DUG UNVEILS THE WORLD'S MOST POWERFUL SUPERCOMPUTER ... BUBBA

Petaflop power: (from left to right) Phil Schwan, DUG CTO, and Dr Matt Lamont, co-founder and MD, with Bruce, Bubba's sibling supercomputer in Perth.

DALE GRANGER

Mention the name "Bubba" to any golf guru in Texas and you can bet their response will wax lyrical on the driving power of the man who belts his driver longer than any pro on the US PGA Tour.

In Houston, however, for geophysics geeks who play in the Petaflop realm of superfast processing power, DownUnder GeoSolutions' (DUG) new supercomputer, Bubba, packs far more punch than Bubba Watson, the one-time US Masters champion.

Last month, as cooling tanks arrived for the huge, geophysically-configured Bubba at its Skybox Houston facility, it signalled a milestone moment in the annals of the global geoscience and tech services company that rose from humble, start-up origins in Subiaco.

DUG founding partner and Managing Director, Matt Lamont, had every reason to smile as Bubba, part of a unique cloud service tailored specifically to the geophysics community, called DUG McCloud, was launched to house a once fully-installed, 250 Petaflop (single precision) machine, ramping up to an eventually-planned Exaflop.

Moving forward, DUG expects to flex the most powerful computing muscles on the planet between its four global computer rooms; Bubba in Houston, Bruce in Perth, Bodhi in Kuala Lumpur, and Bazza in London.

So why Bubba: "Our marketing team had the idea that we should name our computers. So, we came up with Bruce, Bazza, Bodhi ... and we just liked it, because it sounded like a real big Bubba," Lamont said.

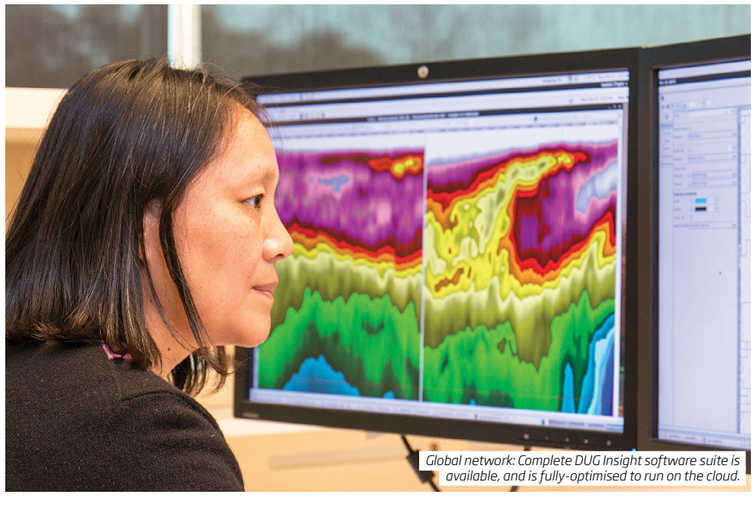
In layman's terms, the 20 Petaflop Bruce, already the biggest supercomputer in the southern hemisphere, wields the equivalent processing power of two million laptop computers which would soar four times the height of Mt. Everest if vertically stacked. With one Petaflop able to make 1000 trillion calculations a second, DUG is on track to have the most efficient data centre in the world.

Closer to home it's not hard to see why, considering that Bruce most recently distinguished himself with the unlocking of the Dorado prospect– the third largest discovery on the North West Shelf.

Construction of a purpose-built Exaflop compute facility to house Bubba began in Texas last year and, in spite of initial setbacks caused by winter storms, the company was delighted with Swiss-timing progression building up to the May launch date of DUG McCloud.

> *Bubba and his three global siblings will offer high-frequency, full durations that we believe will produce the best images the industry has ever seen in a very short turnaround time.*
>
> *- MATT LAMONT*

In February, along with immense concrete slabs for the facility's 10 enormous cooling towers, 20 km of cooling pipes were installed for Bubba, and enough power boards and air handlers to line the entire 50m (165ft) north wall.



