

Session 6: "We Can Work It Out":

How Can SCEC Keep Up with Rapid Developments in Computational Science?

Philip J. Maechling and Ricardo Taborda-Rios

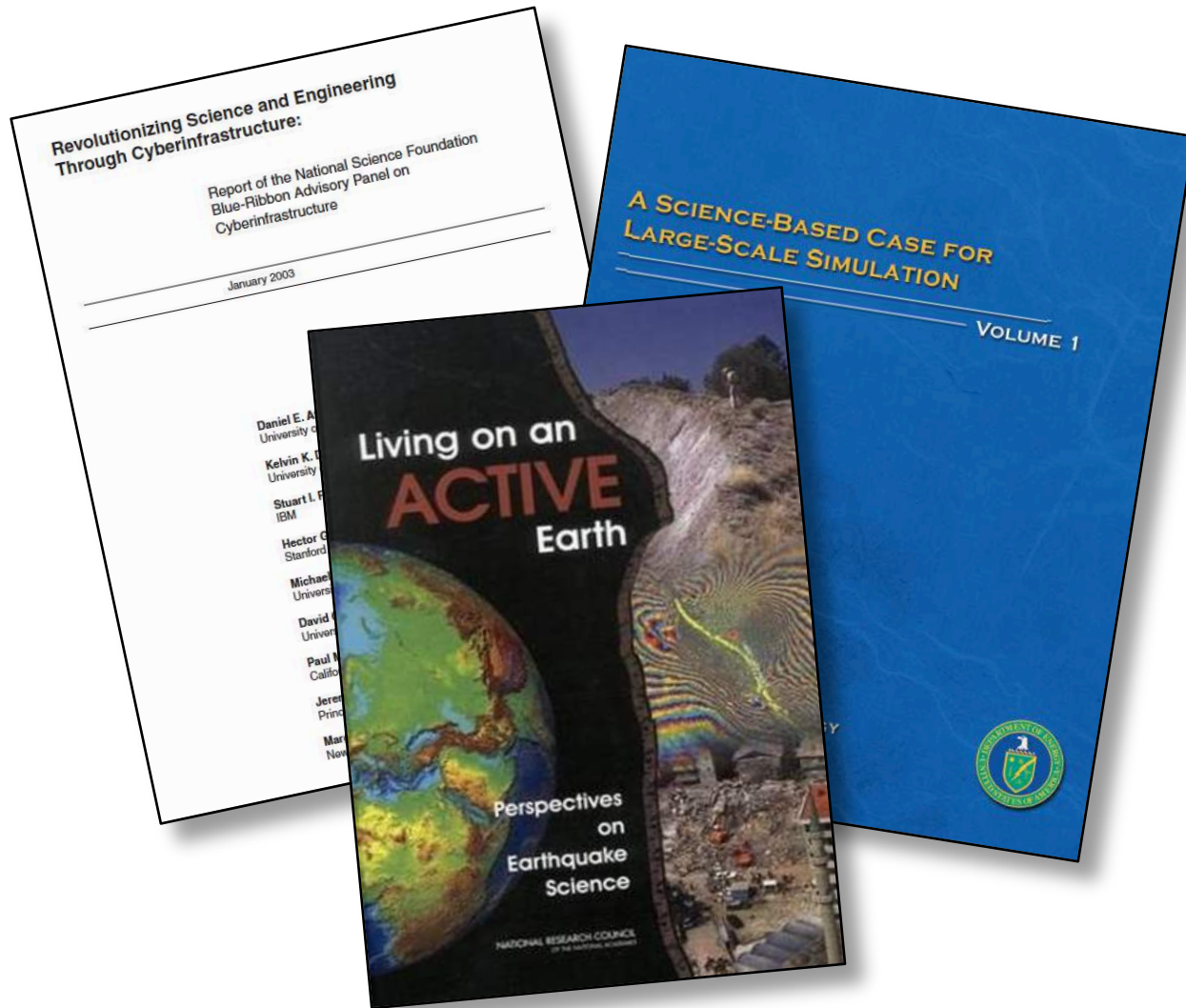
Predictive Understanding of Earthquake Processes



