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HIGH PERFORMANCE COMPUTING FOR CURRENT AND FUTURE NASA APPLICATIONS

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ABSTRACT

Over the past three decades, high performance computing (HPC) has consistently played a critical role in meeting the modeling and simulation needs of several NASA missions. Three years ago, NASA made a bold decision to dramatically increase the agency's computational capability an order of magnitude by installing the 10,240-processor SGI Altix supercomputer, named Columbia, at its Ames Research Center. Recently, the computational infrastructure has been significantly enhanced with additional Altix nodes (2048 Itanium dual cores), SGI ICE cluster (1024 Xeon quad cores), IBM Power5+ system (640 processors), and visualization cluster (128 8800GTX GPUs, 256 Barcelona quad cores) with display wall (245 million pixels). The total computational capability now stands at 221 teraflops.

This has had an immense impact on a variety of areas of interest to NASA, including shuttle operations, next-generation space vehicles, Earth and space sciences, and fundamental aeronautics research, demonstrating HPC's ability to accelerate NASA's Vision for Space Exploration. It has also invigorated research and development in programming paradigms and runtime environments, system- and user-level monitoring and management tools, and scalable algorithms and numerical methods.

This talk will describe how the integrated supercomputing production environment at the NASA Advanced Supercomputing (NAS) facility in Ames is being used to solve a variety of immediate- and near-term computational science and engineering problems. However, NASA's future missions pose challenging requirements that demand even more powerful supercomputing systems. These petascale systems must be able to solve multi-scale, multi-disciplinary, multi-phase problems with higher fidelity, finer resolution, and faster time-to-solution. NASA therefore intends to add further computational capability next year and beyond. The talk concludes by projecting how this enhanced infrastructure will continue to remain an invaluable enabling asset to help meet NASA's diverse computational requirements.