OpenSpirit 2000i**

PrismTech is the developer and marketer of the OpenSpirit 2000i Application Integration Framework. OpenSpirit 2000i is an application independent software platform which enables the 'plug-and-play' integration of software applications across the exploration and production (E&P) lifecycle through the use of distributed business objects and services. It allows applications to dynamically share data

and events across heterogeneous datastores and improves developer and end-user productivity. OpenSpirit 2000i has benefits for: application developers; lower development and maintenance costs to integrate with multiple vendor datastores and applications; quicker time to market by exploiting reusable objects and services; broader market for product by better integration with industry leading datastores; and aids UNIX/NT integration and migration. End-user applications include increased end-user productivity by avoiding data reformatting; improved workflow by enabling use of multiple vendors' applications to form a virtual application; increased choice of vendor applications by lowering integration costs; and lower IT support costs by reducing data management efforts. OpenSpirit 2000i is an ideal environment for in-house (oil company) E&P IT developers and managers; systems integrators working in the E&P industry; IT consultants recommending or implementing E&P projects; software vendors developing or integrating E&P applications; and researchers working in the E&P industry.

*Fax: +44 191 4979901**E-mail:**openspirit@prismtechnologies.com**Web: www.prismtechnologies.com***R&R GeoTech**

R&R GeoTech, founded in 1994, operates two geoscience and engineering training centres, one in Stavanger, Norway and the other in Aberdeen, Scotland. Both these cities are the respective oil capitals of their countries with a large concentration of geoscientists and engineers that need regular training in both theoretical aspects and to a greater extent, practical aspects with hands-on training on interpretation workstations and PCs.

R&R GeoTech believes in the concept of creating a shared facility, available for all users and suppliers of training, and thus reducing the cost of training. The two centres are well equipped with UNIX workstations, PCs, projection facilities, and all necessary classroom facilities. Each centre

has multiple rooms enabling parallel classes. In each centre the staff takes care of all administrative issues allowing the course participants and providers to enjoy a productive environment.

Over the years R&R GeoTech has become a point of contact for companies that are looking for specialist courses. R&R GeoTech identifies the appropriate courses and leading trainers in the specialist fields, and makes all the administrative arrangements for the course to run in its facility. In addition to proprietary courses, R&R GeoTech also arranges public courses on which companies can send one or more participants, and in this manner, R&R GeoTech helps cut the cost of training by cutting out the need for poorly attended in-house courses, or for participants to travel abroad for the training they need.

R&R GeoTech provides software and course suppliers facilities for marketing its products without the expense of hiring hotel rooms and ordering equipment from a third party. The R&R GeoTech centres are permanently set up and guarantee a smooth operation.

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### READ Well Services

The READ Group, founded in 1986, employs 170 personnel worldwide and has a turnover of £26 million. The core business activities of the group are seismic data acquisition and processing, production and reservoir technologies and production process, design and manufacture.

The head office is in Oslo. Seismic data processing centres are located in Oslo, Aberdeen and Houston. The offshore operations bases for the North Sea are located in Aberdeen and Bergen. The Americas are operated from Houston.

Acquisition of rig source, offset and complex walkaway VSP services, including 3D walkaway, are performed using multi-level three component sensors, and a range of advanced technologies including downhole sources and large capacity air gun arrays. As an R&D force in the seismic market,

READ is bringing integrated seismic services from a range of technologies such as SMWD for coiled tubing, vertical cables, and OBC.

A team of geophysicists and programmers in Oslo, Aberdeen and Houston specializes in borehole seismic, OBC, and surface seismic processing. READ has a clear focus on R&D activity for development of seismic processing software and has extensive experience with 3D Borehole seismic processing using internal developed software.

The service is characterized by a swift and tailored response to client needs, including a 24 hour fast turnaround of walkaway surveys, AVO, and anisotropy studies, anisotropic depth migration, tomographic inversion, and post-stack and pre-stack surface seismic and OBC processing are among services offered.

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### Robertson Geologging

Robertson Geologging is a manufacturer and contract operator of digital slimhole borehole logging systems. The company has launched its new high resolution optical imaging probe (the optical televiewer or OPTV) together with the latest generation of surface equipment (RG Videologger2) for use in both logging and borehole video surveys.

The OPTV provides a very high resolution continuous colour image of the borehole walls 'unfolded' onto the flat surface of the logging paper. The image is aligned to North by the integral orientation module and full borehole drift and tilt information is also provided.

A major application of the probe is for fracture studies. It is complemented by RG-DIP interpretation software to allow full characterisation of features for dip and orientation. Standard outputs include arrow and stick plots, stereograms, mean dip and zone-axis calculations, fracture density and cumulative thickness. A synthetic core presentation makes this a perfect tool to aid

orientation of fractured or incompletely recovered cores.

A further application is to replace CCTV for casing or well inspection and monitoring where the continuous hardcopy record offers a much more convenient alternative for analysis than conventional VCR tapes. External lighthoods allow surveys in boreholes or casings up to 20 in (51.8 cm).

The OPTV probe runs at full resolution on standard 4-conductor or coaxial wirelines at logging speeds of 2.5 m/min.

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### Robertson Research International

Robertson Research International has been associated with the provision of quality services for the upstream petroleum industry since the early 1960s. The present company has a strategy and structure that will allow it to continue to supply innovative and integrated services, consultancy and products for oil and gas new ventures, exploration, appraisal, development and production throughout the world.

Robertson Research International has an unrivalled expertise and experience in the industry. With more than 500 specialists in geophysics, geology, engineering and data management Robertson can supply integrated teams to meet the demands of the current market. Robertson Geospec, a division of the company formed in 1988, has increased the Robertson presence in the non-exclusive and seismic brokerage business.

The Geophysical Division of Robertson Research International is based in Swanley, Kent. International offices are also situated in Perth, Jakarta and Milan. All of the operational centres offer 2D and 3D, land and marine seismic data processing using IBM and HP computer hardware and either proprietary UNISEIS software or ProMax based applications. Teams of in-house research and development programmers support the operational groups to ensure future requirements are catered for. Integrated products in-

volving AVO and inversion are regularly supplied through the company's interpretative-processing group.

