



# the seismic observer



## Veritas Premiers Wide Azimuth

Prize-Winning Innovation Pivotal in Success of Industry-First Deep Water Survey

## Anytime, Any Place, Anywhere!

New Secure Extranet Services Allow Real-Time Client Access to Data

## Dirty Tapes Come Clean

98% of Data Retrieved from 'Shocking' Batch of Tapes Neglected for 15 Years

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volume  
1

2006

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Cover Image:  
The Mad Dog platform, in approximately 4,500 feet of water in the southern Green Canyon area of the Gulf of Mexico, is the second of four gigantic fields discovered by BP in the late 1990s, and one of the top 10 largest discoveries to-date in the Gulf of Mexico. The platform has the capacity to handle more than 100,000 barrels per day of crude oil and 60 million cubic feet of natural gas per day.

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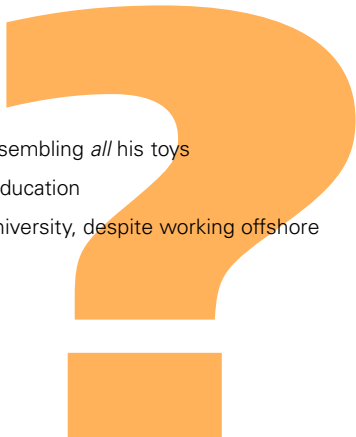
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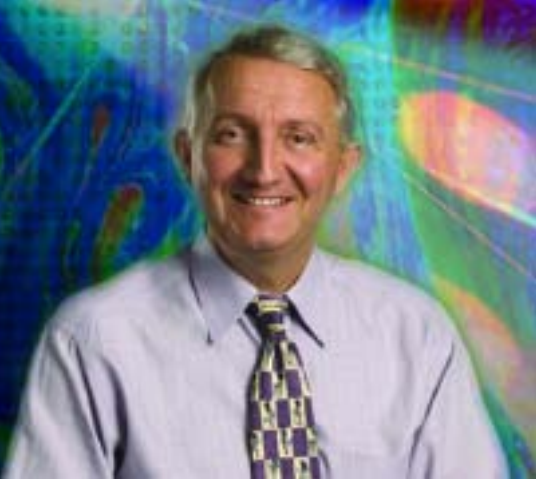
>guesswho

- > His parents emigrated from Madeira
- > During childhood, he enjoyed dismantling and reassembling *all* his toys
- > He sold futon sofa beds to help pay for a college education
- > He earned a BSc Honors degree from the Open University, despite working offshore

See Who's Who Profile on page 15



*"Historically, the seismic 'race' was about productivity. Today it is increasingly about innovation and effectiveness."*



industry trends - where are we?

Any of us who've been in the oil business for more than a handful of years probably has one eye on today's high oil price and the strong outlook for seismic services, and the other eye warily scanning the rear-view mirror. The energy sector and its associated service businesses are notoriously cyclical and many of us have experienced the industry's highs and lows before, often in the form of uncomfortably abrupt changes.

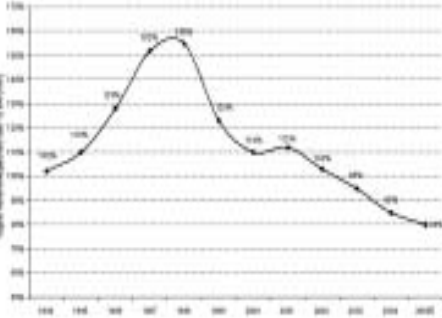
Today, investors, industry participants and observers are all asking the question: "where are we in this cycle?"

While it is always a perilous exercise to try and speculate on the shape and duration of the industry cycles, it can be insightful to analyze important trends in the seismic business and see if they can make the future slightly more predictable.

Firstly, and most importantly, one of the underlying trends that increased our customer's interest and spending on seismic services over the past two years has been the growing concern about reserve replacement. Oil production is declining in 33 of the world's 48 largest oil-producing countries and organic reserve replacement is the lowest it has been for many decades.

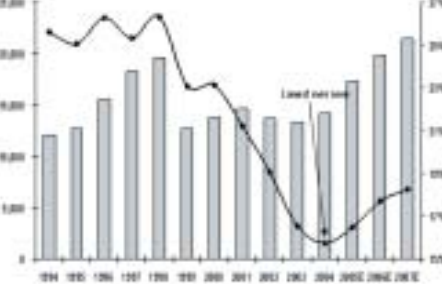
Organic replacement of hydrocarbon reserves is a difficult and lengthy process, particularly as new reserves are typically found in locations and environments that are increasingly harsh, such as very deep waters and remote provinces where the challenge of transporting the hydrocarbons is added to the risk of

exploration, or in countries where geopolitical access is very limited. Exploration in such areas requires new and better data and information to lower risk, and seismic analysis remains the safest and most cost-effective way to reap such information.



Organic reserve/replacement ratio 1994-2005  
Source Ensklida Securities

Within the global economic framework, this trend of low reserve replacement when combined with the world's increasing demand for energy tends to suggest a longer and more sustainable up cycle than we have seen historically.



Exploration spending and proportion of total E&P spending  
Source Ensklida Securities

Secondly, this upward trend was led by an increase in customer spending on reservoir development and optimization, not on seismic services as seen in previous cycles. As a result, seismic expenditures (as a percentage of total E&P spending) initially continued to

decline. It's only since late 2004 that we've seen a real increase in exploration spending.

Finally, technology advancement has always been a key ingredient for improving oil and gas exploration success rates. Within the seismic services sector, there has been a strong focus on productivity and efficiency as service companies competed at ever-lower prices in a market plagued by over capacity. Today, in a capacity-constrained market, combined with reserve replacement concerns and challenging geologic, geographic and geopolitical environments, oil and gas companies are increasingly interested in seismic technology advancements rather than just pricing. Advancements such as wide azimuth acquisition techniques or advanced processing technologies can dramatically enhance reservoir illumination and delineation. This trend is moving seismic further away from commoditization and more towards differentiation – a domain where Veritas excels.

So where are we in the current cycle? It is impossible to know for sure and I would hesitate to guess when the seismic industry will peak in this cycle, but we can certainly see that the key trends in our industry combined with technological advancements in both seismic acquisition and imaging, have put the fundamentals in place to drive further growth into the industry as we look towards 2007. And Veritas is very well positioned to take advantage of this opportunity.

*Thierry Pilenko*  
Chairman & Chief Executive Officer



# New Industry Buzz: Veritas Premieres **WIDE** azimuth

One of the hottest buzzwords in today's geophysical industry is 'wide azimuth'. There has been a huge movement towards wide azimuth seismic surveys in recent years, many on land and some on the seafloor, but the first one in deep water using towed streamers was completed successfully by Veritas for BP in early 2005.



While the industry is 'buzzing' about marine wide azimuth, Veritas — the first company to have completed a commercial marine wide-azimuth survey using towed streamers — remains tight-lipped. Why? Because of confidentiality concerning BP's proprietary design used for the survey.

But what about the new and proprietary technologies designed by Veritas for wide azimuth acquisition? There were several, one of which particularly stands out.

## Extraordinarily Complex Acquisition

There are enormous challenges to acquiring (and processing) wide azimuth seismic data at sea using towed streamers. For starters, wide azimuth acquisition requires two or more source vessels, one or more streamer vessels and source locations that must be precisely repeated several times during the same survey. Furthermore, several towed streamers, usually at least 6,000-meters long, must be correctly positioned to record a multiplicity of short to long offsets over a 'wide' range of azimuths.

Needless to say, this requires not only an extraordinarily complex acquisition design, but also extremely precise inter-vessel navigation and communications.

"Our biggest single challenge in wide azimuth is repeatedly moving and positioning the seismic

## What is wide azimuth?:

Imagine dropping a pebble into a pond and measuring the ripples first from one direction, then dropping another pebble at the same spot and measuring the ripples from a different direction.

Do this several times for every pebble (source) location, then combine the ripple measurements from all the recordings as if they had all taken place at once.

That's a very simplistic explanation of a marine 'wide azimuth' survey.

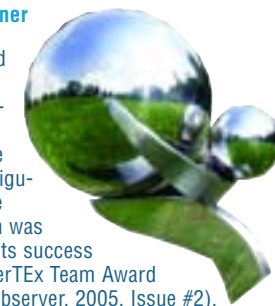
## Why wide azimuth?:

The main benefits of wide-azimuth data are improved subsurface illumination and resolution below complex overburden.

In challenging environments with complex geology, such as sub-salt in the deepwater Gulf of Mexico, this improved illumination allows for a deeper and richer view of subsurface geology through the use of state-of-the-art computer imaging techniques. This can provide our customers with information that is vital to successful exploration, appraisal and development of reservoirs.

## VerTex Award Winner

The positioning and communications function for coordinating complicated multi-vessel source and recording configurations during wide azimuth acquisition was so significant that its success garnered a 2005 VerTex Team Award (see The Seismic Observer, 2005, Issue #2).



sources for each shot location, and keeping all the vessels synchronized throughout this process," confirms Phil Fontana, Geophysical Manager, Marine Acquisition.

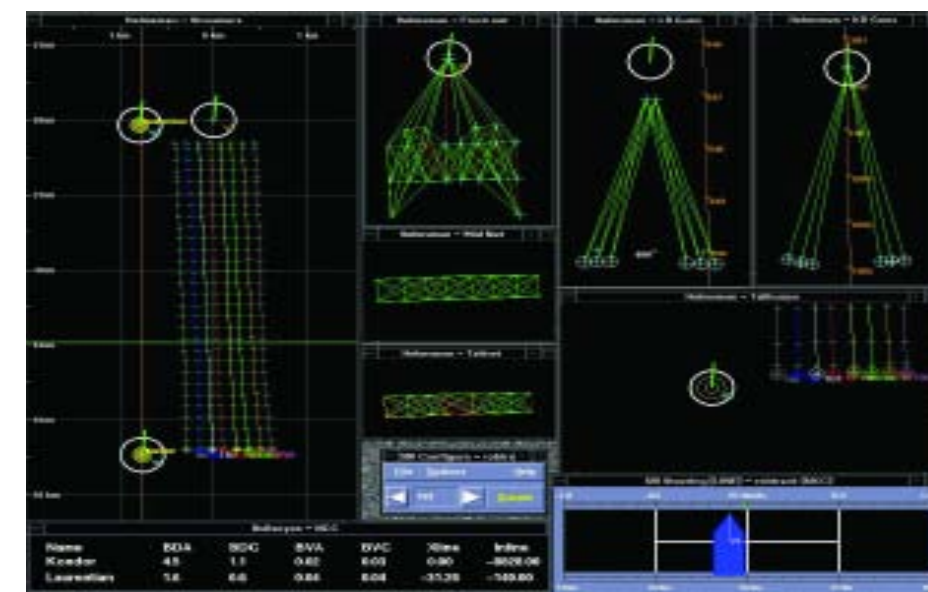
## Separate Vessels, Combined Data

Leaving our competitors treading water, Veritas was first off the blocks by developing an innovative new system to deliver the precise inter-vessel positioning and synchronized ship-to-ship communications required for wide azimuth acquisition operations at sea.

