Case study

CGG

HP Z Turbo Drive facilitates fast, highly accurate geophysical interpretation

Industry
Geoscience, Oil & Gas

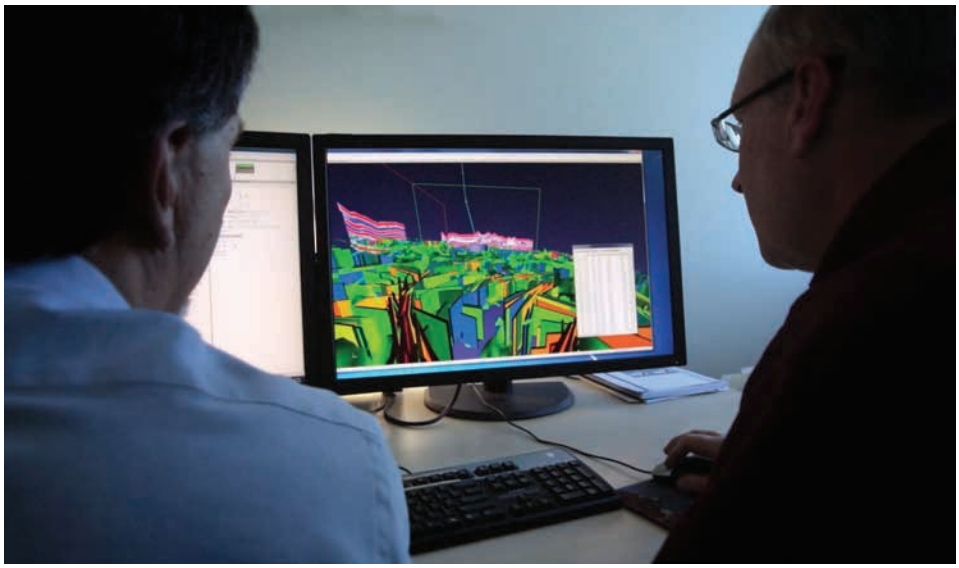
Objective
Increase the speed of geophysical interpretation supporting the oil and gas industry

Approach
CGG deploys HP Z840 Workstations with a Samsung-powered HP Z Turbo Drive SSD to analyze geophysical data using its Insight Earth software

IT matters
- Significantly faster I/O speed
- Improved data resiliency
- High return for low incremental cost

Business matters
- Load and save times for massive geophysical data files cut by half compared to other solid state drives, and by more than 80% compared to traditional hard drives
- Faster loading of geophysical data sets improves productivity and reduces need to decimate files prior to analysis
- Faster saves of geophysical data sets improves data resiliency during interpretation
- Additional productivity enables better results

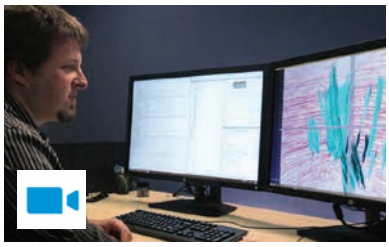
HP recommends Windows.



"The HP Z Turbo Drive SSD is leading-edge Samsung SSD technology put on a PCIe Express card, so it eliminates the I/O bottlenecks of the SATA channels and communicates directly with core components of the Workstation."

– Stephen Dominguez, Applications Engineer, CGG

CGG is a fully integrated geoscience company that provides leading geological, geophysical and reservoir capabilities to a broad base of customers in the global oil and gas industry. Its Insight Earth software, running on HP Z840 Workstations equipped with the HP Z Turbo Drive, enables the company to consistently guide oil and gas customers to productive fields and well sites.



Click image to view CGG video

HP recommends Windows.

The oil and gas industry has long been associated with the "boom or bust" stories from the movies. For more than a half century, companies drilled wells based on little more than an instinctive, best guess at where oil might lie beneath the surface. Midway through the 20th century, the odds of finding oil in a given location could be worse than a roll of the dice in Las Vegas.