Global network: Complete DUG Insight software suite is available, and is fully-optimised to run on the cloud.

DUG cools the massive Houston computer using its own patented immersion system that submerges the computer nodes in more than 700 specially-designed tanks filled with polyalphaolefin dielectric fluid. This greatly reduces both energy usage and costs, and increases the life and efficiency of the hardware, making it one of, if not the, greenest compute centres in the world.

Last month, the first of these 722 tanks arrived in shipping containers. The specially-designed tanks had spent many months in crates at sea, travelling thousands of kilometres across continents, through storms and plain sailing weather.

"We are beyond excited with how well the construction of the Houston facility is going. In a few short months we have gone from mud to six-metre high pipe stands for our cooling towers, and from an empty room to rows of our familiar orange, custom-made tanks.

DUG McCloud uses the largest installation of Intel® Xeon® Phi™ Knights Landing (KNL) nodes in the world. Already the largest commercial user of the high-performance KNL CPUs for several years, DUG will have in excess of 40,000 KNL nodes.

The initial DUG McCloud data hall at Skybox has 15 MW of power, and will house the 250 Petaflop (single-precision) machine, known as Bubba. DUG already has a second, identical, data hall with plans in place to commence build out in late 2019.

Joint capacity of the two data halls will be approximately 650PF and work is currently underway for DUG to expand the supercomputer facility at Skybox beyond an Exaflop (double-precision) by 2021.

At this juncture, DUG McCloud will potentially offer the only "genuine supercomputing power" on the planet with 20 Petaflops in Perth, 13 PF in KL and Bazza in Central London playing a supporting cast to Bubba's

supercomputer lead role in the Lone Star State.

"It's all on a big firebird global network, all linked with jobs transferred one to another. If needs be, overflow work from Bruce in Perth can be work overflowed to Houston and Bubba. But 20 Petaflops is still a huge machine, so a lot can still be done in Perth before it overflows onto Bubba," Lamont said.

In a world where a modern Apple iPhone has more computing power than the four computers that launched the Apollo space mission that culminated in the first moon landing in 1969, DUG McCloud is set to deliver mind-boggling, transformational data analysing capacity to the geophysics sector.

"Houston is just the first machine room and we plan to start work on the second machine room, which will be a touch bigger in size laid with more power Intel chips of 400-420 Petaflops. Out back we've got 10 acres available. We will work with architects on this exascale centre where power demand of 100MW is anticipated.

"We don't know yet, but we would expect the second data hall to be commissioned early next year and maybe the exascale centre by early 2021. But it depends a lot on demand, which looks really high at this stage. So, timing wise the natural progression could be sooner." Lamont said.

With NASA headquartered in Houston, it's fitting that Bubba is located in Texas. But for Australia the expansion of DUG from a small, geophysics business in a Perth backyard shed 15 years ago, to accomplishing its global, corporate vision, conjures up man on the moon analogies.

By all accounts, one big step for Bubba will be many great leaps for the oil and gas and geophysics industry.

"There are two objectives we aim to accomplish," Lamont said. "Technically, and overall to try and reduce the turnaround time of projects, we can achieve this by looking at high-frequency, full wave form inversion.

"What we want to do is run genuine high-frequency FWI at full-migration apertures. DUG McCloud can do this by offering the only genuine high-performance computing service in the world.