Our VerTex Award-winning multi-vessel positioning and communications system has since become a key component of our wide azimuth acquisition service capability, and its success in providing effective and efficient operational delivery was part of the reason we've been awarded a follow-up six-month wide azimuth program in the Gulf of Mexico by BP, to be initiated later this summer.

The new system uses multiple radio and satellite data links monitored and optimized continually to provide 100% uptime. All navigation and positioning is referenced to the master vessel at various distances and in multiple orientations, while the system's flexibility allows our vessels to reconfigure 'on the fly' and acquire data with zero time needed for maneuvering or reconfiguration.

During last year's wide azimuth project for BP over the Mad Dog field — a 400 square-kilometer program that took about five months to complete — our new system successfully helped attain and maintain the required shooting configurations with zero technical downtime.



Helmsman's display showing positions of parts of the streamers and source arrays. Literally thousands of complex position calculations are carried out in real-time every few seconds as the vessels remain constantly on the move.

"The vessel positioning accuracy, source position repeatability and redundancy required for wide azimuth acquisition could never have been achieved without this new technology," confirms Russ Endersby, Operations Supervisor on the SR/V Veritas Vantage.

challenges," adds Kevin Stiver, Marine Marketing Manager. "A big opportunity in the future for Veritas is achieving even clearer, more detailed illumination of the reservoir."

— Written with files from:

Phil Fontana, Tor Haugland and Kevin Stiver

## Future Opportunities

Our new positioning and communications system is currently being adapted for other shooting configurations, and affords the Veritas marine fleet a powerful new capability. This, combined with emerging new wide azimuth techniques, opens up tremendous opportunities for us to offer greatly improved seismic imaging in other areas of the world.

"We're looking at various related acquisition methods to satisfy a new industry demand for wide azimuth acquisition, and to address different customers' unique geologic



# Supersize Me!



## Construction of new flagship vessel ‘on schedule’

Construction of our seventh, and largest, marine seismic vessel is on schedule in Ølen, Norway, with a target launch in the first quarter of calendar year 2007, in time for 2007’s summer season of seismic work in the North Sea.

Reports from Ølen’s Westcon Shipyard that our new vessel currently resembles "bare steel that barely looks like a boat" belie the fact that the total build is scheduled to take only 13 months instead of the customary 18 months for a vessel of this size. In fact, subcontractors have already completed 20% of the fixed deck equipment which will be installed in stages starting this fall.

Currently referred to as the 'V4 Project' (signifying our fourth vessel built in partnership with Eidesvik Shipping), the new vessel is not based on our Viking-series hulls but will be “more like a super-sized seismic vessel, 105 meters long, with improved propulsion and optimized for faster transit times and superior sea-keeping abilities," clarifies Tor Haugland, Senior Vice President, Marine Acquisition. “This will be the new flagship of our fleet.”



An artist's impression of our seventh, and largest, marine seismic vessel, currently under construction in Ølen, Norway, and scheduled for launch in the first quarter of calendar year 2007.

The vessel will be equipped with the latest in seismic acquisition, recording and wide-tow technologies, a full onboard cable repair facility and even a freight elevator to service the four decks between the waterline and the bridge! She will be able to tow as many as twelve 8000-meter solid streamers and will "lend herself ideally to our niche market of using multiple long streamers, including unconventional acquisition configurations such as Wide Azimuth," says Haugland.

Stay tuned to the Seismic Observer for updates.

“The total build is scheduled to take only 13 months, instead of the customary 18 months for a vessel of this size.”

Peter Sack, Engineering & Vessel Support Manager

# >vantagepoint

## ‘Safety Guy’ Swaps Office Comforts for a Month in the Frozen Arctic

### alaskan adventure: ian brann, QHSES office coordinator, EAME

I was really excited to get away from office life to gain first-hand experience working for a month on one of our land acquisition crews in Alaska. My mission there was ‘to learn the ropes and assist my counterparts’. Not everyone gets to do this kind of thing, so I was determined to make the most of it.

When I got off the plane in Alaska the first thing I noticed was just how cold -18°C really was. After spending a few days in our Anchorage office I took a one-hour plane ride to our Beluga field crew camp near the Cook Inlet. I got to work straight away, helping cordon off a helicopter-landing zone, then helping to write the emergency plans and compile contact numbers and notices to be posted all over the camp to give the crew quick and easy steps to follow in an emergency.

The next morning I was introduced to the crew at the daily safety meeting where safety concerns, hazards and the day’s activities are discussed. I was impressed at how seriously the various teams took these meetings — and other meetings held at intervals throughout each day — discussing everything they might face such as heavy weather, lakes, trees, moose, icy rivers, hypothermia, rough terrain and...bears! Coming from the U.K., I’d never seen a bear before, and soon learned that they weren’t big cuddly loveable creatures at all — in fact, the ‘Bear Awareness’ video that all field employees must watch, and the fact that each survey team was accompanied by an armed bear guard soon made me realize that. All of these hazards were encountered at some stage during my stay.

While waiting for our drilling equipment to arrive via barge, I got a chance to actually work ‘hands on’ with the survey crew. I helped organize explosives, fuel bladders, clear snow and generally get things prepared. I didn’t realize how tough their work is, we walked for miles and miles, laying out drilling and recording points, marking up hazards, trudging through deep snow, clambering up and down steep mountainsides, across frozen rivers and through thick forests in freezing cold temperatures. And we did all this carrying equipment and wearing snowshoes, while trying not to fall over!

By my last week in Alaska I’d got used to the icy cold temperatures and had gained a good idea about crew life and the many hazards in the field. I now have a whole new respect and appreciation for our land crews. Working with them was an education in organization, team spirit and good, honest hard work. As if to reinforce this last point, during my final night in Alaska, one of the crew became seriously ill and had to be airlifted to hospital. The crew medic’s swift actions probably saved that crewmember’s life.

My time with our crew has me thinking and working with a completely new outlook on safety, regardless of whether it’s in the field or in the office. People often become defensive when faced with safety people, but all those emergency plans and contact numbers on the wall are there for a good reason – you might want to have a look at them next time.



[ 1 ]



[ 2 ]



[ 3 ]



[ 4 ]

[ 1 ] Ian Brann organizes explosives ‘in the safety zone’ Photograph: Dylan Shorter

[ 2 ] A helicopter in the landing zone Ian helped cordon off. Photograph Ian Brann

[ 3 ] The drilling equipment was delayed by too much ice in the Cook Inlet. Photograph Ian Brann

[ 4 ] Drilling equipment arrives. Photograph Ian Brann

# Anytime, Any Place, Anywhere!

Secure Extranet Allows Real-Time Customer Access to Data



VRQC provides a live, on-line window into Veritas



### The Ultimate Test!

Intrepid Phil Gaskell, Global Manager, Networking Technologies, logged in to VRQC wirelessly from a commercial airline flight about 30,000 feet above Afghanistan and fired up Tornado, just to see if it would work.

It did work!

Realistically, the (lack of) wireless bandwidth was “a constraint, as was the latency introduced by the satellite-based Internet connection,” reported Phil. “At this time it isn’t very practical to perform real-time quality-control from high-altitude, but it can be done(!), and Internet technology is constantly advancing, so who knows what the future may bring?”



Veritas has launched a new on-line service that allows secure, interactive access to current projects and seismic data in real-time from almost anywhere in the world.

Named as Veritas Remote Quality Control (VRQC), the new service enables customers, partners and employees to “remotely interact with their data through a live on-line window into Veritas, around the clock and around the world, in complete security,” states Chris Denchfield, Development & Quality Manager, EAME.

Previously, remote access was intended for a limited group of users and was hard to manage securely if deployed to non-Veritas equipment. Now, VRQC — one component of our overall Partner Extranet Solutions — can be accessed from any computer/laptop with a browser, whether owned by Veritas or not, from almost

Our customers can now USE our interactive graphical seismic applications from the convenience of...almost anywhere!

anywhere with a network, e.g. home, office, airport, cyber cafe, etc.

### Saves Time and Money, Maintains Quality

Wittily nicknamed "The Martini Project," (because of some TV ads for Martini that chime, "anytime, any place, anywhere, it's the right one, it's the bright one, it's Martini") VRQC is mainly designed for customers and business partners who can't or don't want to travel. Kerr-McGee, for example, is one of several customers currently using VRQC for remote Quality Control (QC) of seismic processing projects, thereby reducing travel costs while maintaining control of product quality.

“VRQC has helped us, in Houston, perform quality-control on the work Veritas is doing for Kerr-McGee and its partners in the Veritas Crawley office,” confirms Victor Kriechbaum, Geophysicist with Kerr-McGee.

VRQC also allows guest users to use our interactive graphical seismic applications such as Expose, Tornado, PaceSetter, etc., on-line from the convenience of almost anywhere!

“In both the 3D fast-track volume processing of our new 3D seismic, and our extensive PSTM project currently underway, the use of VRQC has helped in situations where PowerPoint images won’t work,” confirms Kriechbaum. “Through VRQC, we are able to view and run the Expose program, which gives us the flexibility to scroll, zoom or scale the seismic data and to create difference sections.”

Guest users can also rotate volumes, examine different velocities, apply filters, change gain, colors, etc. Veritas staff can do the same and more, actually working on-line from home if and when necessary.

VRQC can also be used to host collaborative on-line meetings between more than one remote user in more than one location in more than one time zone — literally anytime, any place, anywhere — all interacting with live data in real-time.

"Collaborative on-line meetings enable client representatives, interpreters and processors to

interact directly with the seismic (and associated) data and with each other,” says Denchfield. “This saves enormous amounts of time and money, both for our customers and for Veritas, and can lead to earlier interpretive input, more focused processing and enhanced quality control!”

Our Crawley center in the UK, the heaviest proponent of VRQC so far, has remote users logging in from as far afield as Norway, Denmark, Malaysia, the USA and France, as well as UK users in London and Aberdeen. Our Calgary, Houston and Singapore centers can also offer the same level of VRQC access.

### ‘Watertight’ Security

Most of the technology required to deploy VRQC was already in place, e.g. secure portals, high performance firewalls, ThinAnywhere® servers, etc., so very little capital outlay was needed. However, several additional security measures have been implemented:

- > Guest users work on a separate server that does not touch our production environment

- > Guest users can only access certain projects and datasets, as determined by Veritas
- > Our programming department made some key modifications to Veritas’ interactive seismic applications to ensure that simultaneous guest users cannot interact with other clients’ datasets.