But in recent years, technology has dramatically changed the odds. Oil and gas companies can now predict more reliably where petroleum reserves lie beneath the soil, thanks to companies like CGG and its Insight Earth software, which facilitates seismic exploration.

It all starts with the acquisition of seismic data. A company like CGG transmits controlled acoustic energy into the earth, and records the sound that is reflected back from the layers in the subsurface.

The reflected sound is the raw data of seismic exploration. Once CGG has the reflections, it can apply its sophisticated processing software solutions to create a final dataset ready for interpretation. The Insight Earth software is then used to interpret the reflections and create a 3D map of the subsurface structure.

"The noise reflected back to our geophones gives us the raw data we need to ultimately determine how many rock layers there are, where they are, where there are cracks and voids in the layers, and ultimately, where oil and gas deposits are most likely to occur," explains Stephen Dominguez, applications engineer with CGG.

Seismic interpretation is a "Big Data" challenge

Sounds simple, right? Unfortunately, while the seismic exploration process can be described simply, it is infinitely more difficult to carry out. It requires a massive amount of data, which must be analyzed extensively in the interpretation process.

Imagine the challenge: many sound sources and hundreds or thousands of geophones, each collecting the reflected sound from all the sources. The amount of seismic data recorded by CGG during just one small-sized marine 3D survey would fill more than 20,000 compact discs.

"We need a lot of power to interpret large datasets quickly and effectively," says Dominguez.

That's where Insight Earth and an HP Z840 Workstation with the HP Z Turbo Drive can help. CGG configures its Z840 Workstations to optimize seismic interpretation. The Z840 Workstation is configured with Intel® Xeon® E5 v3 processors with 36 processing cores, the maximum available RAM, and multiple NVIDIA graphics, along with the HP Z Turbo Drive SSD. The company runs Insight Earth under Red Hat® Enterprise Linux® 5 or Genuine Windows® 7.

"We believe Insight Earth running on HP Workstations is faster and more accurate than its competitors," says Dominguez.

The software's interpretive algorithms account for its accuracy. They include Fracture Spark, to visualize discrete fracture networks in the ground, FaultSpark to identify and construct fault planes, PaleoSpark to show hydrocarbon deposits in the stratal domain, and SaltSpark to identify salt bodies.

Other seismic interpretation software requires users to manually click through the data, over and over, possibly for weeks to months on end. Insight Earth automates the interpretation.

> "We believe Insight Earth running on HP Workstations is faster and more accurate than its competitors."
>
> – Stephen Dominguez, Applications Engineer, CGG

"If you don't have the software automate all this, it turns into a mundane, mind-numbing operation," Dominguez says. Sometimes users will opt for decimating the data file — essentially throwing out up to 90% of the data —just to make it more manageable.

CGG retains and interprets all the data— something that is practical only because it invests in the fastest, most capable configuration of its HP Workstations. "When you consider the value of time you would waste by working on a less capable workstation, the cost of a bigger, faster workstation is a small investment," Dominguez says.

HP recommends Windows.

HP Z Turbo Drive featuring Samsung M.2 PCIe SSD technology

Z Turbo Drive overcomes the I/O bottleneck

The first challenge of the interpretation process is simple: getting the data into the workstation. "Data I/O is historically one of the bottlenecks in seismic interpretation," Dominguez explains.

The HPZ840 Workstation used by CGG is ideally suited to the task, thanks to the HP Z Turbo Drive SSD. The Z Turbo Drive is powered by a Samsung XP941solid state drive and a unique PCIe interface.

> "When you consider the value of time you would waste by working on a less capable workstation, the cost of a bigger, faster workstation is a small investment."
>
> – Stephen Dominguez, Applications Engineer, CGG

Benchmark testing shows the HP Z Turbo Drive is six times faster than a traditional hard disk drive, and roughly twice as fast as SSDs utilizing a SATA/SAS interface[1]. Raw read performance exceeds 1 GB per second. The empowering Samsung SSD at the core of the Z Turbo Drive delivers extreme performance with its PCIe 2.0 interface.