In addition to the conventional seismic processing and interpretation services, Robertson Research International has developed a range products - applications of its Short-Offset processing technique for geohazard and reservoir targets, use of GeoQube for mixed vintage matching, interpolation and 3D migration, specialised depth imaging products and its AVO atlas of the North Sea. Robertson has also introduced to the industry a seismic processing interactive tutorial.

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### Rock Solid Images

Rock Solid Images offers solutions for borehole calibration of seismic volumes for prediction of lithology, porosity and fluids between wells. This is achieved by a unique synergy of leading edge petrophysical and seismic attribute modeling technology and expertise. Seismic attributes are used to extract specific characteristics from seismic data volumes which are then related to rock and fluid properties. Utilizing the science of petrophysics allows a direct relationship between seismic measurements and reservoir properties such as lithology and fluid properties.

In addition to seismic reservoir characterization studies, Rock Solid Images is a provider of advanced software applications such as PetroSolutions, an exclusive spin-off from the Stanford University SRB Project and Attrib 3D, developed from the Seismic Attributes Consortium.

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### Roxar

Roxar is a reservoir technology company providing products/systems for reservoir optimisation and production management. It helps clients to increase production, improve recovery, and reduce development costs.

Roxar's main office is located in Stavanger, Norway with major offices in London, Houston, Perth, Kuala Lumpur and technology centres and other sales offices in Aberdeen, Beijing, Dubai, Moscow, Oslo, Oxford, Calgary and Tønsberg. Roxar specializes in 3D geological modelling, stochastic reservoir simulation, monitoring and metering. It offers expertise and technology for uncertainty analysis, field development planning, reservoir optimisation and permanent monitoring and metering operations. It also provides drilling engineering and drilling operations management.

Roxar is acknowledged for its reservoir modelling applications IRAP RMS and Tempest. It develops software which enables multidisciplinary teams to derive more information from expensively collected data, and therefore provide better decisions in less time. The techniques embedded within the applications are equally applicable to exploration and exploitation. The software capabilities have proved particularly useful in the development and management of marginal and more complex fields where the financial risks are considerable.

The newly launched IRAP RMS 6.0 has been extended to include functionality previously embedded in other elements of the Roxar suite. The new features are advanced engineering functionality, easy ranking of possible reservoir models and dynamic well evaluation from a drilling perspective.

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### Sattlegger

Sattlegger specializes in the development and worldwide support of software system ISPoo3 for processing, migration, modelling and mapping results of seismic interpretation and related information. The software is the result of 25 years continuous development incorporating experience from application in many locations worldwide.

ISPoo3 is highly integrated around geoscience-oriented high performance database system ISPLIB with history file

HIFI and KEYWORD system. It comprises modules for depth conversion, modelling, digitizing, mapping, velocity processing, reservoir volumetrics and synthetic seismogram computation. In addition, ISPoo3 offers modules for data exchange in various formats and with all common seismic interpretation systems.

Modules for 2D and 3D discrete event migration and modelling allow for velocities within formations described by 12 different types of velocity functions whose parameters may vary laterally. Migration and modelling provide displacement vector fields which may be used to move faults and seismic attributes from time to depth domain or back.

ISPoo3 is integrated under LAND-MARK OpenWorks/SeisWorks and is presently being integrated under Schlumberger GeoFrame/IESX and GeoFrame/CHARISMA. The integrated versions are available in addition to the stand-alone version of ISPoo3.

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### Schlumberger Oilfield Services

Schlumberger is a worldwide leader in technical services with operations in more than 100 countries. It comprises three business segments: Resource Management Services, Test & Transactions and Oilfield Services. Resource Management Services provides metering, consulting and analysis services for utility and energy service providers. Test & Transactions provides smart card-based solutions, semiconductor equipment and services and secure Internet systems.

Schlumberger Oilfield Services provides virtually every type of service to the upstream exploration and production industry. Worldwide service is delivered by 25 GeoMarket regions, which bring together geographically focused teams to meet local needs and to provide customized solutions. New technological development is organized into three product groups that represent the key processes that dominate oil company requirements throughout the

life cycle of the reservoir. Reservoir Evaluation provides wireline and seismic services. Reservoir Development combines all services relevant to well construction and well productivity: directional drilling, pressure pumping, drilling fluids, testing, drilling bits, electrical submersible pumps and completion products.

Reservoir Management brings together the services needed for comprehensive reservoir optimization projects, including integrated project management; data services, interpretation development and consulting services; software products from GeoQuest and Merak; data management services; and gas compression services and production systems.

This year, Schlumberger launched a revolutionary new technology for land, marine and borehole seismic imaging. Q-Land, a single sensor seismic acquisition system with 30 000 channel capacity, was launched in March. Q-Land delivers an optimally sampled 3D seismic wavefield corrected for the intra-array perturbations that degrade the seismic signal with conventional acquisition systems.

GeoQuest continues to advance the GeoFrame reservoir characterization system, which is its centerpiece for software development. This year GeoQuest is introducing new software applications to the GeoFrame suite of products, including SeisClass attribute analysis and classification and Seismos seismic data processing system, as well as adding new high-performance visualization and 3D interpretation capabilities in GeoViz three-dimensional interpretation and visualization software.

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Web: [www.slb.com](http://www.slb.com)

### Scintrex

Scintrex has more than 50 years experience in geophysics. The company comprises two main branches, the Earth Science Instrumentation division and the Survey division. With its own instruments and the recent acquisition of Auslog and Micro-g Solutions, Scintrex

has a wide range of geophysical instrumentation to offer. The recent addition by acquisition of EDCON, ValdOr Sagax, Sial Geosciences and PhotoGravity to the existing Survey division which included Scintrex Surveys, Scintrex Pty and Megafisica enables Scintrex to provide a complete range of geophysical survey solutions. It can provide instrumentation or survey solutions for borehole, airborne and marine geophysical needs.

New developments include SARIS, a fully automated resistivity system designed for high resolution targets for such applications as the groundwater and environmental markets. In addition, the Micro-g subsidiary has started making deliveries of its new A10 Absolute Gravimeter.

Scintrex operates its various business units through its head office in Toronto, Canada and through regional offices in Dallas, Houston and Denver in the USA, Rio de Janeiro, Brazil, Chile, Mexico, France, Brisbane and Perth, Australia.