VRQC and ViewPort, together with multi-party conference calls, data transfer, 3D visualization in the Houston office and USB disks, are all tools that Kerr-McGee is using to maintain good quality, keep processing projects on schedule and to get valuable input from their partners.

“In the future, more and more of our services will be delivered via the web and so we intend to continue expanding the use of our extranet to enhance client communications and to deliver an array of new services,” says Ted Mariner, Vice President Advanced Hardware & Software Systems. “The ability to make timely, sound parameter decisions is improved with these tools, reducing risk and leading to better data quality and on-time delivery.”

### As Easy as 1 – 2 – 3:

1. User connects to the Internet via any computer/laptop with a browser, whether owned by Veritas or not, from almost anywhere with a network, e.g. home, office, airport, cyber cafe, etc.
2. Our Secure Portal authenticates the user and enables a secure connection to a ThinAnywhere® server where the user logs on, initiating the communication and compression processes.
3. Our application server allows secure access only to certain projects, datasets and applications, as determined by Veritas. Guest users work on a separate server that doesn't affect our production environment.



# Safely Does It

## Oman Field Crew Breaks Safety Record



Crew #52 celebrates more than 3,000,000 exposure hours with no LTIs



Dave Kennedy (right) presents Johnny Glover with a plaque to recognize Crew #52's three-million LTI-free exposure-hours. Photograph: Aaron Call

On March 4, 2006, Crew #52 in Oman clocked 3,167,560 exposure-hours worked over an 18-month period without a single Lost-Time Incident (LTI). That's the equivalent of one person working 7.5-hour days for 400,000 days ...which would compute to a staggering 1,095 years with no days off!

What makes this milestone even more remarkable is that Crew #52 have seen new hazards and risks added to their projects over the last 18 months. For example:

- > using a helicopter
- > using large fleets of bulldozers
- > hiring additional short-term field personnel and mountaineers
- > working in Oman's the toughest terrain
- > working in extreme heat of +50°C
- > working in areas with unexploded military test ordnance

### Proper Planning

Achieving this safety milestone is mainly due to the crew's and management's commitment and determination to prevent workplace injuries

and to reduce risk in their operations. Each member of the crew adopts a personal objective to ensure that safety is constantly reviewed and improved, with the philosophy that 'prevention is better than cure'.

"Every time something new is introduced, such as our mountaineers assisting operations, new procedures are written, employees are trained and everyone adheres to the new guidelines," explained Dave Kennedy, General Manager, Oman.

### The Biggest Hazard?

Though climate and terrain are challenging factors it's actually *driving* that is the number one hazard. Collectively, the crew drives approximately 130,000 kilometers per month!

"Terrain conditions contribute to a high risk for our drivers in and enroute to our work areas," commented Kennedy.

Veritas helps by providing first-class driver training. Crew members are tested every couple of months on their driving proficiency and receive additional training where needed.

### Safety First

In addition to the emphasis on driving skills, the crew follows strict guidelines and receives rigorous safety training including: defensive driving, graded road driving, driving assessments in all types of terrain, HSE induction, ESSW, H2S, fire training, Supervisor Safety and First Aid and CPR. New recruits and temporary employees have to undergo all this training before they can join our crew.

### Acronyms

- > LTI = Lost Time Incident
- > ESSW = Enhanced Site Supervision Workshop
- > H2S = Hydrogen Sulphide safety
- > CPR = Cardiopulmonary Resuscitation safety

# >movingforward

## Employees 'On the Move' at Veritas



**1 Loretta Allison** has joined Veritas as a Senior Marketing Representative for Time Seismic Exchange Ltd. in Calgary, Canada. Reporting to Jonathan Banyard, Loretta will be concentrating on developing and marketing our Canadian land data library.

Loretta started in the oil and gas industry in 1982, and prior to joining Veritas, worked at CGG in Calgary as a Business Development Manager for one year, and prior to that, at Millennium Seismic in Denver, Colorado, developing 3D seismic programs.

**2 Frances Crump** has been promoted to Director of Treasury Operations in the Treasury department in Houston, U.S.A. Reporting to Ed Kaplan, Frances will oversee global treasury operations.

Frances joined Veritas in 1999, and prior to her new position she was Treasury Manager, responsible for cash and treasury functions for the past seven years.

**3 Shaun Graham** has been promoted to General Manager of our Libya office in Tripoli. Reporting to Rob LaFleur, Shaun will manage all our land operations in Libya

Shaun has extensive experience with mechanical equipment and vibroseis units. He has worked in numerous countries including North Africa, Yemen, Saudi Arabia, Oman, U.S.A. and the U.K. Shaun joined Veritas in 1995, and prior to his new position, was Operations Manager in Oman, responsible for client liaison and day-to-day management of Oman land crews.

**4 Tor Haugland** has been promoted to Senior Vice President, Veritas Marine Acquisition. Reporting to Tim Wells, Tor will be concentrating on our global marine data acquisition product lines.

Tor joined Veritas six years ago and has extensive experience with acquisition technology and operations. He has co-authored several technical papers on a variety of seismic data acquisition topics and has invented several useful technologies for acquisition.

**5 Frank Jacques** has been promoted to Operations Supervisor in Muscat, Oman. Reporting to Dave Kennedy, Frank will be concentrating on supervising Crew #52's operations in Oman, client relations and helping to ensure that projected efficiencies are met.

Frank started in the oil and gas industry in 1974 and joined Veritas in 1998. Prior to his new position, Frank was Project Manager, responsible for day-to-day operations of running a very complex, large 3D vibroseis crew.

**6 Brandy Obvintsev** has joined Veritas as Manager of Public Relations for Corporate Marketing. Based in Houston and reporting to Hovey Cox, Brandy will be concentrating on enhancing corporate exposure throughout the industry with a variety of public relations tools including media management, advertising placement and value-added sponsorships.

Brandy started in the oil and gas industry in 1995, and prior to joining Veritas; worked at Nalco Energy Services as Worldwide Communications Manager, responsible for public relations, advertising, tradeshow and

corporate communications for the past seven years.

**7 Don Pham** has been promoted to Processing Manager in Singapore. Reporting to Peter Whiting, Don will be managing the Singapore processing center.

Don started in the oil and gas industry in 1989 and has gained extensive experience with velocity model building, multiple suppression, imaging and multicomponent technology.

Don joined Veritas in 2002, working in our Houston center as an Imaging Director, responsible for many technical aspects of processing for the past two years.

**8 Dennis Turnipseed** has joined Veritas in Houston as CFO for the NASA region. Reporting to Deanna Goodwin, Dennis will be concentrating on NASA accounting and finance management.

Prior to joining Veritas, Dennis worked at TIMEC Company, Inc. as its Chief Financial Officer, responsible for managing the accounting, treasury, IT and supply management functions of the company for the past two years.

# Don't Give Up Your Day Job

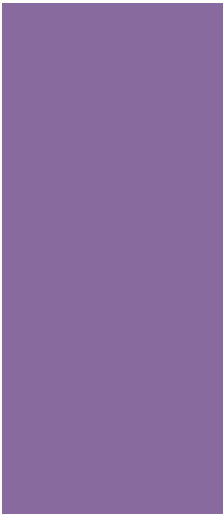
Learning New Skills...From Each Other



Employees swap jobs to become Associate Trainers for two days every three months



Robert Thompson teaches a class the importance of excellence in the work place. Photograph: Vee Skeet



Tom Patterson and Lloyd Maher  
Photograph: Leone Lew



Rob Thompson, Darlene Klippenstein, and Mark Lane  
Photograph: Vee Skeet

Veritas employees from various departments in Calgary and Houston are taking part in a new Learning & Development (L&D) program where they swap their regular jobs for two days every three months to become Associate Trainers, teaching fellow employees new professional skills.

Developing Associate Trainers means that:

- > employees get a chance to learn and use different skills
- > Associate Trainers meet new people and expand their knowledge
- > employees attend courses facilitated by fellow employees

"It's a win-win for Veritas," Mary Corbett, Manager, L&D told me. "Associate Trainers learn new skills, employees learn from people they know and L&D expands its resource base, increases its talent pool and helps develop more multi-talented employees," she said.

"The program has been very successful and we will soon be asking employees from other centers to step up to the challenge and

become Associate Trainers in their own region," concluded Corbett.

Recently, I attended the 'Quest For Excellence' course taught by Rob Thompson, a Unix Administrator in Calgary. I've always known Rob as being helpful, trustworthy, pretty outgoing and technologically 'savvy', but I couldn't believe how easy he made this look.

There was a wide variety of personalities attending the course from an equally wide variety of departments. Rob was adept at managing the range of opinions during discussions as if he'd been doing this kind of thing for years.

The program is clearly working well. The courses are 'to the point', allow enough time for group and class discussions are a fun, quick and an easy way to learn. Even the busiest employee can find three hours a month to learn new skills.

### 'Trains of Thought'

Here are comments from some of our employees who applied for and were selected to

become Associate Trainers and have already taught their first class:



Karen Griebe, from Human Resources in Houston, decided to become an Associate Trainer because she enjoys presenting and sharing her knowledge and wanted to learn how to connect better with an audience. "There's a lot more to training than most people realize. Making sure every participant learns something new takes a lot of skills," commented Karen.



Darlene Klippenstein, from Technology Services, in Calgary became an Associate Trainer after taking an L&D Professional Presentations course and realizing how exhilarating it was to be in front of an audience. "After I had presented my very first training class I felt really great," she beamed.



Rob Thompson, from Technology Services in Calgary, felt inspired after his first course. "There were a couple of 'ah ha' type moments from the participants that made up for any anxiety I felt beforehand. There is quite a difference between presenting, where information flows one way, and facilitating an interactive class, where information flows both ways."



Tom Patterson, from QHSES (Quality, Health, Safety, Environment & Security) in Houston, said, "being an Associate Trainer has broadened my understanding of training and helped improve my communication skills with a variety of personalities. I would encourage anyone to take part in this program."



Lloyd Maher, also from QHSES in Houston, became an Associate Trainer because he travels to different centers regularly and can simply add an extra day on to each trip to present his course. "I continue to learn just how differently people learn and communicate. Not everyone gets the message the same way so, as trainers, we have to be very adaptable."



Mark Lane, from Programming in Calgary, grew up in a teaching environment, since both his parents were teachers. "If you are dedicated enough, the rewards are huge. You just need to be prepared for a lot of work," he said.

Other Associate Trainers include: Mike Colwell from QHSES in Calgary, Amanda Bonfitto from Processing in Houston and Ken McMullin from Land Acquisition in Houston.

### What Makes a Good Trainer?

Here are the traits our Associate Trainers recommend you should have before you consider becoming a trainer. A trainer needs to be: patient, respectable, confident, empathetic, sensitive, brave, adaptable, assertive, flexible, dedicated, personable, a good listener, a quick thinker, have a love of learning, a good attitude, and high concentration levels. By far the most popular trait was...a good sense of humor!