Using the Z Turbo Drive improves workflow productivity for CGG's interpretation activities and removes a longstanding I/O barrier.

"The HP Z Turbo Drive SSD is leading-edge Samsung SSD technology put on a PCIe Express card, so it can eliminate the I/O bottlenecks of the SATA channels and communicate directly with the Workstation's core components," says Dominguez. "In our own tests, the Z Turbo Drive is **twice** as fast as other SSDs in certain circumstances, with burst rates that are over **three** times as fast."

This gives CGG a distinct advantage. For others in the industry using a traditional hard drive, it might take an hour or more to load a 30 GB data file into RAM for processing and interpretation. Once processing starts, the temptation is not to interrupt the workflows to save the work, because that would take part of another hour. So if there's a power outage and battery backup fails, or there's another glitch, all the day's work is lost.

Thanks to the Z Turbo Drive, inputting the file is significantly faster at CGG—roughly twice as fast as a SATA-connected SSD, and many times faster than a spinning hard drive. Therefore incremental data saves throughout the day are possible. So, data transfer is faster, and the data itself is more secure.

Optimizing software on HP Workstations

Another reason for Insight Earth's speed when running on HP Workstations is CGG's long experience in working with HP Workstations, and tweaking its software to take full advantage of the processing capabilities of the Z840.

Customer at a glance

Application
Seismic interpretation

Hardware
- HP Z840 Workstation
- HP Z Turbo Drive featuring Samsung PCIe SSD technology

Software
- CGG GeoSoftware Insight Earth

HP recommends Windows.

"It's very uncommon for off-the-shelf software to take advantage of dozens of processing threads. Most applications don't really use all that capability," Dominguez says. "Applications that are written for multi-core processing might be written to take advantage of eight cores. We've written Insight Earth to take advantage of every core in the Z840 Workstation—giving us several times the compute power."

In addition, the software takes advantage of GPU acceleration. GPUs in the Z840 Workstation are used to accelerate compute-intensive tasks, rather than being tapped only to process and display graphics. So CGG configures its HP Workstations with three graphics cards: an NVIDIA Quadro K6000 for graphics, and two Tesla K40 cards to process seismic data.

The FaultSpark module utilizes Automated Fault Extraction, a GPU-accelerated process that is highly optimized for parallel processing across multiple GPUs. PaleoSpark relies on a stratal domain transform which is a CPU-based process, so it relies solely on the processing cores in the Workstations' CPU.

FractureSpark, a fracture detection workflow, uses algorithms from both FaultSpark and PaleoSpark, making it the most taxing module of all. By tweaking the software to take advantage of both CPU and GPU processing, FractureSpark runs dramatically faster than it would otherwise.

CGG recommends HP Workstations

Such optimization is no accident. It results from a long, close history between HP and the creators of Insight Earth. They have recommended HP Workstations to run the software for several years.

"We were already working with HP and HP Workstations before we went commercial with Insight Earth," Dominguez explains. "We saw early on that HP would make significant advancements with each generation, such as the Z Turbo Drive SSD.

> "We get to test the leading edge HP equipment and make sure we're tuned for it ahead of time, so we're proactive and not reactive to changes in computer architecture. It's one of our keys to success."
>
> – Stephen Dominguez, Applications Engineer, CGG

"Since our software relies on high-end workstation computing, we want the best and fastest thing on the open market. We benchmark and certify our application on HP hardware ahead of releases and optimize our software to take advantage of what HP offers."

In fact, Dominguez says, without the HP relationship, the development of Insight Earth would be significantly behind where it is today. "We get to test the leading edge HP equipment and make sure we're tuned for it ahead of time, so we're proactive and not reactive to changes in computer architecture. It's one of our keys to success."

Learn more
hp.com/go/zworkstations
hp.com/go/zturbo
hp.com/go/oilandgas
samsung.com/us/hpworkstation

Sign up for updates
hp.com/go/getupdated

Share with colleagues

Rate this document

[1] Source of benchmark data.

4AA5-7574ENW, April 2015