National Aeronautics and Space Administration

# NASA ADVANCED SUPERCOMPUTING (NAS) DIVISION

## PLEIADES

NASA's Pleiades supercomputer is currently ranked fourth in the U.S. on the TOP500 list of the most powerful supercomputers. Pleiades is the central component of an integrated, high-end computing environment providing NASA users with mass storage, high-speed networking, modeling and simulation, data analysis and visualization, application performance optimization, and advanced user services.

### Architecture Overview

- 182 SGI ICE X racks with 11,776 dual-socket nodes
- Intel quad-, six-, and eight-core processors: Sandy Bridge, Westmere, Nehalem, and Harpertown
- 126,720 cores, 233 terabyes total memory
- Enhanced with Nvidia GPUs (32,768 cores)

### Performance

- Sustained performance of 1.24 petaflops (June 2012)
- Theoretical peak performance: 1.75 petaflops

### Quick Facts

- Features the world's largest InfiniBand interconnect network, with more than 65 miles of double, quad, and fourteen data rate cabling—about the distance from Earth to the boundaries of outer space.
- The archive storage systems at the NASA Advanced Supercomputing (NAS) facility can hold up to 115 petabytes of data generated by the simulations run on Pleiades. This data is stored on about 58,000 tapes.



### NASA Mission Support

Pleiades serves as the major computational resource for NASA's three mission directorates: Aeronautics Research, Human Exploration and Operations, and Science. Among the important scientific and engineering advances enabled by Pleiades:

- **Kepler Planet Discoveries:** Pleiades is essential for scientists to calculate high volumes of observational data from the Kepler spacecraft to search for habitable Earth-sized planets in the Milky Way galaxy. To date, Kepler has identified more than 2,300 candidate planets and 74 confirmed planets.
- **Rotorcraft Performance Improvement:** NASA is performing cutting-edge research to help reduce rotorcraft noise and increase performance. High-fidelity simulations, enabled by Pleiades, are providing new insights into the complex aerodynamic and aeromechanic phenomena that are at the heart of rotorcraft performance.
- **Space Weather Predictions:** Scientists run petascale simulations on Pleiades to better understand the complex interaction between the solar wind and Earth's magnetic field. This "space weather" affects Earth and its technological systems, causing billions of dollars in damage to satellites.
- **Earth Ocean-Ice Studies:** Scientists use Pleiades to get a more accurate representation of the global sea-ice state by assimilating observations with ocean circulation models. Syntheses are used quantify the role of the oceans in the global carbon cycle, and to better understand the recent evolution of the polar oceans.
- **Next-Generation Launch Vehicle Design:** Pleiades is crucial for running high-fidelity simulations that supply key aerodynamic data to NASA's aerospace engineers. These simulations help reduce the design cycle and cost and increase the safety of future space vehicles, including the Space Launch System.

***http://www.nas.nasa.gov/hecc/resources/pleiades.html***