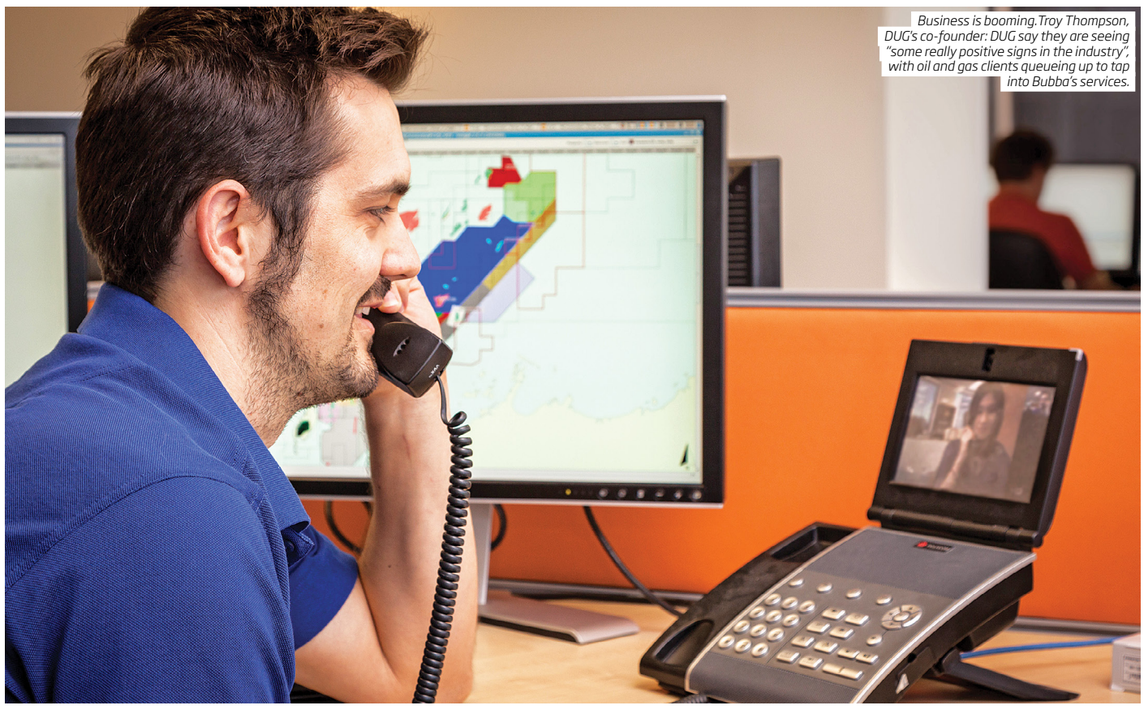
"Bubba and his three global siblings will offer high-frequency, elastic, full aperture FWI that we believe will produce the best images the industry has ever seen in a very short turnaround time. Turnaround time is determined by machine size.

"In practical terms, we would like to be able to achieve this and reduce the turnaround time involved from about 12 months to one or two months."

At the time of going to press, Lamont said DUG was seeing "some really positive signs in the industry", with both oil and gas business and other sectors queueing up to tap into Bubba's services.

"We've got all sorts of work lined up, including non-oil industry projects, such as a testing code for the Square Kilometre Array (SKA) project, so our 50 Petaflops are busy at the moment and we will be very busy moving onto the new machine too," Lamont said.

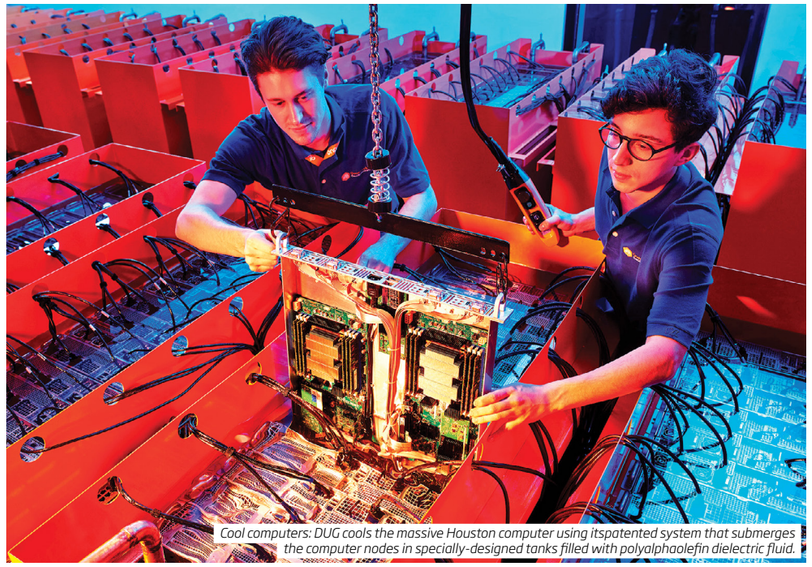
You can bet that even Bubba Watson would doff his cap with approval. ◗