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### Scott Pickford

Scott Pickford is the reservoir management arm of Core Laboratories. As a result of the integration with a number of seismic processing and geoscience consultancy companies acquired by Core Laboratories, Scott Pickford has 400 staff with offices in London, Aberdeen, Houston, Calgary, Lagos, Mexico, Caracas, Rio de Janeiro and Jakarta.

Scott Pickford operates in two principal business areas to provide integrated reservoir solutions: production and reservoir geoscience (PRG) and advanced reservoir geophysics (ARG).

PRG: The integrated geoscience consultancy division, comprising interpretation geophysicists, geologists, petrophysicists and engineers. The principal activities of PRG rely upon successful multidisciplinary collaboration. These include unitisation/equity re-determination resolution and support; independent asset valuations/reserves certification; reservoir characterisation; formation evaluation; exploration sup-

port; regional prospect analysis and reservoir management.

ARG: This group has been created as a vehicle for the delivery of a mix of leading edge reservoir characterisation techniques. These include depth conversion, depth imaging, P-wave anisotropy, Coherence Cube processing, AVO analysis, trace inversion, Lambda/Mu/Rho parameters, attribute analysis and 4D seismic. ARG establishes a coherent approach within which to capitalise on these diverse, yet related, capabilities. Fundamental to ARG is the premise that regardless of the nature of a problem, the solution may be within the seismic. It recognises two scales of uncertainty; the reservoir framework, such as geological setting, structure, depth and faulting; and reservoir properties, including lithology, porosity, fluid fill and overpressure. This approach can and does succeed by integrating fundamental seismic processing skills and techniques, an in-house suite of specialised geophysical software applications and substantial interpretation experience with the ARG toolbox of technologies.

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### SeiScan GeoData

SeiScan GeoData is a specialist geoscience contractor for E&P data with established offices in London and Houston. A new office in Aberdeen will open immediately after EAGE 2000.

The company was founded on the basis of its proprietary software SeiSfile designed to allow the conversion of hard copy seismic data to SEG-Y format. SeiSfile features a total waveform tracking algorithm that allows the reconstruction of digital files with a remarkable degree of accuracy.

Other software packages, including LogFile for log digitising, have been developed to allow the conversion of other hardcopy data (well logs, maps, reports, etc) into modern digital formats. Data that already exists in digital form can be transcribed to modern media for efficient management of all data either in the workstation or corporate

database environment. Licenses for the software packages SeiSfile and LogFile are also sold to third parties.

Initially designed to complement the data conditioning services, SeiScan GeoData offers customised seismic processing, log curve manipulation and map rationalisation services. This has been expanded to incorporate old and new data so that datasets can be organised as fully integrated workstation projects.

Additionally, SeiScan GeoData has established a VSP planning, processing and interpretation service that is completely independent of any VSP acquisition activity. Staffed by acknowledged experts in this field, the VSP section is growing rapidly as it seeks to impart the knowledge from their combined experience to oil company interpreters.

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#### Seismic Image Software (SIS)

As developer of 2D/3D seismic processing software (VISTA) and 3D survey design and analysis software (OMNI), SIS offers professional services ranging from 3D-survey design and bid evaluation to large integrated projects involving 3C/3D or time lapse studies, seismic processing QC/analysis and post-mortems.

VISTA, with leading edge technology algorithms for statics noise attenuation and imaging plus many powerful QC functions to locate and correct position and data errors, is ideal for field crew use, office processing or as a teaching tool.

The company's OMNI suite provides 3D-survey design for surface, subsurface and artefact analysis.

Fax: +1 403 266 2685

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#### Seismic Micro-Technology (SMT)

Since 1984, Seismic Micro-Technology (SMT) has provided computer technology to the geoscience industry. At SMT's goal is to produce, provide and maintain quality PC interpretation software, at a reasonable cost. SMT is com-

mitted to a philosophy of quality, flexibility and personal assistance.

Seismic Micro-Technology was the first to develop software for Windows NT and it continues expand its range of exploration tools. Currently available from SMT is *The KINGDOM Suite*. This bundle includes: *2d/3dPAK*, for Windows NT-based seismic interpretations of 2D and/or 3D data; *VuPAK*, an interactive tool that offers full interpretation capabilities in the 3D cube; *SynPAK*, a full-featured package that helps streamline the process of synthetic seismogram generation; *TracePAK*, a cost-effective solution for analyzing and processing post-stack seismic data; and *ModPAK*, an effective tool for creating a unified geophysical/geological model of the subsurface.

Available soon is the release of *The KINGDOM Suite+*, which will add *EarthPAK*, for the geologist, to our seamless integration of products.

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#### SERCEL Group

In the geophysical equipment market, the SERCEL Group has been providing the industry with high-technology solutions since 1956 for land, shallow and marine seismic operations meeting the requirements of any oil exploration project.

The SERCEL Group continuously endeavours to improve its products with the latest technology available and with a large part of its staff dedicated to R&D activity. Being ever closer to its clients and their needs is also one of the prime concerns of the SERCEL Group, with a presence in 10 locations worldwide.

Having acquired Syntron last December, SERCEL offers a complete range of versatile equipment for total coverage in all environments continually evolving for better performance, flexibility and reduced weight aiming to provide its customers with highly productive acquisition systems:

- Land data acquisition systems (SN388 & 408UL): recording units, combined cable and radio telemetry,

mono- or multi-channel units, cables, geophones and hydrophones;

- Marine data acquisition systems (Seal & Syntrak);
- OBC and streamers products;
- Real-time quality control software (SQC-Pro & SeaPro QC);
- Vibrators and vibrator electronics (VE432);
- Drills and borehole seismic tools (MSR, SSR).

As part of the services related to equipment, SERCEL customer support provides assistance in starting up seismic systems, and offers training courses in the use of SERCEL equipment.

With its worldwide teams, SERCEL customer support is able to provide any assistance, from set-up of systems to engineering updates, everywhere in the world 24 hours a day, 365 days a year. With extensive field experience, the company's engineers are very close to clients for a better understanding of their current and future requirements.