### Associate Trainer Courses:

- > Establishing Goals and Priorities
- > How to Deal with Workplace Mistakes
- > How to Provide Gold Standard Customer Service
- > How to See Your Company Through your Customer's Eyes
- > How to use Your IQ to Increase Your EQ
- > Managing the Challenge of Change
- > Managing the Velocity Factor
- > The Quest for Excellence



# 'Power Up' in Malaysia

Kuala Lumpur Center Gets an Overhaul



Installation of new technologies brings incredible potential for future growth



The computer room in Kuala Lumpur before the upgrade. Photograph: Mike Nathan

The Veritas data processing center in Kuala Lumpur is arguably the premier center for advanced seismic imaging in Malaysia. To secure that reputation, newly installed cluster computing hardware and a new networking infrastructure have recently boosted the center's processing capacity and capabilities even further.

It's been six years since Veritas moved to the 56th floor of the Petronal Towers in Kuala Lumpur, and with the fast-paced increases in technology and clients' expectations in the Asia Pacific region, the timing was ideal for an investment in upgrading to the latest processing technologies.

The goal was first to increase office space by 35%, then to install state-of-the-art Opteron servers, dual-core CPU clusters, wireless networking, new air conditioning units and a new UPS (uninterruptible power supply). No small task!



After the upgrade. Photograph: Mike Nathan

### On Time, On Budget

"There were many building rules and regulations to adhere to, with our contractors often having to work within stringent conditions and technical constraints," explained K T Tong, Center Manager. "Nonetheless, our upgrade was successfully completed in less than three months, on time and on budget, with negligible processing downtime."

Our overhauled Kuala Lumpur facility is now optimized for the demands of today's high density computing and offers advanced techniques such as 3D velocity modeling in Tornado, 3D gridded tomography, anisotropic prestack depth imaging and wave-equation imaging.

"The imaging work conducted at this center is concentrating more and more on detailed prestack depth images, which is proving to be a powerful way to improve exploration success in Malaysia," says Peter Whiting, Vice President, Processing, Asia Pacific Region.

Tong anticipates that our Kuala Lumpur center now has an incredible potential for

future growth, being perfectly positioned to successfully take on "even more challenging" data processing projects.

### Three Steps to a Successful Upgrade

To minimize production downtime, the Kuala Lumpur upgrade was strategically split into three steps:

**Step I:** In December 2005, a second conference room and a third visitors office were constructed. During the course of one weekend, all geophysicists' PCs were relocated to a new, larger area with space for an additional five employees, going from 22 workstations to 27. By Monday morning it was back to work as usual, albeit at a different desk!

**Step II:** In January 2006, the new equipment was installed and tested. Once again, our 'weekend workers' moved networks, servers and computers so that, on Monday morning, everything was powered back up and production was back to normal by the afternoon.

**Step III:** Through the rest of February, several ancillary projects were completed, including a comprehensive new tape library.

## >who'swho

"From Lambeth to Dartford, from Swanley to offshore, this Party Manager enjoys life in the fast lane!"



[ 1 ]

### steve spinola, party manager, m/v seisquest

On October 7, 1970, Steve Spinola was born in Lambeth, London, England. His parents had emigrated in the 1960s from Madeira to England, where his father is a chauffeur for the Qatar embassy, and his mother spent several years working with special-needs children.

Steve always liked toys that he could take apart and put back together again. "I even did that with toys that weren't supposed to be taken apart and put back together again, which is probably why my parents eventually bought me Lego and Meccano sets," grins Steve.

Living in the city center, close to Tower Bridge, meant that there was never a dull moment for Steve and his two sisters. "I used to love watching the London Marathon on Tower Bridge with my older sister every year," Steve told us.

At the age of nine, Steve recalls living in Datchet for a year in a huge mansion where his parents worked for an extremely rich lady. "The lady stayed in all day, smoked like a chimney and played cards by herself — I always thought that was pretty sad," said Steve. "But the mansion was a cool place to live, and it was right on the River Thames in one of the most expensive parts of London."

At school, Steve enjoyed Mathematics and Chemistry, though he and his friends were little troublemakers in the chemistry lab, lighting matches on the open gas outlets and playing tricks on their teachers. When not at school, Steve and his sisters enjoyed many holidays in Madeira with their grandparents.

Steve was keen on athletics, both in and out of school, particularly the 400-meter sprint, triple jump and cross-country running. "I guess all that London Marathon watching had a big impact on me," he laughs.

At 16, he left home to study at the Merchant Navy College in Dartford, London. This was his first taste of living away from home and he really enjoyed his newfound independence at such a young age. He had a weekend job selling Futon sofa beds, where he met loads of people and the wages helped him pay his way through college. It was during his student party days that he met his partner Verity in a local nightclub.

At 19, Steve graduated with a BTEC Diploma in Microelectronics and Communications and took a job at Horizon Exploration as a Junior Laboratory Technician, designing, producing and testing electronics, and fitting equipment on the company's seismic vessels when they were in dock. After a couple of years, Steve went full-time on the seismic vessels as an offshore technician.

Steve joined Veritas in 1999 as an Observer and is currently Party Manager on the M/V Seisquest, working a shift of six weeks on and then six weeks off. Steve enjoys spending his time off with his family and relaxing.

Steve and Verity have two children. Alice (10) enjoys dancing, playing soccer and is very arty, recently winning two school competitions for a model of a Viking boat and an Easter bonnet. Owen (7) also loves soccer and plays in goal for the Under-8 Dartford Town Football Club.

Steve loves to study and in 2003 he graduated from the Open University with a BSc Honors degree in Communication & Information Technology. "It was hard work having a full-time job offshore, a family and studying, but it was well worth it," said Steve.

Steve plans on starting a Masters degree with the Open University in the next year or so and is looking forward to his next six weeks off when he plans on spending a day at Brands Hatch race course driving a race car, a present Verity bought him for Christmas.

"I can hardly wait!, It's going to be so cool racing around such an historical race track, literally 'in the fast lane'. I love driving fast, and to drive somewhere safe, with no speed limit, will be fantastic!"

[ 1 ] Steve Spinola Photograph: Sara Samuelson





# Opportunity Knocks

## Realizing the Potential of a Hydrocarbon Giant: Kazakhstan



This project will be the largest non-exclusive data library program in history

It may be time to invest in a bookshelf full of Kazakh and Russian phrase books. Veritas is on its way to Kazakhstan to conduct the largest non-exclusive data library program ever undertaken by a seismic contractor. Judging by that country's bustling economy (the second-fastest growing in the World) and untapped exploration potential, this is an exceptional opportunity both for Veritas and for Kazakhstan.

Although oil and gas exploitation has been going on in Kazakhstan for over 100 years, the whole Caspian region is still considered under-explored, both onshore and offshore. Opportunities exist for some major discoveries over a wide range of stratigraphic levels.

It's in this light that Veritas' recent announcement of a major data library agreement with the government of Kazakhstan is such exciting news.

"There is a green light for this region to take-off."

*Elwyn Jones, VP, Business Development, EAME*



The Republic of Kazakhstan is in central Asia, deep in the Eurasian continent. At 2,717,300 sq km (1,049,150 sq miles) of surface area, it is the ninth largest country in the world.

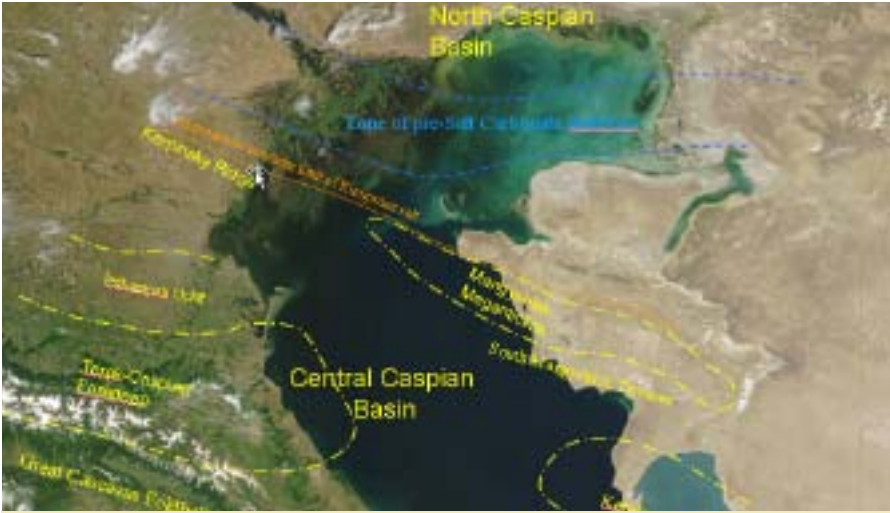
The Ministry of Energy & Mineral Resources of Kazakhstan has reached an agreement with Veritas, via our joint venture company Veritas Caspian LLP, to acquire non-exclusive seismic data over the entire open acreage of the Kazakh sector of the Caspian Sea. This will be the largest non-exclusive data library program ever undertaken by a seismic contractor and, upon completion, will offer a new level of illumination to the reservoirs under the Caspian Sea.

"The key is to take the potential of this region to another level, and Veritas is committed to achieving that goal," states Elwyn Jones, VP Business Development, EAME, who believes the timing is now perfect. "We are at a crossroads where the infrastructure is developed enough to warrant more exploration, which in turn will result in additional development. With the award of this data library project, the advances in acquisition and drilling technologies and the geopolitical circumstances both in Kazakhstan and the rest of the globe, there is a green light for this region to take off."

Veritas believes it is uniquely equipped to deal with the huge and challenging logistics of this project; from getting marine, land and transition crews into the land-locked Caspian region to processing the resulting data volumes.

"This project requires both commitment and resources and it's a source of great pride for Veritas that Kazakhstan's government decided on us as the company of choice when making this award," emphasizes Elwyn.

What's most exciting is having this opportunity to be involved in such a key project, helping the region share the stage with the world's biggest hydrocarbon players. Oil will be a big story over the next decade and Kazakhstan will be prominent among those directing how that story unfolds.



### Regional Geology

There are two distinct geologic provinces underlying the area of the Caspian Sea within Kazakhstan.

The Northern Basin, north of the Karpinsky Ridge – Mangyshlak Meganticline, extends over a large part of northwestern Kazakhstan up to the border with Russia. In the Caspian Sea area it is marked by carbonate deposition and salt; a winning combination of huge carbonate platform reservoirs overlain by an excellent salt seal. The carbonate reservoir section ranges in age from late Devonian to early Permian and is overlain by a thick late Permian salt. Where vertical migration has been made possible through areas of thinned salt, further fields are found in the Mesozoic clastic reservoirs draped over the salt highs.

