BLUE WATERS

An Extraordinary Computer for Extraordinary Research

How do viruses spread destruction in the human body? How can we better predict when and where tornadoes will strike? How can we prepare for earthquakes and the destruction that they cause? How did galaxies form in the early universe?

The Blue Waters supercomputer at the National Center for Supercomputing Applications is designed to address these and many other important scientific questions. Blue Waters is one of the most powerful supercomputers in the world, capable of performing quadrillions of calculations every second and of working with quadrillions of bytes of data. This makes it an ideal tool for scientists and engineers to tackle larger and more complex research challenges.

WHO USES BLUE WATERS?

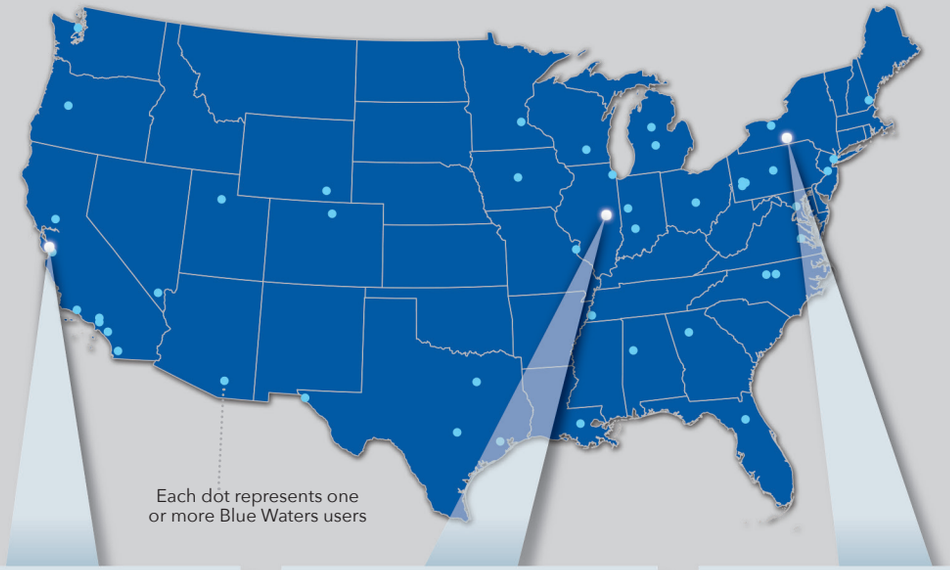
Scientists, engineers, educators, and companies from across the United States use Blue Waters to better understand satellites, space weather, and sub-atomic particles, among many other projects. For almost all users, this amazing resource is ***free***.

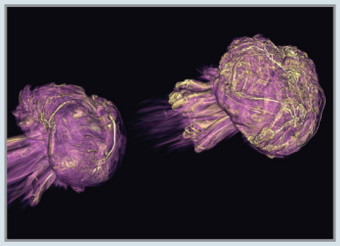
- At least 80 percent of the capacity of Blue Waters is available to scientists and engineers across the country through the National Science Foundation's Petascale Computing Resource Allocation program.
- Up to 7 percent of Blue Waters is available to faculty, staff, and students at the University of Illinois at Urbana-Champaign through a campus application process.
- Researchers at institutions in the Great Lakes Consortium for Petascale Computation can apply annually for time on Blue Waters.
- Blue Waters is available to educators and students for classes, workshops, and special projects.
- Blue Waters Graduate Fellowships are awarded each year to several PhD students, who receive financial support and can use the supercomputer to advance their research.
- Companies can also apply to use Blue Waters for their advanced modeling and simulation needs.

For details on how to apply to use Blue Waters through any of these pathways, **visit https://bluewaters.ncsa.illinois.edu/aboutallocations.**

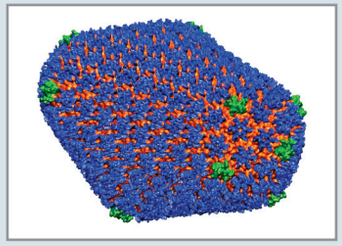
SCIENCE SUCCESSES

Hundreds of people across the country use Blue Waters to supercharge their research in a wide variety of fields. Blue Waters is enabling these researchers to make important advances:





The UC Santa Cruz team led by Stan Woosley was able to complete a 3D simulation of a turbulent flame in a supernova at unprecedented resolution—about eight times greater than typical simulations. These results were recently published in *The Astrophysical Journal*.



Illinois biophysicist Klaus Schulten and his collaborators used Blue Waters to determine, for the first time, the precise chemical structure of the HIV capsid, a protein shell that protects the virus's genetic material. The capsid has become an attractive target for the development of new antiretroviral drugs. This work was reported in the journal *Nature*.

Patrick Reed of Cornell University uses Blue Waters to better predict how the orbits of satellites will change over time, allowing them to be placed more accurately and effectively. We rely on satellites for communication, navigation, and environmental monitoring; satellite data can even be used to predict famines, floods, and drought. "We're compressing thousands of years of scientific exploration into weeks of computing on Blue Waters," Reed says.

For more about the work made possible by Blue Waters, visit:
https://bluewaters.ncsa.illinois.edu/impact-overview

AN EXTRAORDINARY SUPERCOMPUTER

To help put the enormous power of Blue Waters into context, compare Blue Waters to a typical laptop computer :

WEIGHT

Blue Waters: 576,000 lbs (>288 tons)

Typical laptop: ~6 lbs

That's like 58 elephants standing on the second floor of the computing facility.

SIZE

>5,500 square feet

~1 square foot

That's bigger than an NBA basketball court.

NUMBER OF PROCESSORS

>49,000

1

FLOATING-POINT OPERATIONS PER SECOND (FLOPS)

13,340,000 billion (13. 34 quadrillion)

60 billion

If you could multiply two numbers together every second, it would take you 423 million years to do what Blue Waters does each second.

MEMORY (RAM)

1,500,000 GB (1.5 petabytes)

4 GB

DATA STORAGE

>26,000,000 GB (26 petabytes)

500 GB

That's enough to store all of the printed documents in all of the world's libraries.

MORE INFORMATION

For more information about Blue Waters visit:
http://bluewaters.ncsa.illinois.edu

Questions about Blue Waters can be sent to:
help+bw@ncsa.illinois.edu

For more information about NCSA visit:
www.ncsa.illinois.edu

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