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Web: www.sercel.com

#### SEVMORGEO

State company SEVMORGEO of St Petersburg, Russia was founded in 1991 on the basis of the Scientific and Research Institute of Marine Geology and Mineral Resources engineering centre. At first the company specialised in scientific research and design of new technologies for marine geological prospecting. Now the main activities are scientific research, development and introduction of new marine technologies for geological survey of hydrocarbons and mineral resources in the world ocean and offshore zones; offshore deep structure profiling using OBS, transition zone 2D and 3D seismic survey; marine and airborne geophysical survey for state geological mapping; deep sea and transition zone geotechnical survey, sampling and drilling; state geological environmental monitoring in the Russian Arctic offshore; automatic navigation and stabilisation and steering control; technologies of integrated geological and geophysical data interpretation; and informational support, different data banking (geology, geo-

physics, geocology) of the Russian Arctic and Antarctic.

The staff of SEVMORGEO consists of 300 graduate specialists including three members of the Russian Academy of Sciences, five professors and 32 PhDs. All available company devices, technical systems and methods have passed state control and obtained required certificates. All laboratory and field systems connect up to IBM-compatible PCs with real-time software for data processing and interpretation. The company's main customers are the Russian Ministry of Natural Resources, GAZPROM and different Russian oil companies.

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### Sevmorneftegeofizika (SMNG)

Sevmorneftegeofizika (SMNG), founded in 1979 in Murmansk, Russia, is a large Russian offshore geophysical company providing a wide range of geophysical services, including marine seismic data acquisition, radio navigation, VSP, data processing, and data interpretation.

SMNG owns a specialized fleet of seven vessels built in Finland, Poland and Russia between 1983 and 1989, equipped with 16-bit and 24-bit digital streamers, integrated navigation systems and multi-array energy sources, and capable of shooting high-resolution 2D/3D surveys worldwide both in deep and shallow waters.

SMNG has two processing centres located in Murmansk and Gelendzhik, Russia (in its subsidiary SMNG South) equipped with IBM RISC-6000, Sun Sparc Ultra-I and Sun Enterprise-4000 systems with ProMax 2D/3D, VSP (Landmark) and Focus 2D/3D, GeoDepth 2D/3D (Paradigm) software.

SMNG's interpretation department has an extensive network of Sun Unix workstations, and PC desktops running Landmark 2D/3D and Paradigm 2D/3D interpretation software.

SMNG has worldwide experience in seismic data acquisition in the Arctic Seas, North Sea, Atlantic Ocean, Antarctica, off West Africa, Spitsbergen,

the Falkland Islands, Cuba, the Gulf of Mexico, in the Mediterranean, Black, Azov, Caspian and Irish Seas.

Since 1991 most of the SMNG's vessels have been operating under agreements with BGR, CGG, Digicin, Geco-Prakla, Lasmo, PGS, Spectrum, TGS-NOPEC, etc.

SMNG has prepared and produced a number of seismic data sets and atlases covering Arctic Seas, Black and Azov Seas and available for sale under non-exclusive license agreements.

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Web: [www.smng-geophysics.com](http://www.smng-geophysics.com)

### Silicon Graphics

Silicon Graphics (SGI) is a leader in high-performance computing technology. The company's systems, ranging from desktop workstations and servers to the most powerful supercomputers in the world, deliver advanced computing and 3D visualisation capabilities to scientific, engineering, and creative professionals and large enterprises. In addition, SGI creates innovative software for design, Internet, and entertainment applications. SGI provides solutions in key industries, including manufacturing, government, entertainment, finance, communications, energy, the sciences, and education. Headquartered in Mountain View, California, SGI and its subsidiaries have 34 offices and approximately 7800 employees worldwide.

As the emergence of a global market increases competition in the energy sector, companies look to information technology to help reduce time to insight and enable new collaborative methods of working across different geographical and cultural boundaries. SGI's visualisation facilities offer solutions for viewing and managing life-size, real-time simulations of virtual models and processes.

These capabilities allow oil and gas companies to interpret large volumes of data – identifying and rectifying problems earlier in the design cycle, improving extraction efficiency and reducing drilling risk.

Bringing teams together in an immersive environment improves collaboration. Data can be incorporated from all exploration disciplines – geophysical, geological, petrophysical and engineering. And by connecting these environments over a high-speed network, companies can share models on large screen displays across multiple sites worldwide. Video and audio capabilities enhance discussion of data while SGI supercomputers enable the manipulation of data models in real time. SGI customers include BP and Texaco.

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Web: [www.sgi.com](http://www.sgi.com)

### Spectrum Energy and Information Technology

Spectrum Energy and Information Technology is an established group of companies providing seismic data processing, non-exclusive surveys and electronic data management services to a wide range of international clients. With headquarters in Woking, UK, Spectrum now has operational centres in Houston, Buenos Aires, Cairo, Lagos and Tehran with active joint ventures in Islamabad and Algiers.

The technical capability and performance of several of the group's computer centres were increased last year in line with the increased demand for Spectrum's services, particularly 3D seismic processing utilising pre-stack Kirchhoff time migration. The major processing centres continue to use the successful combination of interactive SeisUp running on multi CPU Hewlett Packard Exemplar systems with the addition of an NT cluster to run prestack time migration.

As a pioneer of seismic trace scanning and digital reconstruction, Spectrum continues to improve its Geoscan service and product with more sophisticated reconstruction algorithms and an upgraded, interactive operating environment.

Spectrum Data Management provides an integrated range of document scanning and transcription services predominantly to the E&P sector. Transcription services include seismic media preconditioning, 3D polygon extraction

and workstation data loading together with re-mastering of old tape media to new high density cartridges.

Spectrum Data Management is increasingly active in providing systems, integration and consultancy services in support of the implementation of document imaging technology.

Non-exclusive surveys are an important part of the group's activities. The international portfolio has recently increased with the completion of phase one of Spectrum's offshore Brazil survey and additional Nigerian data.

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### **Society of Exploration Geophysicists (SEG)**

The Society of Exploration Geophysicists (SEG) (founded 1030) has more than 17 000 members in 100 countries. SEG publishes two journals, *Geophysics* and *The Leading Edge*, seven technical books per year, and has more than 10 000 pages of geophysical material on its Website. SEG has hosted international conferences and expositions for explorationists for more than 40 years. Major conferences/expositions in 2000 will be held in New Delhi, Caracas, Bucharest, Bali, and Bahrain.