To the south of the Karpinsky Ridge – Mangyshlak Meganticline, water depths increase dramatically and the geology changes significantly. The Central basin is structurally more complex, containing elements of the Terek-Caspian Foredeep, the Prikumsk Uplift and the South Mangyshlak to Ustyurt system of depressions. Its southern boundary is the Karabogaz-Karakum high. The Permian salt, which provides the seal for underlying, and structure for overlying, closures in the north, is not present in the Central Caspian basin. Here, the reservoirs are primarily sandstones sealed by shales. Numerous reservoir intervals are present throughout the Triassic to Cretaceous so that stacked pay is common. Traps are formed within fault closures or across anticlines and oil discoveries have been made throughout the Mesozoic section.



Elwyn Jones, VP, Business Development EAME (left), meets Kazakhstan's Energy Minister Baktjozha Izmukhambetov.

### Kazakhstan's Oil Industry

Kazakhstan produced its first barrel of oil in 1899. The country's first oil refinery was built in 1945 and many oil and gas fields have been developed onshore over the last 60 years.

However, it's only in the last few years that the true potential of the Caspian Sea region of Kazakhstan has been revealed with the discovery of Kashagan and a number of other giant fields. Kashagan is the largest field to have been discovered in the world in the last thirty years.

The impact of these new fields, which are currently being developed, will be to raise oil exports from the current 1 million barrels per day to around 2.25 million barrels per day by 2015.



# BP MS150 Bike Ride

35 Riders on Team Veritas



Veritas launches cycling team and raises \$50,000 for multiple sclerosis



Jesse Rivera and Gabriel Carvajal  
Photograph: Mark Cassellis

With cycling enthusiasts all over the company, Veritas has had representation at the Annual BP MS150, a charity bike ride between Houston and Austin, for years. This time, however, employees decided to take things to a new level.

“After many years of riding under the names of other industry teams, we realized that interest in the event and the cause within Veritas had grown to the point that it was time to create our own team. The support from all over the



Riders standing from left to right include: Humberto Ribera, John Hayes, Gabriel Carvajal, Dennis Baldwin, Larry Sanders, Dennis Turnipseed, Jesse Rivera, Larry Worden, Mark Cassellis, John Tortorici and Obren Djordjevic. Riders kneeling from left to right: Michele Wood, Taylor Weaster, Chelsea Wood, Caroline Bec, Paul Collins and Annette Moss. Photograph: Liza Yellott

company for this years ride has been tremendous which resulted in our inaugural ride as Team Veritas being a roaring success,” shares Mark Cassellis, Lotus Notes Supervisor and riding team captain.

The energy spread with the news of the formation of the Veritas team. Michele Wood, Manager, Marketing Communications, and her group went to work and designed high impact cycling uniforms. The designs formed a basis for the ridership campaign. “When they saw the jersey designs posted throughout the building along with an invitation to join, people could truly envision themselves as part of TEAM VERITAS. In addition to quite a few veterans, we had lots of first time riders,” notes Michele.

Throughout the organization, riders were managing fundraising and awareness campaigns of their own, including an unusual effort by Humberto Ribera, Senior QHSE Coordinator in the Houston center. Back in January, a couple of Humberto’s colleagues designed an internal

mini-marketing campaign to help raise awareness, support and pledges for his participation in this year's ride. As a result, cartoon-like 'nodding Humberto' graphics have adorned posters, door signs, badges and stickers throughout much of the East Wing of our Houston center. Humberto also sent e-mails asking all of his colleagues to consider sponsoring his ride and there was even a 'Ribera-Meter' that charted his sponsorship progress!

"Initially, Humberto set a personal goal to raise US\$1,000," says Veronica Rollandi,



Veronica Rollandi (left), QHSES Administrator and Costa Straub, System Support Specialist, show off their 'Ribera-Meter'. After this picture was taken, Humberto increased his fund-raising goal from US\$1,000 to US\$2,500. Photograph: Humberto Ribera



25 volunteers helped out from start to finish. Photograph: Veronica Rollandi

QHSES Administrator and co-architect of the mini-marketing effort. "But the response and pledges were so numerous that he re-set his goal to US\$2,500."

In addition to the fundraising efforts, the ride itself took a great deal of worthwhile coordination. Riders trained by riding up to 150 miles per week in Houston's unpredictable weather. This dedication was necessary to prepare for the challenges of the ride.

"There were hills, blisters and fatigue in wind and high heat!" notes Humberto. "But in addition to the training, all I really did was spend one weekend riding 182 miles to help somebody living with MS."

Other ride challenges, including hunger, backaches and fatigue were combated by the 25 person volunteer team under the direction of Ken McMullin, Assets Manager, Land US. Volunteers set up a large tent, cots and tables, cooked and had cold drinks on hand throughout the day. In addition, riders were treated to massages by licensed therapists.



Michele Wood and Mark Cassellis at the end of day one. Photograph: Liza Yellott

“We really focused on the comfort of the riders so that they were able to concentrate on finishing the ride safely,” he reflects.

Veritas raised \$50,000 for the Lone Star Chapter of the Multiple Sclerosis Society. Supporting over 17,000 Texans who live with Multiple Sclerosis, the organization is dedicated to finding a cure for this debilitating disease. Over 13,000 riders participated in the event, making it one of the largest in the country. Pledges for 2006 are currently being tallied and the event is expected to raise over \$10 Million dollars.



Team Veritas at the finish. Photograph: Doug Mainous



Annette Moss about to cross the finish line. Photograph: Mark Cassellis

## BP MS150



The BP MS150 Bike Tour ([www.ms150.org](http://www.ms150.org)) is a two-day cycling adventure from Houston to Austin that raises funds to help people living with multiple sclerosis (MS).



# Keeping Cool

## The Hottest Topic in Data Processing?



Pushing the envelope to make new technologies work for us

When your boss tells you to finish a project within a tight deadline...you might sweat a bit, panic a little and then grudgingly work harder/later to get the job done. But when Greg Mooney's boss tells him that Veritas needs more data processing power, Greg thinks, "Cool!"

The colossal computing power required to process seismic data today produces so much heat that modern data processing centers would shut down within a matter of minutes if they were not adequately cooled.

Dealing with extreme heat has not only become the hottest topic in data processing today, but it has also been at the top of Greg Mooney's (Manager, Technology Services) to-do list while he oversees quantum-leap advances in processing power at our Houston Processing Center (HPC).

"The experts were telling us that we could not have as many CPUs in the data center as we wanted, because we wouldn't be able to keep them cool enough," Greg told us. "At the same



Cooling capacity required at our Houston Processing Center (HPC) is enough to air-condition about 350 US households. Photograph: Greg Mooney

time, my boss was telling me that we've got to have more processing power!"

Growth of HPC (2000 - 2006)	
	% Change:
Computers (CPUs)	3640%
Air-Conditioning (tons)	800%
Power (kilowatts)	467%

### The Challenge

The latest upgrades cap a 3,640% surge in the number of CPUs running in HPC. Greg and his team faced the huge challenge of 'cooling the heels' of this ever-growing arsenal of data processing hardware and horsepower. The heat was on to find a solution.

### A Clean Sheet of Paper

"The 'experts' couldn't actually prove why this could not be done, so we decided to work it out for ourselves," continues Greg.

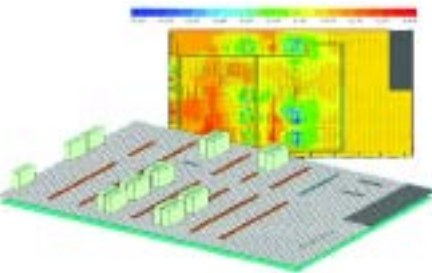
Greg's team took the 'start-with-a-clean-sheet-of-paper' approach by studying exactly how A/C works. They learned that A/C usually

involves monitoring the cooled air as it is returned to the cooling units — this is called 'return side control'.

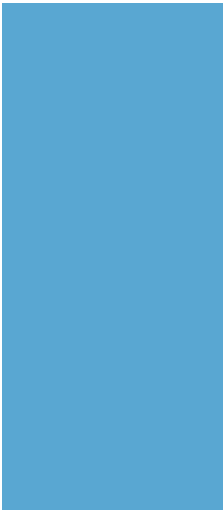
But the team discovered that 'supply side control' — where the cooled air is monitored as it leaves the cooling units — allows for increased airflow and better control of the cooling system.

The team also discovered that precise placement of air handlers and processing hardware is "crucial to making this work".

Despite being told by those same 'experts' that he was "out of his mind", that he had



Calculating heat distribution, placing equipment and managing airflow are crucial in a modern data processing center



New cooling equipment is lifted into place. Photograph: Greg Mooney

"no idea what he was talking about" and that "it can't be done," Greg persevered.

### The Veritas 'Can Do' Attitude

Greg's team designed a new and unique airflow management scheme, driven by enough cooling capacity to air-condition about 350 US households. Strategically placed control panels allow precise monitoring and control of air conditions throughout the data center.

Underfoot, if a non-grated floor tile is ever removed, the force of cold air would be strong enough to blow off the ceiling tile(s) above, or even to break light fixtures!

The result is that our Houston data center's cooling capacity has increased 330% to an industry-defying level that is double what 'experts' claim to be the maximum achievable. Even more remarkably, our power consumption efficiency has actually improved by 10% in the process!



CPUs are up and running efficiently in Houston's high-density data processing center. Photograph: Greg Mooney

Greg's team has pushed technology to the limit to build a 'cool' high-density seismic data processing center that the 'experts' said was not possible.

When asked how they 'defied the odds', Greg replied, "persistence, research, vigilance, good contractors...and more persistence. It's the Veritas 'can do' attitude to push the envelope and make new technologies work for us".

"Even when experts visit our data center, they have trouble comprehending what we're doing and are convinced we have our numbers wrong," laughs Greg. "As long as they think this, and as long as they continue telling our competitors that it's not possible, this is a huge advantage for Veritas. And that's cool."



Prize Puzzle

Win US\$500 for Charity!



Spot all 10 differences and Veritas will donate US\$500 in your name to charity

At first glance, these two images appear identical. But looks can be deceiving. There are actually ten (10) differences between the images. Spot all ten (10) differences and you could win US\$500 for charity.

How To Enter:

- 1. Identify the ten differences between these two images.
- 2. Either indicate your answers on this page, fill in your contact information (below) and fax to +(1)+(403) 205-6040, OR e-mail your answers to: mark\_shepherd@veritasdgc.com
- 3. Deadline for receipt of entries is midnight MST on September 22, 2006.
- 4. A random draw will be made on September 25, 2006 and the first correct solution drawn will be the winner. The winner will be contacted to verify payment to their charity of choice.

Note: Contact information will ONLY be used to inform the prize winner and will NOT be sold or externally distributed.

