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Powering breakthrough discoveries in the Lonestar state

The Texas Advanced Computing Center rolls out Lonestar6, a next-generation supercomputer from Dell Technologies and AMD.

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>
> **Jay Hartzell**
> President, University of Texas at Austin[1]

Business needs

Texas Advanced Computing Center enables discoveries that advance science and society through the application of advanced computing technologies.

Business results

• Accelerating discovery and innovation with leading-edge high performance computing

• Enabling scientific researchers to work with massive datasets

• Supporting diverse research initiatives across Texas

• Helping to solve critical scientific and societal problems

Solutions at a glance

• Dell PowerEdge C6525 servers with AMD EPYC™ processors

• NVIDIA HDR InfiniBand networking

• BeeGFS-based storage on Dell PowerEdge servers and PowerVault storage

• Green Revolution Cooling immersion

1   TACC, "Leading Supercomputing Center Marks Two Decades of Powering Discoveries," September 30, 2021.

Building on a legacy of leadership

For more than two decades, the Texas Advanced Computing Center at the University of Texas at Austin has helped researchers push the boundaries of science and engineering. Drawing on the computational power of some of the nation's biggest and fastest supercomputers, TACC has powered discovery after discovery while jumping in to help with national emergencies — such as ferreting out the secrets of the deadly SARS-CoV-2 virus and simulating storm surges from incoming hurricanes.

This is the type of work done by the scientists, engineers and others who use the computing resources at TACC. Those resources include two of the most powerful university supercomputers in the United States — Frontera, the world's 16th fastest supercomputer, and Stampede2, currently 47th on the list of the TOP500 supercomputers.[1] Both systems were delivered by Dell Technologies.

This legacy of supercomputing leadership continues today as TACC rolls out its newest system. Named Lonestar6, this lightning-fast system from Dell Technologies and AMD is rated at 3 petaFLOPS, meaning it can perform roughly 3 quadrillion operations per second. TACC notes that to match what Lonestar6 will compute in just one second a person would have to do one calculation every second for 100 million years.

Lonestar6 — a look under the hood

For an organization like TACC that stands at the pinnacle of academic supercomputing, the Lonestar6 supercomputer has all the right stuff.

At the compute level, Lonestar6 is composed of 560 compute nodes and 16 GPU nodes. The system employs Dell PowerEdge servers with the latest AMD EPYC™ processors, NVIDIA HDR InfiniBand® technology, and eight PB of BeeGFS storage on Dell hardware. Additionally, Lonestar6 supports server nodes with GPUs to power machine learning workflows and other GPU-enabled applications.

The compute nodes are housed in four dielectric liquid coolant cabinets and 10 air-cooled racks. The air cooled racks also contain 16 GPU nodes. Each compute node has two AMD EPYC 7763 64-core processors and 256 GB of DDR4 memory. Each GPU node also contains two AMD EPYC processors and two GPUs, each with 40 GB of high bandwidth memory (HBM2).

Compute nodes at a glance

Lonestar6 hosts 560 compute nodes with 5 teraFLOPS of peak performance per node and 256 GB of DRAM. Node specifications:

- **Server:** Dell PowerEdge C6525
- **CPU:** 2x AMD EPYC 7763 64-Core Processor
- **Total cores per node:** 128 cores on two sockets (64 cores/socket)
- **Clock rate:** 2.45 GHz (boost up to 3.5 GHz)
- **RAM:** 256 GB (3200 MT/s) DDR4
- **Local storage:** 144-GB/tmp partition on a 288-GB SSD

Collectively, Lonestar6 provides a balanced set of resources to support simulation, data analysis, visualization, machine learning and other workloads that are critical to the success of the research initiatives conducted at TACC.

Supporting groundbreaking research

Lonestar6 is funded through the University of Texas Research Cyberinfrastructure, a collaboration between TACC and the University of Texas System, and is supported by partners at Texas A&M University, Texas Tech University and the University of North Texas, as well as a number of research centers and faculty at UT Austin, including the Oden Institute for Computational Engineering & Sciences and the Center for Space Research. Lonestar6 is available to researchers at all of these institutions.

With this broad constituency, Lonestar6 will support a wide range of University of Texas Research Cyberinfrastructure initiatives, including COVID-19 research and drug discovery, hurricane modeling, wind energy and dark energy research. The system will also support work conducted through the Department of Energy Predictive Science Academic Alliance Program at UT Austin.

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1   TOP500 list, June 2022.

For an in-depth looks at the research conducted with the support of TACC systems, see TEXASCALE, The Magazine of the Texas Advanced Computing Center at UT Austin.

In this role, Lonestar6 will pick up the computational mantle on a lot of the groundbreaking research conducted at TACC.

A few examples:

- Astronomers used TACC systems to analyze data and confirm the Event Horizon Telescope's first-ever image of a black hole.

- TACC supercomputers helped confirm the first observation of gravitational waves by detectors at the Laser Interferometer Gravitational-Wave Observatory (LIGO) — a discovery that opened a new window to the universe and led to a 2017 Nobel Prize in physics.

- TACC supported more than 50 COVID-19 research teams, leading to the first atomistic model of the SARS-CoV-2 virus and daily pandemic forecasts that continue to drive policy decisions.

- TACC produced urgent storm surge simulations for hurricanes in the Gulf of Mexico making landfall and guided first responders after the Deepwater Horizon oil spill.

Working with Dell Technologies

With the launch of the Lonestar6 supercomputer, TACC is building on a long-running partnership with Dell Technologies to architect systems and develop tools for the academic research community in Texas and points beyond.

Earlier Dell Technologies systems deployed at TACC include Frontera, which debuted on the TOP500 list in June 2019 as the nation's fastest academic supercomputer, along with the Stampede2 supercomputer, launched in 2017, and Wrangler, which came online in 2013.

"TACC's growth has been remarkable and is a testament to the people who work here and the organizations that have supported us, notably UT Austin, UT System, the National Science Foundation, the O'Donnell Foundation, and Dell Technologies — our longest and most consistent champions," notes Dan Stanzione, TACC Executive Director and Associate Vice President for Research, UT Austin.[2]

Adds Jay Hartzell, President, University of Texas at Austin: "Two decades ago, UT made a big bet on TACC and supercomputing. It's an investment that's paid off handsomely. And, given the proliferation of data science, AI and machine learning across fields and throughout society, there's no limit to TACC's impact over the next 20 years."[2]

2   TACC, "Leading Supercomputing Center Marks Two Decades of Powering Discoveries," September 30, 2021.

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> "At Dell Technologies, we are incredibly proud to stand alongside UT and TACC as we continue to set the bar for high-performance computing."
>
> **Michael Dell**
> Chairman and CEO, Dell Technologies[2]

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