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### **SODERA**

SODERA in France designs and develops a full range of marine seismic sources, offers a complete test facility and a full support and service for the products manufactured by its sister company Seismic Systems of Houston.

The G. GUN has proved to be a simple, reliable and repeatable air gun, with a range of volumes from 20 cu in to 250 cu in. It can be easily assembled in parallel cluster, specially designed for the G. GUN to overcome all the problems currently encountered by the air gun cluster users.

Scaled down model from the already compact G. GUN, widely used on major flagships, the MINI G. GUN retains the same advantages plus an even simpler technology, making it totally suitable

for shallow water application and transition zones surveys.

The GI GUN, with its capability to reduce or suppress the bubble oscillation, is well adapted to shallow water and transition zone surveys. The G/GI GUN Linear Cluster, a hybrid source made of one G. GUN and one GI GUN rigidly assembled in a linear cluster, provides a stand-alone-low-frequency source. The MINI GI high-resolution source and the S15 Watergun are primarily designed for very high-resolution surveys.

Recently introduced to the industry, the Shut-Off Safety Valve successfully combines the insulation of a leaking gun, without extra wiring, with some safety devices leading to more reliable and safer operations.

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### **Sonardyne International**

Sonardyne International designs and manufactures subsea acoustic positioning and navigation systems for the offshore seismic industry.

For deep marine operations, the company's SIPS 2 (Seismic Integrated Positioning System) system enables networks of over 20 streamers to be rapidly positioned. It uses a combination of signal processes techniques to allow many more ranges to be collected in a single shot point that conventional systems, whilst ensuring reliability in the harshest acoustic environments caused by ships' wakes and gun bubble clouds.

Sonardyne's TZ/OBC system uses low-cost, rugged transponders to provide accurate positioning of hundreds of hydrophone ground stations. The positioning process is independent of the seismic recording system and does not require the vessel to be connected to the bottom cable. An integrated RFID system provides automated asset tracking of both transponders and cable sections.

Other seismic systems from Sonardyne include low-cost acoustic release transponders to assist with cable recovery and Ultra-Short BaseLine (USBL) systems which can be used to determine both drop co-ordinates and

the final lay-down positions of 4C and 4D cables.

Sonardyne is based in Hampshire, England and has regional sales and customer support offices in Aberdeen, Houston, Singapore, Brazil and Norway. In 1996 the company won the Queen's Award for Export Achievement adding to the Queen's Award for Technological Achievement in 1994 for Sonardyne's original SIPS system.

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### **Sony Data Systems**

Sony Data Systems provides a wide range of high-performance tape storage devices and data management capabilities for a wide variety of computing and instrumentation recording applications that include: enterprise-wide data backup and restore, storage area networks and digital asset management and real-time data acquisition.

The flagship for Sony's large scale digital archive and enterprise data back-up solutions is the DMS-8400 PetaSite. Scalable and highly flexible in design for data storage applications up to 29.0 Petabytes (compressed) or 11.2 Petabytes (native). All capacity specifications for libraries are based on DTF-2 large cassettes.

DTF (Digital Tape Format) computer peripheral tape drive incorporates fibre channel connectivity and a 24 Megabyte per second data transfer rate. Highly suited for a wide range of computing environments they are supported by a host of data management applications.

*Fax: +1 201 358 4215*

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### **Sun Microsystems**

Sun has been providing high performance solutions to the petroleum industry from its inception in 1982. In that time Sun has moved into the position of having the largest installed base of Unix workstations in the industry. With the current lineup of workstations and scalable SMP servers, combined with application software from the best software

providers, and Sun's position in the new network economy, Sun can provide solutions to the petroleum industry in all areas of the business.

A singular vision 'the Network is the computer' has propelled Sun Microsystems to its position as a leading provider of hardware, software and services for establishing enter-prise-wide data centre solutions. With more than \$12 billion in annual revenues, Sun can be found in more than 150 countries.

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### System Development (SDI)

System Development (SDI) is probably best known for its presentation graphics software SDI\_MONTAGE, which is a composition tool for CGM+ and other high level graphics formats used by geoscientists in the oil and gas exploration industry. The list of features and options available continues to grow.

SDI\_WinServ provides high quality and high speed CGM+ printing in a server environment, running under MS Windows 95/98/NT. SDI\_WinServ utilises the same pre-processing and rasterising modules (SDI\_BAND and SDI\_RAST) that are used in SDI's UNIX printing software – SDI\_PlotServ. Tests have shown that these modules provide fast CGM+ print processing and output to a wide range of large and small format printers.

For those who need to view and print CGM+ files from their desktop PC, SDI\_WinView Pro offers an easy to use and inexpensive solution. The selected CGM+ file can be viewed, with the facility to pan and zoom on selected areas, and printed via any MS Windows compatible printer driver. In addition, SDI\_WinView Pro allows the user to copy and paste all, or a selected viewport of, a CGM+ file into any MS Windows compatible application such as MS PowerPoint, Canvas, etc.

Increasingly, geoscientists wish to create high level CGM files from their desktop PC applications. SDI\_WinCGM is an MS Windows compatible printer driver that creates ANSI/ISO compliant, binary encoded CGM

files, and is now available on MS Windows NT, as well as 95/98.

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### T&A RADAR

T&A RADAR is part of T&A Survey with offices at the Shell Technology Centre in Amsterdam, The Netherlands. The company was founded in 1992 by the geologist Dr Robert van Ingen and specializes in non-destructive geophysical soil research. Currently 15 professionals are working at T&A with varying backgrounds such as geophysics, geology or experimental physics.

T&A RADAR offers geophysical services which range from shallow surveys (few metres deep) to deep surveys (25 km deep) using all kinds of different geophysical techniques, such as ground penetrating radar (GPR), borehole radar, time domain electro magnetics (TEM), logging tools, electrical measurements, metal detectors, magnetotellurics (MT) and aquatic bed survey techniques. The company's main clients are oil companies, building companies, government, engineering and mining companies.