Rules: This contest is open to anyone – not just Veritas employees – but only one entry is allowed per individual. To be eligible to win, completed solutions should either be e-mailed to mark\_shepherd@veritasdgc.com, or faxed to +(1)+(403) 205-6040, before midnight MST on September 22, 2006. The first correct solution to be randomly drawn on September 25, 2006, from all submitted entries will be the winner and will be notified immediately by e-mail. The correct solution will be published in the next Seismic Observer magazine.



Completed By:

Name: E-mail:

Company: Preferred Charity (choose one):

Phone: ☐ Doctors Without Borders ☐ UNICEF ☐ Red Cross

— Written with files from Dan Boudreault and Peter Gammell

>geomaticsupdate

Positioning for Success



veritas joins consortium to deliver nad83 migration services

Veritas has joined IHS and Geomatics Data Management Inc. in forming a strategic consortium to provide a turnkey solution to manage data conversion from North American Datum (NAD)27 to NAD83.

The IHS-led consortium offers a complete solution for managing data referenced to NAD27 and NAD83. This includes education, project scoping, definition and strategy, consulting and comprehensive data conversion, correction and quality assurance services. Companies can choose all or a subset of the full package to meet the needs of their unique conversion project.

Services also include the upgrade and implementation of an industry-wide authoritative land grid, conversion of data from the NAD27 datum to the NAD83 datum, gate-keeping on data transferred between organizations, and consulting on all facets of this issue.

The consortium also addresses data clean-up, which is a large part of any conversion effort and often the most unknown variable.

In Western and Northern Canada, the oil industry primarily uses NAD27, but all levels of government and the regulatory bodies are either converting to NAD83 or have converted, and most other industries are already using NAD83. A location expressed in NAD27 is different than that expressed in NAD83. For example, if one were to pinpoint the location of a well using NAD27 and NAD83, the UTM location coordinate difference will be greater than 200 meters.

One major Canadian producer we have already assisted has referred to their complete NAD83 conversion as a “competitive and operational advantage”. Their data and grid are now consistent, accurate and precise. Accurate coordinate data is important from operational and cost containment standpoints. In fact, a recent study completed by the Canadian Association of Petroleum Producers (CAPP) stated that the current industry cost of incorrectly located wells due to incorrect coordinates data is estimated at \$25 million annually in Canada alone.

Dan Boudreault, Senior Geomatics Engineer for Veritas, says, “The consortium provides a unique combination of analysis, project management, technical expertise, conversion, quality control services and supporting software. This excellent combination of capabilities will be available to all customers in order to help meet their needs.”

11 Dan Boudreault, Senior Geomatics Engineer for Veritas, speaks at a technical symposium announcing the formation of the consortium between Veritas, IHS and Geomatics Data Management Inc. Photograph: Nicola Clark

A Global Issue

Our industry's initiative to migrate to a more accurate geodetic reference frame is not unique to Canada. South American countries are undergoing similar changes to comply with their NAD83 equivalent, SIRGAS (Sistema de Referencia Geocentrico para Las Americas); Australia has already completed their migration to GDA94 (Geocentric Datum of Australia) and Yemen has implemented YNGN96 (Yemen National Geodetic Network).

The commonality of these datums is their relationship to WGS84, on which all GPS observations are calculated. These datums are compatible to WGS84 within 1 - 2 meters and address local deformities to better position their geospatial data. The U.S.A. have yet to consider converting, but some U.S. companies are interested in the impact and value it brings to their Canadian counterparts.

Offshore data are mostly acquired in WGS84 and may be incompatible with the onshore datum used by that country, thereby initiating migration possibilities.



# Research Review

## 4D Binning



Simultaneous 4D binning compares two 3D surveys to keep only the most repeatable traces

Producing oil or gas from the Earth causes a change in the acoustic/elastic properties of a reservoir, albeit often very subtle changes. Consequently, it is sometimes possible to measure a change in the seismic signal from the reservoir.

Time-lapse, or 4D, seismic exploits this change in reservoir properties by acquiring two or more 3D seismic surveys over a producing reservoir at different times. Differences between the surveys can be used to help understand how the reservoir is changing, in order to maximize future production. For example, it can be used to image and identify areas of unswept oil and then target these with infill drilling.

However, since the changes in the seismic signal are often very subtle, every effort must be made to minimize any differences in the surveys that are not due to production. In order to image the reservoir, the seismic waves must travel down through the Earth to the reservoir, reflect from it, and then travel back up through the earth to be recorded. As might be imagined, even small variations in the ray paths through

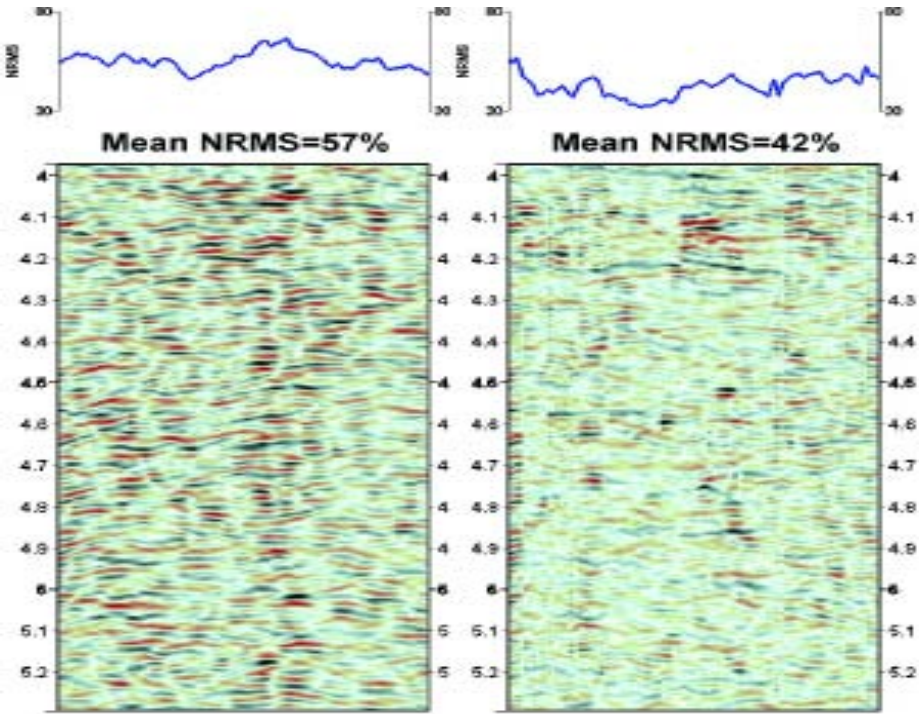


Figure 4: 4D difference displays comparing traditional 4D binning (left) against Veritas' latest simultaneous 4D approach (right). Note the clear reduction in amplitude using the simultaneous approach

the earth above the reservoir can result in changes to the seismic data that are as large, or larger, than the changes due to production, hence masking any potential 4D effects.

With this in mind, 4D monitor surveys should ideally attempt to repeat the baseline acquisition by matching the original shot and receiver positions. In practice, such repeatability can be difficult, especially with marine data, so there may always be differences between the two surveys. 4D binning looks at the geometry data for both surveys simultaneously and then selects from the two surveys the best matching traces. The aim is to keep only the most repeatable data.

### How Does it Work?

4D binning starts from the ideas of 3D binning which are fundamental to 3D seismic processing (see Figure 1). When binning 3D data we can

choose from a range of criteria for selecting which traces to use. For example, in Figure 1 we might keep trace 1 if we wanted the smallest shot-receiver azimuth, or trace 2 if we wanted the trace nearest the bin centre.

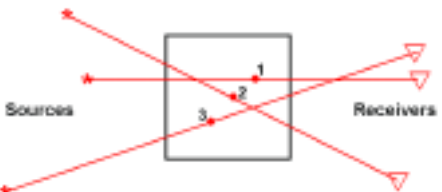


Figure 1: 3D binning (map view)

In 4D processing we now have two surveys to consider, as illustrated in Figure 2, where data from the first survey are shown in red and the second in blue. From these data we want to find the most repeatable or most similar traces.

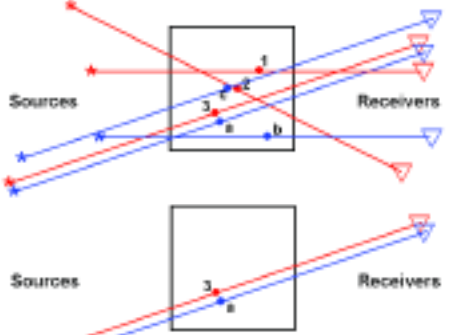
If we were to process both surveys independently, then we might select in each the trace

**What is Binning?** When processing an ideal seismic survey, we take the average of several traces shot at the same location in order to improve the signal to noise of the final image. In this situation, we mean that the mid-points of the traces are at the same location i.e. the point mid-way between the shot and the receiver. This process is called CMP, or Common Mid-Point stacking.

In practice, the mid-points of the recorded traces do not fall at exactly the same positions (this can be caused by feathering of marine cables, or obstructions such as trees meaning that the shots and geophones are not a perfectly regular grid.) So, we divide up the surface of the earth into a grid and each grid cell forms a 'bin'. The traces that fall into a bin are then stacked or averaged to form the image as if they were at exactly the same point. For marine data, a typical bin might be 12.5m x 25m in size. This is illustrated in Figure 1, which shows three different traces assigned to a bin.

The irregular nature of practical shooting means that each bin can receive a different number of traces which causes undesirable differences in image quality from one stacked trace to the next. So, in 3D binning, we select traces within a bin so that ideally each bin has the same number of traces.

nearest the bin centre. This would give us traces 2 and c. A more sophisticated approach (cascaded binning) would be to bin the first survey and then find the trace in the second that best matched it. For example, we could keep the smallest azimuth in the first survey and then find the best azimuth match in the second survey. This would give us traces 1 and b. Both these methods have been used on 4D surveys up until now.



Figures 2 and 3: Data from the first survey are shown in red and the second in blue (map view).

The only way to consistently find the best matched traces is to analyze both data sets simultaneously. If we look for the traces with

the most repeatable shot and receiver positions we get traces 3 and a, as illustrated in Figure 3. These traces will have the most similar ray paths through the Earth so we can be more confident that any differences we observe in the signal from the reservoir are due to oil or gas production. This is our new method of 4D binning.

A more advanced version of our new 4D binning, allows us not only to choose the most similar shot-receiver geometry, but also to use any other geometry attribute (e.g. mid-point, azimuth). We can even use the properties of the seismic data instead of the geometry. For example we could select traces that have the best cross-correlation or smallest NRMS difference. The choice of which criteria to use is up to our clients.

### Results

A great deal of testing is required at this stage of the processing to ensure that the best criteria are selected. As well as looking at seismic displays, Veritas' new 4D binning package

includes full 4D attribute analysis functionality. Numerous attribute combinations can be evaluated in this manner.

