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NANOTECHNOLOGY-INSPIRED GRAND CHALLENGES IN THE UNITED STATES

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Abstract

Nanotechnology has advanced by a succession of science and technology breakthroughs, long-term vision-inspired research, and convergence opportunities. Nanotechnology-inspired grand challenges facilitate faster progress of the field and its implementation in the economy.

A long-term vision for nanotechnology development was formulated in 1999-2000 that has promised to create basic understanding and a general purpose technology (www.wtec.org/nano2/). The presentation will outline key current grand challenges in the United States driven by nanotechnology and its convergence with other emerging technologies. Several trends in nano-, bio-, digital manufacturing, neuromorphic engineering, service and distributed manufacturing, cyber-physical-social systems, life cycle benign by cognitive design, integration of distributed information and sensorial systems, will be discussed. Two new activities in 2016 are the Nanotechnology Signature Initiative on Water and the NNI Grand Challenge on brain-like computing. We envision 'machine intelligence' with versatile cognitive capabilities acting as an interface between humans and their environments, providing perception, insight, calculations, and guidance for problems that cannot be handled by the unaided mind or by computers alone. The NNI research on brain like computing aims to solve unfamiliar problems and save insight information with the energy efficiency similar to that of human brain. NSF will develop scenarios for new system architectures and algorithms for "intelligent cognitive assistants". Two other nanotechnology related challenges are identified in the National Strategic Computing Initiative (NSCI): to increase about 100 times the performance of current 10PF systems across a range of applications; and establish a viable path forward for future HPC systems in the post Moore's Law.