Besides geophysical research, consultancy in the field of geophysics, geology and seismic interpretation, is also offered by T&A RADAR. The research and development department is involved in the development of new borehole radar hardware and software.

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### TEEC

TEEC provides advanced geological and geophysical processing and interpretation techniques for the E&P industry, in close co-operation with its clients and partner companies. Through the many successful projects carried out, it has become a specialist in the fields of reservoir geophysics, advanced seismic processing, neural networks and 3D geological modelling.

TEEC has the in-depth skill set to accurately predict porosity and perme-

ability, estimate the net thickness and make pore fill predictions from seismic data. Methods such as AVO processing and modelling, seismic inversion and seismic lithology modelling, coherency processing or the CRS-processing technique are being used.

TEEC offers sedimentological and petrophysical services. Moreover 2D and 3D geostatistics is used for the interpolation of well data, the integration of borehole data with seismic data to construct enhanced reservoir property maps. Results are being used for assessment studies or as initial models for reservoir simulators after upscaling.

CohTEEC is an ensemble of software and workflows which allows for the mapping of lithology, fluid contacts and fractures. Multi-trace filters detect and map faults and fracture zones while subtle changes in seismic attributes are used to detect oil-gas-water contacts. The package uses pattern recognition and feature extraction algorithms to generate seismic attributes and to process very large 3D seismic surveys. CohTEEC analyses multiple traces simultaneously to capture the similarity of trace segments in a neighbourhood. The size of the segment and the number of traces can be varied depending on the problem to be studied. CohTEEC attributes have been used to identify features that hard to detect or time consuming to interpret. Attributes can be used to map changes in seismic character. In some cases these can be linked to the reservoir heterogeneity. Attributes are derived from 3D image processing algorithms widely used in medical image processing or material science.

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### Teledyne Marine Products

The Marine Products Division of Teledyne Brown Engineering has produced quality marine geophysical equipment for over 30 years. It offers a comprehensive line of towed seismic array products including analog and digital streamer cables, vibration isolation modules, ocean bottom cable assem-

blies, hydrophones, analog and digital lead-in terminations, gun umbilical terminations and numerous seismic array special products and services. From its facilities in Gloucester, UK and Houston, Teledyne provides streamer tow leader and ocean bottom cable repairs for products manufactured by Teledyne as well as other geophysical equipment manufacturers.

Teledyne has delivered more than 200 km of its most recent streamer cable the SDS-55 and more than 500000 model T-2BX hydrophones over the past couple of years. Recent new product introductions include the model T-4BX hydrophone that meets the requirements of the US Department of Commerce for use in export sensitive streamer applications and the new Vibration Isolation Module.

Teledyne Marine Products is a business unit of Teledyne Brown Engineering which is a wholly owned subsidiary of Teledyne Technologies ([www.teledyne.com](http://www.teledyne.com)), a provider of sophisticated electronics and communication products, systems engineering solutions and aerospace engines and components. With 1999 revenues of \$803 million, Teledyne Technologies employs approximately 5800 persons in the US, UK and Mexico. For additional information please contact us in Houston, USA at 713-666-2561 or in Gloucester, UK at (44)-1452-382000.

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### TERRASYS

Founded in 1993 in Hamburg, Germany, TERRASYS offers a wide range of services to the exploration industry, focusing on non-seismic methods.

With Seismo-Gravity, TERRASYS combines high resolution 3D gravity modelling with seismic interpretation resulting in a significant increase of information. In seismically 'blind' areas like salt dome flanks and bases, 3D gravity interpretation is an excellent tool utilizing contrasts in rock density.

TERRASYS' software package GEOMASTER, a highly flexible in-

house development, was designed as a solution for resolving complex geological structures. It allows a full 3D gravity/magnetic forward modelling with interactive model construction and parameter modification tools within a powerful visualization environment. TERRASYS is committed to highest quality standards during acquisition, processing and integrated interpretation of potential field data.

In recent years numerous projects involved areas with complex tectonics; they showed how advanced 3D gravity and magnetic modelling helps to get better seismic results, e.g. constrained velocity models for prestack depth migration or improved sedimentary fault solutions from high-resolution aeromagnetic interpretation. Besides the implementation of geostatistics, e.g. for velocity-density conversions, TERRASYS develops advanced geoscientific software solutions, tailored to the client's requests.

TERRASYS' geotechnology department takes care of engineering and environmental tasks by applying geophysical solutions. Projects like UXO detection, subsurface mapping of cables and pipelines, forensic and archaeological enquiries have been carried out using a wide range of non-seismic systems. A combination of methods often helps to illuminate the target area for a better understanding.

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### T-Group

The T-Group is an alliance of two companies, THOR Geophysical and TEEC. It was formed in response to a demand for a service company with a high level of vertical integration within the geosciences. The group, based in Germany, offers a complete and seamless chain of services from seismic data acquisition to seismic processing and interpretation including geological analysis right through the field of reservoir characterisation. Its management and staff have an extensive international experience gained over many years within the service industry.

THOR Geophysical is a well-established geophysical service company and provides comprehensive geophysical field exploration and reservoir development services via field data acquisition. For 18 years, THOR Geophysical has carried out surveys in all environments, such as in mountain areas, deserts, jungles and transition zones. Production 3D seismic surveys with up to 1500 live channels have been carried out for the oil and gas industry and high-resolution 3D surveys for underground gas storage projects. For all surveys latest technology is used, such as the ARAM24 seismic acquisition telemetry systems.

THOR Geophysical provides Vibroseis as well as explosive and airgun seismics. Engineering and environmental geophysics and all non-seismic prospecting methods, such as multi-electrode geoelectric, electromagnetic, radar and magnetic measurements complete the portfolio of geophysical services. With main offices in Germany, Trinidad and Iran and agencies in Venezuela, Italy, Turkey, Spain, Morocco, Egypt, Kuwait, Saudi Arabia and India, THOR Geophysical has an established presence in several key location worldwide.

Trappe Erdoel Erdgas Consultant (TEEC) provides advanced geological and geophysical processing and interpretation techniques for the E&P industry, in close co-operation with its clients and partner companies. Through the many successful projects carried out, it has become a specialist in the fields of reservoir geophysics, coherency processing, neural networks and 3D geological modelling. State-of-the-art commercial software is available supplemented by in-house proprietary software, which is subject to ongoing development.