4D difference displays obviously provide the ultimate QC however. The accompanying plots (Figure 4) compare traditional 4D binning against Veritas' latest simultaneous 4D approach. Note the clear reduction in amplitude in the difference section (there is no genuine 4D signal in this area – so a reduction in amplitude is a good thing!). Also note the clear reduction in NRMS (normalized RMS defined as: RMS of the difference/Average RMS of the inputs).

### Conclusions

Simultaneous 4D binning is the technically superior route for processing 4D data. Veritas' latest 4D binning package allows both attributes and 4D statistical criteria to be used in a fully simultaneous manner. This approach has produced proven improvements in 4D data quality and is fully production ready having been used on two recent 4D surveys.



# Around the World at Veritas

Buenos Aires, Calgary, Crawley, Houston, Nigeria and Perth



Our shutterbugs have been out and about bringing you pictures from recent Veritas social events



Calgary employees playing pool after work.  
Photograph: Vee Skeet



Buenos Aires employees enjoying a group lunch.  
Photograph: Ana Guigou



Perth employees enjoy a fun game of golf.  
Photograph: John Coffin



Employees from Crawley and Nigeria after the Veritas Geophysical Nigeria board meeting in Abraka, Nigeria.



Houston employees enjoy the 4th Annual Crawfish Broil.



Crawley employees enjoy an evening of curling.  
Photograph: Karen Purcell

— Written with files from John Glover, Dave Kennedy Linda Manning, Roy Bampton, Philip Gunn, Brent O'Brien, Bob Davies, Charlie Stewart and Tim Brooks

## >crewsnews

*“We currently have 11 land crews and six marine vessels at work around the world. Here’s the latest on where they are and what they’re doing.”*



[ 1 ]

### australia, cameroon, canada, india, libya, oman, trinidad, u.k., u.s.a.

**Australia...**The M/V Pacific Sword carried out a series of 2D and 3D projects on the Northwest Shelf of Australia before transiting to Singapore for her fifth special survey dry-docking. Subsequently, she traveled to the Bass Strait (between Australia and Tasmania) to serve as a source vessel for undershooting operations with the SR/V Veritas Viking II. Once complete, she will conduct 3D operations in Vietnam.

The SR/V Veritas Viking II completed a series of 3D projects on the Northwest Shelf of Australia before also moving to the Bass Strait for a proprietary 3D program. Upon completion, the vessel will head to Southeast Asia to carry out additional projects offshore Brunei and Vietnam.

**Cameroon...**a new crew recently mobilized into Douala Harbour for a ‘land’ program to be shot wholly offshore in water depths between 5m and 18m with an airgun source.

**Canada...**There are four crews operating in western Canada. Two are in British Columbia and two are in Alberta acquiring a variety of 2D and 3D dynamite surveys.

**India...**The R/V Veritas Searcher has recently been acquiring 13,000 km of 2D data in eastern and western offshore India. On completion the vessel will travel to Singapore to be decommissioned and replaced with the new M/V Veritas Voyager. The first project for this vessel will be a 2D survey offshore Philippines.

**Libya...**a new crew recently started shooting a large 2D vibroseis program in the northern Sirte basin. The program is expected to continue into the summer of 2007.

**Oman...**We have renewed our long-term contract with Petroleum Development Oman (PDO) for another four years and recently completed a 258 sq km 3D vibroseis program over the existing Amal oilfield in Oman. The crew then mobilized 560 km north to a terrain of undulating gravel plains and small sand dunes in Al Hussain, to shoot a two and half-month, 516 sq km vibroseis 3D program.

**U.K....**The M/V Seisquest returned to West Africa in November, following a maintenance docking in Bergen, Norway. The vessel commenced the West African season with a large proprietary 3D survey in the OPL 320 area, offshore Nigeria in December and January prior to starting work on a proprietary 3D survey offshore Benin, which completed in April. The transit to the North Sea included a short port call in Gibraltar for a cable reel and workshop installation and winch upgrade. A data library project off the coast of Aberdeen is the first project for the North Sea season.

The SR/V Veritas Viking transited from the Gulf of Mexico to the Caribbean where she completed a project offshore Trinidad. The vessel then mobilized to the North Sea for data library projects.

**U.S.A....**In the lower 48 states, two crews are conducting 24-hour vibroseis operations in northwestern Kansas and in south Texas.

In Alaska, one crew is conducting 24-hour vibroseis operations along the North Slope, north of the Arctic Circle, while another crew is in the Cook Inlet conducting 2D and 3D shot hole programs.

The SR/V Veritas Vantage returned to the Gulf of Mexico from the North Sea in early November and made a port call in Galveston before commencing work. As the port call coincided with the SEG Convention in Houston, an Open House was held on the vessel, with over 250 clients and other personnel in attendance. The vessel then completed a three-month 4D project in the Gulf of Mexico, and recently commenced a data library project in the area, which will conclude at the end of July, to be followed by another 4-D, then a wide azimuth project that will continue into next year.

[ 1 ] A cargo transfer in the North Slope of Alaska, U.S.A.  
Photograph: Chad Kalk

[ 2 ] The R/V Veritas Searcher workboat is launched.  
Photograph: Chris Thompson

[ 3 ] 2D vibroseis crew and one of Veritas’ new Hilux vehicles in Oman. Photograph: Jason Schleh

[ 4 ] M/V Seisquest in dry-dock in Gibraltar in April.  
Photograph: Ian Brann

[ 5 ] 2D vibroseis crew operating in South Texas, U.S.A.  
Photograph: George Henslee



# Dirty Tapes Come Clean



98% of data were retrieved from 'shocking' batch of tapes neglected for 15 years

Working at Veritas can expose our employees to an amazing variety of work environments... from riding a boat 2,000km offshore in the Indian Ocean, to flying across sun-scorched deserts in helicopters, to driving a vibroseis truck in -50°C temperatures in Alaska, to using Tornado software wirelessly while airborne at 30,000 feet above the ground...

...But scraping rat droppings off cardboard boxes?

### Dressing Up, Getting Down and Dirty

About one thousand 15 year-old, 9-track magnetic data tapes were delivered to our Crawley, U.K. center looking like they had been buried in someone's garden and left to rot — covered with dirt, mildew, bird and rat droppings and stinking of damp.

Our assignment? To retrieve the seismic data from these dirty tapes.

Julian Hill, Shift Supervisor, Data Services, was one of our staff assigned to the task. As there was no telling what kind of 'nasties' the tapes might contain, Julian and his coworkers had to



Dirty tapes, neglected for 15 years and covered in mildew and rat and bird droppings

wear masks, gloves and protective overalls every time they handled the tapes.

### From Dirt to Data

"We've had 20 years of practice at successful data recovery, but dealing with bird and rat droppings and all the filth and damp damage were a little worrying," commented Jan Wood, Data Services Manager, Crawley. "We have never seen tapes in such shocking condition."

To recover data from deteriorated media we often use heat. Julian and his team baked the dirty tapes in a drying oven for three weeks at a constant, controlled temperature of between 55 and 65°C. As the oven baked the tapes, it also extracted air, drying the tapes' magnetic oxide coatings. This helped the oxide re-bond with each tape.

After the tapes had cooled down, the team painstakingly cleaned the full length of every tape (2,400 feet) using a modified tape-cleaning

drive, a skilled eye, incredible attention to detail, reams of tissue paper and, above all, endless care and patience to remove any loose particles.

The team then started reading the now-much-cleaner tapes on robust vacuum drives, but the drives kept stopping on almost every tape error and inter-record gap. At every stoppage, the team had to clean the tape-drive head, rewind the tape a few feet, then re-start the reading process in order to eventually copy all the data safely onto disk.

This process was repeated for every tape.

"I never thought I'd see the day where I would have to dress up like I was about to graffiti our warehouse walls for an underground rave party. Most of the time, our work is perfectly clean."

Julian Hill,  
Shift Supervisor, Data Services



Julian, dressed in his 'raving outfit', collects the dirty tapes



The condition of the dirty tapes was 'shocking'



Inspecting a dirty tape for internal damage



Dirty tapes go into the oven for three weeks



Dirty tapes are cleaned with tissue paper and a careful hand



Data are copied from a dirty tape to disk

Once all the data from the tapes were copied to disk, the data were easily copied to modern 3590 tapes and returned to a very satisfied client.

"Experience, technically advanced tools and highly skilled employees enabled us to rescue over 98% of the data," Jan said proudly. "It was an agonizing process at times, but well worth it when you consider that the data will be useable for many more years to come."

Lets hope the new tapes are stored in better conditions this time! Veritas offers this type of data recovery service through any of our 20 centers worldwide.

For more information on our data services please contact [jan\\_wood@veritasdgc.com](mailto:jan_wood@veritasdgc.com).



98% of the data were rescued and copied to new 3590 tapes

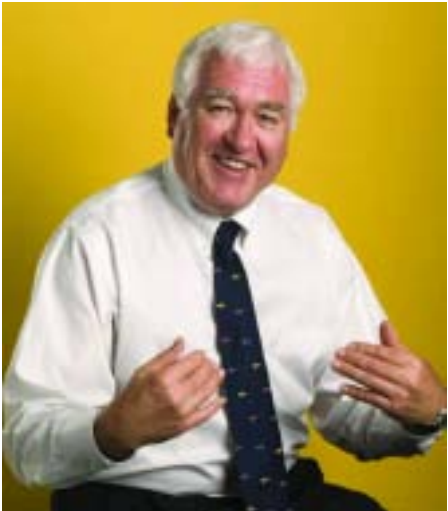


# Employee Service Awards

Celebrating 1,306 Years of Experience

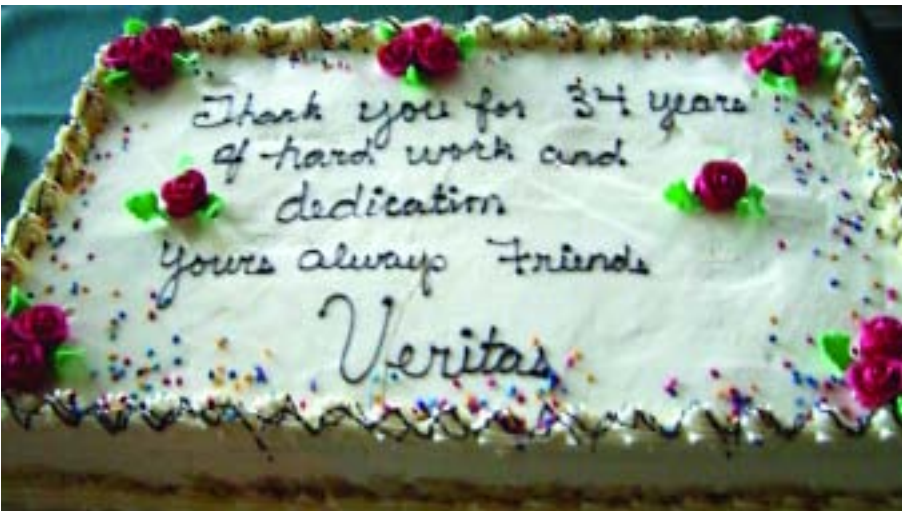


From July through December 2005, the following individuals celebrated employment anniversaries with Veritas:



After more than 34 years with Veritas, Vice Chairman Steve Ludlow retired on Friday 31st March 2006. Good luck in your well-deserved retirement Steve!

