

Boulder's Jet Supercomputer

A Legacy of Innovation at NOAA

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Powered by
Global Systems Laboratory

Colorado: A national center for research and innovation

The largest concentration of NOAA scientists is in Boulder Colorado. Colorado is home to over 30 federally funded labs that contributed an estimated \$2.6 billion to the state's economy in 2016 and supported more than 17,600 jobs, according to a report from the University of Colorado Boulder Leeds School of Business. Colorado has one of the highest per-capita concentrations of federally-funded science, research, and engineering facilities in the nation. In Boulder County alone, the federally funded labs contributed \$743.2 million to the economy and employed nearly 3,600 people.

Boulder has the highest number of atmospheric scientists per capita in the U.S. whose work has a global impact. Local research includes natural resource management, climate change, air quality, weather research, and renewable energy.

"Colorado's federal labs help foster the innovation that fuels our state and the nation's economy. Leveraging the labs' research and technology with the state's innovative entrepreneurial spirit creates a strong foundation for Colorado's business ecosystem. We are proud of the extraordinary advancements coming from the research in Colorado and will continue to support our federal laboratories and their world-class workforce."

- Former Colorado Governor John Hickenlooper

A supercomputing legacy

NOAA Boulder is home to High-Performance Computing (HPC) that is critical to the advancement of NOAA's weather models. The six supercomputers located within NOAA David Skaggs Research Center are managed by the NOAA Global Systems Laboratory and provides ~ 30% of weather research and development computing in NOAA. Many NOAA HPC architecture improvements were first explored on Jet and are now standardized across NOAA.



Energy-wise facility

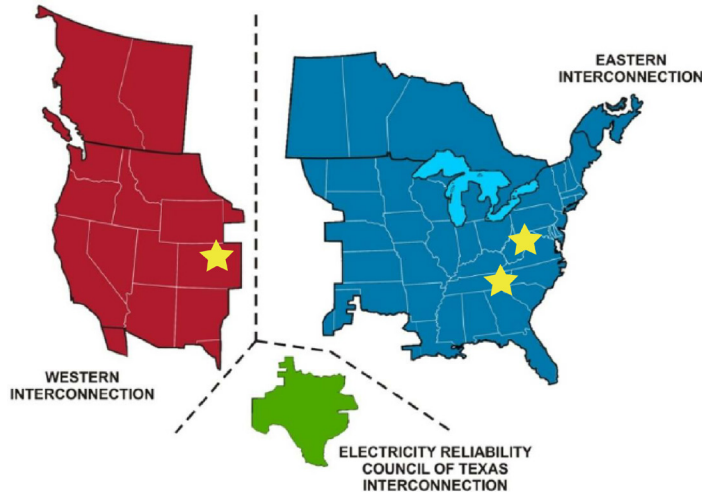
Jet is housed in a 2,060-square foot computing facility with an ENERGY STAR Certification from the EPA of 96 out of 100, indicating that it performs better than 96% of similar buildings nationwide based on strict energy performance standards. ENERGY STAR certified buildings save energy, save money, and help protect the environment by generating fewer greenhouse gas emissions. The data room's award-winning design can handle the rigorous environmental and electrical demands of Jet. State-of-the-art ambient air cooling

Comparison	Boulder/Jet	Fairmont/Hera
NOAA Trusted Internet Connection Access Point (TICAP Site)	Yes	No
NWAVE Core Site	Yes	No
"ENERGY STAR" rated building	Yes	No
Operation and Maintenance Costs	Lower	Higher
System Support Costs	Lower	Higher

and a clean-agent fire protection system, as well as many sophisticated facility environment monitoring and control safeguards, are features that save more than \$130K/year and add up to a highly reliable and resilient center.

Benefit to the Colorado economy

The Jet system contributes over \$1M per year to the local economy through vendor contracts and local suppliers. Jet’s location in Colorado provides stability to NOAA’s computing infrastructure and reduces the risk for the agency. Boulder power is on the Western Interconnection transmission line, geographically separating it from the other three systems to ensure continuity of operations if one of the other systems becomes unavailable.



A critical need to boost computing capacity

As the complexity of weather models increases, current NOAA HPC resources are not keeping up with the needs of our researchers. To date, NOAA has only a fraction of the computing capabilities required to fulfill its mission. Researchers are working with a 1:1 research to operations capacity, but the industry standard for other national weather prediction institutions is 10:1. NOAA’s ability to compete and achieve the mandates of the Weather Act are severely hindered by this lack of HPC. In

December, 2021 NOAA’s Science Advisory Board released their report that suggests NOAA needs “at least a 100-times increase” in computing power over the coming decade to realize the potential of new models and address an imbalance between computing resources available to communities engaged in weather research versus operational forecasting. “Without increased computing resources, none of the recommended new models and data assimilation that improve the forecasts will be able to run on time,” it warns.

Research & development projects on Jet

Jet is unique among NOAA’s other HPC systems because it has a reservation system for scheduling model runs to replicate a pseudo-operational environment. This allows extensive testing of high-priority research to operations projects necessary for a transition into NOAA National Weather Service operations. With Jet located within the DSRC, the onsite data center is leveraged for quick and easy access to datasets that are needed for executing real-time experimental model runs, and the distribution of those model runs to users to obtain feedback that then improves the models.

- Jet has enabled a multi-year demonstration of GSL’s Rapid Refresh (RAP)/HRRR system that was ultimately implemented at the National Centers for Environmental Prediction (NCEP) as its first hourly storm-scale numerical weather prediction model serving the lower 48 states. Without Jet, the operational HRRR would not have been implemented into NWS operations in September 2014. Since then, Jet has supported research for consistent and significant improvements in these models with the final version transitioned to operations in December, 2020.
- Jet is used by GSL, the Developmental Testbed Center (DTC), and the numerical weather prediction community to test and evaluate new models and techniques for use in research and operations.
- Jet enables real-time HRRR forecast demonstrations to produce Consolidated Storm Prediction for Aviation (CoSPA) forecasts for the FAA to help demonstrate national airspace tactical and strategic planning capabilities.
- Jet has supported development of model physics, data assimilation and validation techniques in support of renewable energy forecast improvement projects.
- Jet is the sole computing system for the Hurricane Forecast Improvement Program (HFIP).