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### TGS-NOPEC

TGS-NOPEC is a global provider of non-exclusive seismic data and associated products to the oil and gas industry. Oil companies use this seismic data

to explore for and develop oil and gas deposits. TGS-NOPEC specialises in the planning, acquisition, processing, interpretation, and marketing of non-exclusive surveys worldwide. TGS-NOPEC offers a broad range of tools necessary to explore for hydrocarbons in both mature and virgin regions of the world. The company places a strong emphasis on providing high quality seismic data and the highest level of service to the industry. TGS-NOPEC also offers proprietary seismic acquisition and processing services, as well as gravity and aeromagnetic surveys.

The TGS-NOPEC marketed multi-client data library consists of more than 1.2 million km of 2D seismic and more than 80 000 km<sup>2</sup> of 3D data mainly in North West Europe, Gulf of Mexico and Australia. However, new oil production technology for deep waters has opened vast new areas for exploration. Hence TGS-NOPEC has committed to new frontier areas such as Nova Scotia, Greenland, deepwater offshore North West Shelf of Australia, Indonesia, as well as offshore Brazil, Morocco and Portugal.

Over 200 oil companies worldwide have licensed or contracted for TGS-NOPEC's projects and services. With its offices in Texas, Norway, UK, and Australia, TGS-NOPEC is positioned to help its clients to explore a world of opportunities.

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### Thomson Marconi Sonar

Thomson Marconi Sonar (TMS) is a specialist technology manufacturing company formed in 1996 by the combination of the Sonar business activities of Thomson CSF and GEC Marconi. A worldwide group, the company has a total of 3500 employees at sites in France, the UK, Australia, and the US. TMS is a world leading exporter of underwater acoustic technology, and ranks among the top three companies worldwide in the field of sonar technology.

TMS supplies products and services into the specific markets of seismic

towed array systems (3D and 2D applications); submarine sonar systems; surface ship sonar systems; surface ship mine hunting sonar systems; air-deployed anti-submarine sonar systems (sonobuoys and dipping sonars); underwater acoustic monitoring systems and sea bed systems; acoustic signal processing and imaging systems; sub-sea magnetic detection systems; bathymetry, echosounder and acoustic positioning systems; and high resolution marine seismic systems.

TMS recently introduced the innovative, high performance Sentry solid streamer as its first major product for the geophysical market and is strongly committed to maintaining and growing its presence in the marine seismic market.

The company is vertically integrated in each of its markets, and able to address all aspects of the system from hydrophone design and manufacture through to complete integrated hardware and software packages, including training and product repair services.

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### T-Surf

Founded in 1997, T-SURF develops, markets and supports GOCAD, an innovative 3D earth modelling tool. The software package benefits from eight years of research and development by the GOCAD Research Consortium, an international consortium whose sponsors include over 70 leading oil and gas companies, software vendors and universities. Staff includes over 20 people based in Houston and in Nancy (France).

T-Surf enables oil and gas, and mining companies to maintain a competitive advantage in rapidly changing markets by optimizing work processes and operational cost. By using leading edge technology, T-Surf provides a unique cost-effective suite of tools to explore and model reservoirs on affordable Windows platforms as well as on UNIX workstations. The software suite enables multidisciplinary teams to share

not just the same data, but the same reservoir model, from exploration to exploitation.

T-Surf software suite includes an end-user and a developer version of the flagship product GOCAD, and three add-on modules: VR for immersive visualization, OpenSpirit Plug-In, for direct access to Gequest and Landmark databases, and Jacta for reservoir risk evaluation.

GOCAD object-based core technology enables geologists, geophysicists and E&P engineers to share and improve the same reservoir model, avoiding misinterpretations that might result from new or heterogeneous data. Through streamlined workflow, as opposed to serial manipulations, GOCAD facilitates the optimization of the whole process. From seismic interpretation, GOCAD builds surfacic and volumic models, defines the reservoir stratigraphy, facies, and petrophysical properties in a complex structural environment. The developer version provides easy integration of GOCAD into existing applications.

T-Surf makes it team of experts available for a wide range of training, customer support and consulting services. Major Customers include Arco (virtual reality drilling planner); BP Amoco (probabilistic ranking of well location options), Chevron (modelling of Britannia gas field); ExxonMobil (Tengiz velocity modelling); Shell (integration of gravity data and seismic imaging); and TotalFina-Elf (uncertainty reservoir management).

### Veritas DGC

Veritas provides a full suite of integrated geophysical technologies, including land, transition zone and marine seismic data acquisition, seismic data processing, data visualization, data interpretation and reservoir characterization, data archiving, data management, and extensive non-exclusive data library surveys worldwide.

In the last few months, Veritas has substantially increased its global capability to deliver and interpret enormous volumes of seismic data. The company has installed two new-generation NEC

SX-5 supercomputers in Houston and Singapore, with a third scheduled for London, UK. The SX-5, one of the world's most powerful supercomputers, is now the backbone of Veritas' global computing resource. The new systems can process huge volumes of 3D and 4D seismic data through complex sequences in significantly reduced time frames.

Complementing this leap in processing horsepower, the company has also installed three additional data visualization centres in Calgary, London and Perth enabling rapid, three-dimensional volumetric interpretation of complex exploration data. Veritas already operates a fourth data visualization centre in Houston, plus a total of 20 data processing centers in major oil and gas producing regions around the world.

Veritas is presently conducting land seismic data acquisition projects throughout North and South America and the Middle East, and has recently undertaken a major 3C (three-component) and 4D (time-lapse) reservoir monitoring project in western Canada. The company's fleet of marine vessels, including two state-of-the-art *Viking*-class ships, is acquiring 2D and 3D seismic data on various proprietary and multi-client surveys offshore eastern Canada, Brazil and West Africa, also in the Gulf of Mexico and Asia Pacific. The company continues to aggressively grow its non-exclusive data library, now estimated at over 2.6 million line km of land and marine data worldwide and, through powerful data visualization capabilities, offers enhanced products such as prestack depth migration, AVO analysis, reservoir characterization and pre-interpreted packages on its library data.