3 5 Y E A R S			1 0 Y E A R S		
Conerly, John	16-Nov-70	Houston	Barthold, Clarence	21-Oct-95	Offshore
3 0 Y E A R S			Borthelle, Santiago	1-Oct-95	Buenos Aires
Kelley, Daniel	1-Nov-75	Offshore	Bratke, Michael	4-Jul-95	Calgary
2 5 Y E A R S			Canal, Gerardo	17-Aug-95	Gabon Land Crew
Goh, Kue Kee	26-Aug-80	Singapore	Carrillo, Rafael	27-Aug-95	USA Land Crew
Kumar, Jitendra	25-Nov-80	Singapore	Carter, Charles	9-Sep-95	Houston
Law, Raymond	1-Oct-80	Calgary	Cassellis, Mark	1-Nov-95	Houston
Mah, Kim Fong	3-Nov-80	Singapore	Graham, Shaun	7-Dec-95	Oman Land Crew
Pasveer, Frederick	15-Jul-80	Houston	Harman, Noel	1-Jul-95	Offshore
Shui, Sap Pho	18-Aug-80	Singapore	Hood, Danielle	2-Oct-95	Houston
Supuan, Sitinorsinah	16-Oct-80	Singapore	Hutchinson, Melvyn	15-Sep-95	Offshore
Yusoff, Borhanudin	22-Oct-80	Singapore	Jones, Stephen	29-Dec-95	Offshore
2 0 Y E A R S			Kryski, Gil	28-Dec-95	Canada Land Crew
Andersen, Kim	1-Sep-85	Calgary	Lomas, Christopher	16-Jul-95	Offshore
Baxter, Shelley	1-Aug-85	Calgary	Mah, Anna	25-Sep-95	Canada Land Crew
Desjarlais, Murray	21-Aug-85	Calgary	Mendez-Pardo, Alvaro	27-Jul-95	Houston
Kelley, Don	2-Dec-85	Houston	Munday, James	15-Nov-95	Offshore
Parrott, Geneva	22-Jul-85	Houston	Nelligan, Peter	5-Sep-95	Canada Land Crew
Shirley, Michael	14-Dec-85	Houston	Parfett, Blair	18-Sep-95	Calgary
Turner, Robert	8-Jul-85	Canada Land Crew	Petrella, Allan	28-Aug-95	Calgary
Webb, Kerry	1-Sep-85	Calgary	Quintanilla, David	27-Nov-95	Houston
1 5 Y E A R S			Ramsay, Roland	31-Jul-95	Canada Land Crew
Cheadle, Scott	4-Sep-90	Calgary	Rideout, Christopher	19-Dec-95	Canada Land Crew
Chernis, Leon	1-Oct-90	Houston	Rondoleanu, Aurel	21-Oct-95	Offshore
Green, Karen	3-Dec-90	Calgary	Sfara, Ronald	1-Aug-95	Houston
Harding, Matt	13-Sep-90	Houston	Trevino, Rick	11-Oct-95	Houston
Joyce, Robert	13-Aug-90	Houston	Warren, Craig	10-Aug-95	Canada Land Crew
Ma, Francis	1-Aug-90	Calgary	Wong, Donald	20-Nov-95	Calgary
Mignogna, Tony	22-Oct-90	Houston	5 Y E A R S		
Newton, Chris	15-Oct-90	Crawley	Aguilar, Alberto	12-Nov-00	Gabon Land Crew
Sack, Peter	8-Oct-90	Houston	Aldenete, Ariel	26-Oct-00	Offshore
Sander, Al	27-Dec-90	Houston	Ambrosi, Mark	1-Aug-00	Houston
Scott, Peter	25-Nov-90	Calgary	Amparo, Carlyle Rosdyn	27-Sep-00	Canada Land Crew
Singh, Malvinder	30-Aug-90	Singapore	Asuelo, Neil	7-Sep-00	Offshore
Wilkinson, David	7-Aug-90	Calgary	Atherton, David	25-Aug-00	Crawley
Williams, Douglas	30-Sep-90	USA Land Crew	Bagby, Myles	23-Oct-00	Canada Land Crew
			Bell, Ronald	8-Aug-00	Canada Land Crew
			Brown, Mary	29-Sep-00	Calgary
			Brown, S. Neil	12-Dec-00	Canada Land Crew
			Butler, Lisa	27-Nov-00	Calgary
			Campbell, Gregory	9-Jul-00	Offshore
			Collins, Jeremy	27-Aug-00	Offshore
			Cox, Brian	9-Jul-00	Oman Land Crew



Cuskern, Peter	17-Jul-00	Offshore	Beckner, Katie	8-Sep-03	Houston
Da Costa, Jose	13-Sep-00	Gabon	Brata, Albertus	10-Oct-03	Offshore
Downie, Sue	1-Nov-00	Houston	Brown, Stephen	15-Aug-03	Oman Land Crew
Du, Harry	21-Aug-00	Calgary	Buffham, Wayne	2-Jul-03	Offshore
Gallagher, Brian	13-Nov-00	Calgary	Canuel, Anita	29-Oct-03	Canada Land Crew
Gassiot, Kevin	27-Jul-00	Houston	Carvajal, Gabriel	1-Dec-03	Houston
Hassoun, Omar	1-Nov-00	Calgary	Cassim, Glenn	10-Nov-03	Offshore
Howard, Graeme	24-Jul-00	Calgary	Chen, Linda	14-Jul-03	Calgary
Kennedy, Aaron	21-Oct-00	USA Land Crew	Dawood, Sulaiman	1-Aug-03	Oman Land Crew
Keyes, Ken	18-Nov-00	Calgary	Dina, Harold	1-Dec-03	Perth
Korembli, Marcelo	1-Oct-00	Buenos Aires	Dobson, Donna	21-Nov-03	USA Land Crew
Lau, George	25-Jul-00	Calgary	Duggdal, Clive	17-Nov-03	Offshore
Li, Gong	2-Oct-00	Calgary	Epp, Chris	1-Oct-03	Canada Land Crew
Lofts, Alan	29-Jul-00	Offshore	Ernst, Marti	18-Aug-03	Houston
Lugones, Adolfo	1-Oct-00	Buenos Aires	Gammell, Peter	1-Aug-03	Calgary
Manek, Bharat	18-Dec-00	Oman Land Crew	Griebe, Karen	21-Jul-03	Houston
Mooney, Bradley	23-Aug-00	Offshore	Hamlin, Rick	8-Sep-03	Houston
Motazid, Momtaz	8-Jul-00	Oman Land Crew	Haydon, Jennifer	24-Jul-03	Houston
O'Connell, Kevin	13-Sep-00	USA Land Crew	Hunt, Natash	21-Jul-03	Crawley
Pagliero, Angie	2-Oct-00	USA Land Crew	Infante, Charley	1-Dec-03	Houston
Pagliero, Joe	2-Oct-00	USA Land Crew	Ji, Shuo	3-Nov-03	Houston
Pangle, Glen	18-Dec-00	Offshore	Khamis, Talal	1-Aug-03	Oman Land Crew
Payne, Patrick	25-Sep-00	USA Land Crew	Klein, Arthur	16-Sep-03	Rio de Janeiro
Perrone, Ricardo	25-Sep-00	Brazil	Laforest, Mark	1-Oct-03	Canada Land Crew
Ramirez, Victor	11-Jul-00	Houston	Lin, Forest	10-Nov-03	Houston
Renderos, Wil	12-Dec-00	Calgary	Lin, Wen-Jack	1-Dec-03	Houston
Rios, Edgar	5-Oct-00	Houston	Luo, Xiaowei	5-Aug-03	Calgary
Richardson, Nicole	12-Nov-00	Gabon Land Crew	Machicao, Cinthia	5-Dec-03	USA Land Crew
Rodriguez, Jesus	22-Oct-00	USA Land Crew	Mahmood, Mohammed	1-Aug-03	Oman Land Crew
Saenz, Alvando	1-Nov-00	USA Land Crew	McDonald, William	22-Sep-03	Luanda
Smith, Tad	7-Nov-00	Houston	Mcintyre, Joanna	16-Jul-03	Offshore
Statham, Andrew	15-Aug-00	Offshore	Mohammed, Masood	1-Aug-03	Oman Land Crew
Stubbs, Michael	25-Jul-00	Canada Land Crew	Passey, Thomas	24-Nov-03	Perth
Tallents, Steven	21-Jul-00	Offshore	Rahman, Said Abdul	1-Aug-03	Oman Land Crew
Thornton, Mike	28-Nov-00	Houston	Rollandi, Veronica	5-Dec-03	Houston
Tong, William	13-Dec-00	Calgary	Rosas, Francisco	7-Sep-03	Offshore
Trupp, Rick	18-Sep-00	Houston	Salim, Abdullah	1-Aug-03	Oman Land Crew
Tubman, Ken	11-Sep-00	Houston	Scott, Shane	15-Oct-03	Canada Land Crew
Wang, Pei San	13-Nov-00	Singapore	Smith, Jeff	31-Aug-03	Offshore
Whiteley, Brent	10-Jul-00	Houston	Soo, Khok Ping	1-Jul-03	Kuala Lumpur
Williams, Ken	2-Oct-00	Houston	Sultan, Salim	1-Aug-03	Oman Land Crew
Winspear, Paul	20-Dec-00	Crawley	Talal, Abdullah	1-Aug-03	Oman Land Crew
Xie, Yi	1-Dec-00	Singapore	Ting, Chu-Ong	4-Dec-03	Houston
2 Y E A R S			Trist, Jenny	27-Oct-03	Perth
Abdala, Gabriel	1-Nov-03	Buenos Aires	Trotter, David	6-Oct-03	Calgary
Abdullah, Hamad	1-Aug-03	Oman Land Crew	Uldum, Tristan	1-Nov-03	Perth
Ancira, Cheryl	21-Jul-03	Houston	Ward, Liam	22-Sep-03	Offshore
Anicich, Pablo	2-Dec-03	Buenos Aires	Young, Richard	28-Jul-03	Crawley
			Zucchi, Hector	1-Oct-03	Buenos Aires







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the seismic  
observer

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