Business is booming. Troy Thompson, DUG's co-founder: DUG say they are seeing "some really positive signs in the industry", with oil and gas clients queueing up to tap into Bubba's services.

How Bubba's 250 (initial) Petaflops Muscles up to 10 of the World's Fastest Supercomputers

Source: ***networkworld.com***

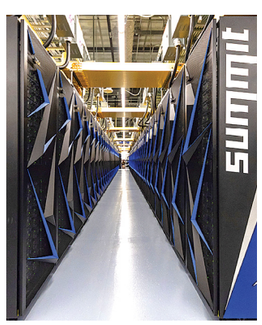


Bubba.

Cool computers: DUG cools the massive Houston computer using itspatented system that submerges the computer nodes in specially-designed tanks filled with polyalphaolefin dielectric fluid.

1. Summit

Built by the Department of Energy's Oak Ridge National Laboratory, Summit produces **143.5 petaflops** using 2,282,544 Power9 cores and 2,090,880 NVIDIA Volta GV100 cores.



Summit. *Picture Source: Oak Ridge National Laboratory.*

2. Sierra

The US Department of Energy's Oak Lawrence Livermore National Laboratory housed Sierra produces **94.6 petaflops**. It has 1,572,480, IBM cores powered by IBM Power9 processors boosted by NVIDIA Volta GV100 accelerators, which added another 1,382,400 cores.

3. Sunway TaihuLight

Installed at China's National Supercomputing Centre in Wuxi, TaihuLight's delivery is **93 petaflops**. It uses 40,960 Sunway processors, each with 260 cores and its power efficiency is 6.051 gigaflops/watt.

4. Tianhe-2A

Powered by Intel Xeon E5-2692v@ and Matrix-2000 processors, Tianhe-2A is housed at the National Super Computer Centre in Guangzhou, China, boasts a maximum performance of **61.44 petaflops**.

5. Piz Daint

Housed at the Swiss National Supercomputing Centre in Lugano, Switzerland, Europe's most powerful supercomputer can deliver **21.2 petaflops** powered by Intel Xeon processors and NVIDIA Tesla P100 GPUs.

6. Trinity

A Cray XC40 system at the US Department of Energy's Los Alamos National Laboratory, Trinity improved its performance from **14.4 petaflops** to 20.2 petaflops and is the only top 10 supercomputer using Intel Xeon Phi processors.

7. AI Bridging Cloud Infrastructure (ABCI)

The National Institute of Advanced Industrial Science and Technology in Japan was built by Fujitsu and uses Primergy CX2550 servers equipped with Xeon Gold processors and NVIDIA Tesla V100 GPUs. It is capable of **19.9 petaflops**.

8. SuperMUC-NG

Built for the Leibniz Supercomputing Centre in Germany by Lenovo, SuperMUC-NG comprises Intel Xeon Scalable processors and can deliver **19.5 petaflops**.

9. Titan

The US Cray Titan at the US Department of Energy Oak Ridge Laboratory achieved **17.6 petaflops** using NIVIVIA K20x GPU accelerators.

10. Sequoia

The US Department of Energy computer, an IBM BlueGene/Q System can deliver **17.7 petaflops** using 1,572,864 cores and peaks out at 20.13 petaflops.