Veritas has substantially broadened its technical knowledge base by becoming involved with an impressive portfolio of external geophysical research activities. The company also continues to foster innovation and spearhead new technologies. For example, the VERITAS GOLD web browser applies the latest Internet technologies to online marketing of seismic data. Also, its new FractAL technology for analysis of

fractures in hydrocarbon reservoirs, and the ground-breaking Millennium II satellite communications initiative are just a few of the company's latest advances focused on optimizing operating efficiencies and delivering superior products to its customers.

With over 35 years of operating experience, Veritas is an industry leader in the application of advanced geophysical technologies. Veritas is traded publicly under the ticker symbol VTS on the New York and Toronto Stock Exchanges.

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#### **VIRG-Rudgeofizika**

The All-Russian Scientific-Research Institute of Exploration Geophysics – VIRG-Rudgeofizika was founded in 1945 and today it is a Russian organization in mining geophysics. VIRG-Rudgeofizika is known as the country's developer of resources-saving and environmentally safe geophysical methods, instruments and technologies for predicting, exploring and mining of metallic ores (iron, chromium, copper, lead, zinc, gold and others) and exploring for oil and gas.

Problems are successfully solved using the powerful scientific potential of the 450 staff, 12 Professors and over 60 Doctors of Sciences with great practical experience at the Institute. During the 55 years of its history, the people of the Institute have discovered tens of large deposits in the country, including abroad. The results of the developments have been acknowledged by known exploration companies of USA, Canada, Finland, Norway, Australia, South Africa and China.

VIRG-Rudgeofizika provides all types of geophysical surveys; computer processing and interpretation of data, based on original programs; delivery of technologies, instruments and software; and expertise and consulting.

#### **Western Geophysical**

Western Geophysical, a division of Baker Hughes, provides comprehensive resources for seismic exploration, field development, and reservoir monitoring.

Its worldwide services include one of the world's largest libraries of multi-client seismic surveys for prospect evaluation; high-resolution 2D, 3D and 4D onshore and offshore surveys using conventional sensors or three-component land or four-component ocean-bottom cable sensors; data processing services through a worldwide computing network of major computer centres linked to remote and infield computing facilities; Omega seismic processing system software available for licensing by oil company clients; and exploration and reservoir services (ERS) to provide high-end surface-seismic and borehole geophysical interpretation services, including depth migration, time-lapse seismic (4-D) reservoir monitoring, and data management.

Recent highlights in Western's EAME operations include: launching of Western's newest super seismic vessel *Western Trident* currently operating in offshore West Africa; availability of Western's proprietary Sentry solid streamer service on the company's super seismic vessels; opening of a new seismic data processing centre in Aberdeen, Scotland to serve an increasing number of oil companies who have exploration divisions based in the city; establishment of a virtual immersive environment workroom in London to allow oil company asset teams to view and interpret data collectively; acquisition and processing of approximately 35 000 km<sup>2</sup> of 3D data for offshore Angola; seismic services in support of licensing rounds in Cameroon, Equatorial Guinea, Ivory Coast, Mozambique, Senegal, and Yemen; the acquisition of 16 000 km of high-quality 2D seismic data in the central and southern Caspian Sea offshore areas in preparation for a planned offshore licensing round by Turkmenistan later this year; and the award of a two year, \$20 million contract for a major survey in Oman

*E&P Solutions*

E&P Solutions, a division of Baker Hughes, pursues oil and gas projects with operating partners where advanced geoscience technologies can reduce risk and improve economic rewards. For companies with project opportunities, but lacking the internal resources to pursue them in a timely manner, E&P Solutions can contribute technical resources to projects under a range of performance-based compensation arrangements, or sharing risk in return for an economic interest in the project results.

E&P Solutions participates in projects globally with project centres in Houston and London, staffed with multidisciplinary teams of geologists, geophysicists, and reservoir engineers. E&P Solutions' industry-proven staff offer an integrated solution to oil finding through effective application of 3D seismic, speculative data and logging services, and comprehensive geophysical, geologic, geostatistical, engineering, and economic analysis.

*Baker Atlas*

The Baker Atlas division of Baker Hughes is a provider of advanced formation evaluation, borehole seismic, completion, pipe recovery, and reservoir monitoring services. A worldwide network of geoscience centres help E&P companies more accurately evaluate and maximize recovery from their oil and gas reservoirs.

One of the new-generation technologies offered by Baker Atlas is the Cross-Multipole Array Acoustilog (XMAC) service. This new full-wave monopole, dipole, and cross-dipole system provides quality compressional (P-wave) and shear (S-wave) velocity data in formations ranging from soft, unconsolidated sandstones to low-porosity, fractured carbonates.

Baker Atlas also provides a wide range of borehole and cross-well geophysical services that provide detailed description of reservoir properties deep into the formation and ahead of the drill bit for both exploration and field development.

**ZEH Software**

For almost 20 years, ZEH Software with offices in London, Singapore and Houston, Texas has been recognized for networked output management solutions. ZEH provides complete network printing and plotting solutions for worldwide clients with heterogeneous applications, systems, and output devices. ZEH's clientele include petroleum and chemical companies, architectural and engineering firms, public utilities, government agencies, aircraft/aerospace and automotive manufacturers, universities, and service bureaus.

ZEH products include enterprise-wide output management solutions, which enable users to direct technical

output of varying file formats to high-speed, large and small-format printing devices. As a part of this output process, ZEH's products provide administrative system's management functionality such as job processing and tracking, load balancing, and usage accounting. These web-enabled and client-server solutions are designed for UNIX and Windows NT environments. The need for ZEH's solutions is most prevalent among the energy, engineering and MCAD markets.

ZEH products include software solutions, such as WebPlot, which provide current and prospective ZEH Plot Express users with a web-enabled tool to send output in various graphic formats to high-speed, large format printing devices. ZEH also provides an enterprise-wide printing and plotting solution in EnterPrize which addresses virtually all issues associated with configuring, maintaining, monitoring, and using printer and plotter resources across multiple-server environments. EnterPrize and WebPlot allow an organisation's users to print to almost any output device on any TCP/IP network in the company using *File/Print* from within PC and UNIX applications or using any browser-capable workstation.

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