How to Convince These Researchers Computing is Important

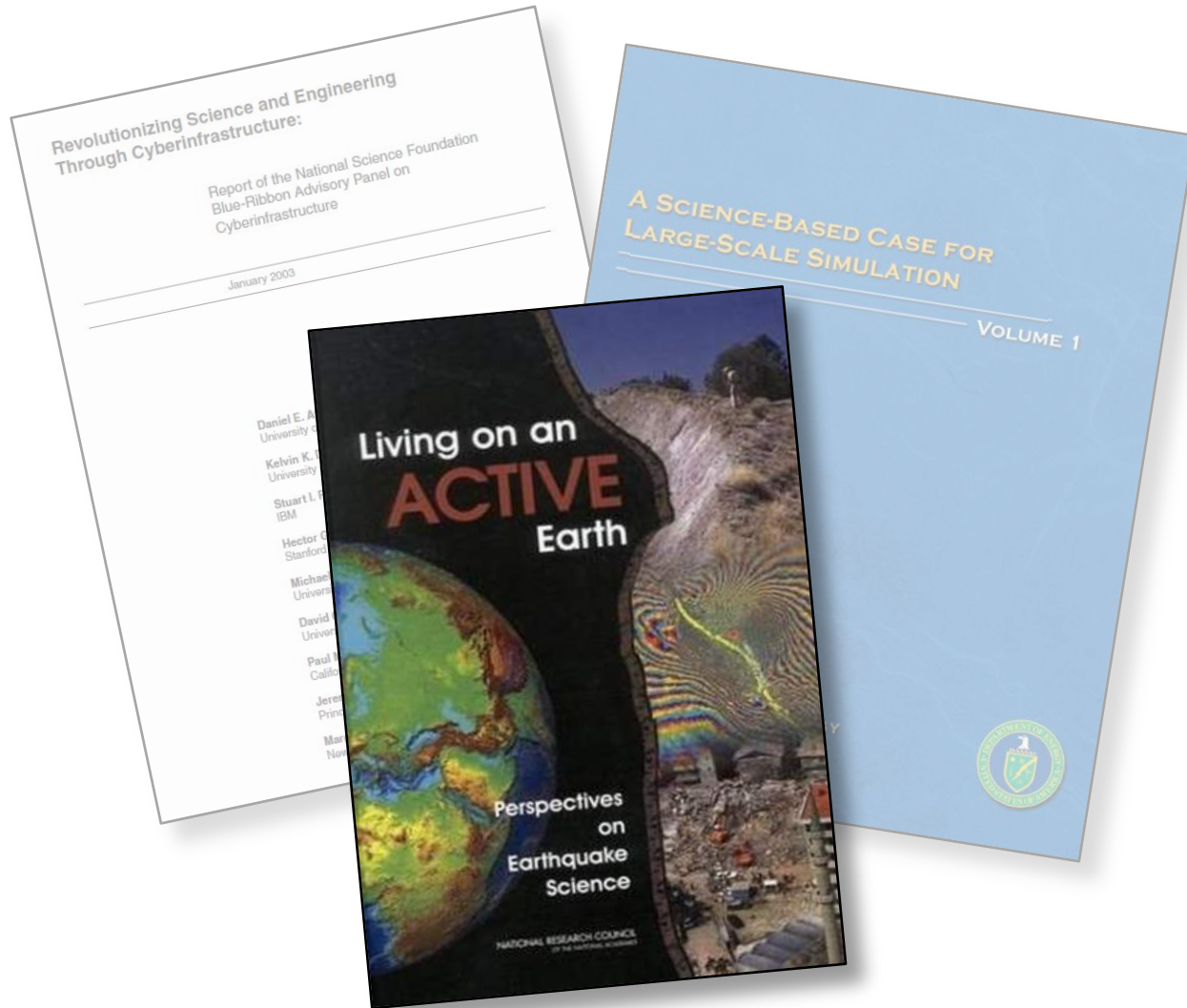


Modern Research Requires Advanced Computing



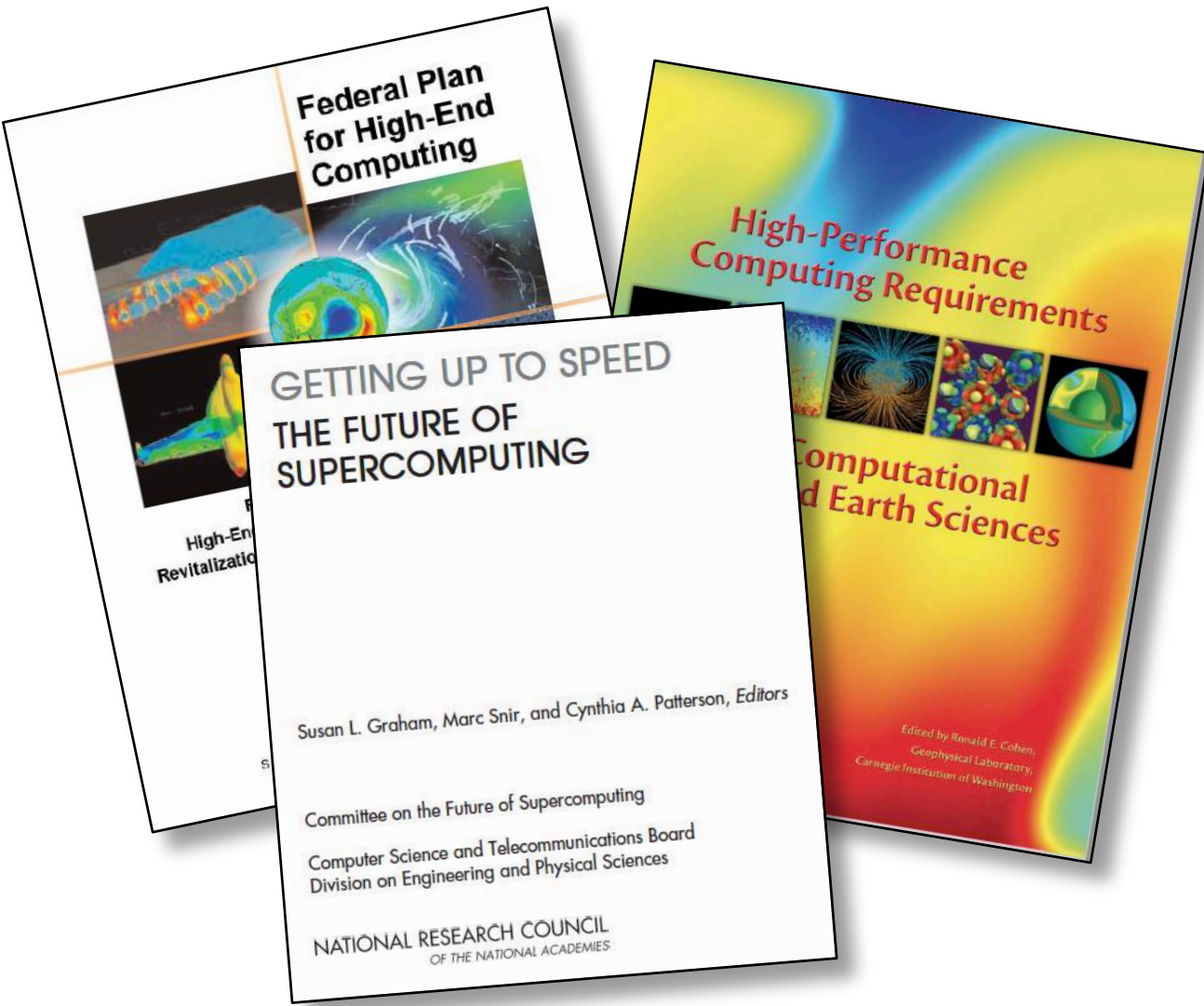
- » ***Revolutionizing Science and Engineering through Cyberinfrastructure***, National Science Foundation Blue-Ribbon Advisory Panel report on cyberinfrastructure (2003)
- » ***The Atkins Report***, National Science Foundation report on the Importance of Cyberinfrastructure to the Future of Science and Engineering (2003)
- » ***A Science-Based Case for Large-Scale Simulation***, Office on Science, U.S. Department of Energy (2003)
- » ***Living on an Active Earth: Perspectives on Earthquake Science***, National Research Council (2003)

Modern Research Requires Advanced Computing



“ High-performance computing is now **furnishing the means to process massive streams of observations** and, through numerical simulation, to quantify many aspects of earthquake behavior that are completely resistant to theoretical manipulation and manual calculations [...] **Transforming the field** from a haphazard collection of disciplinary activities to a more coordinated ‘system-level’ science... ”

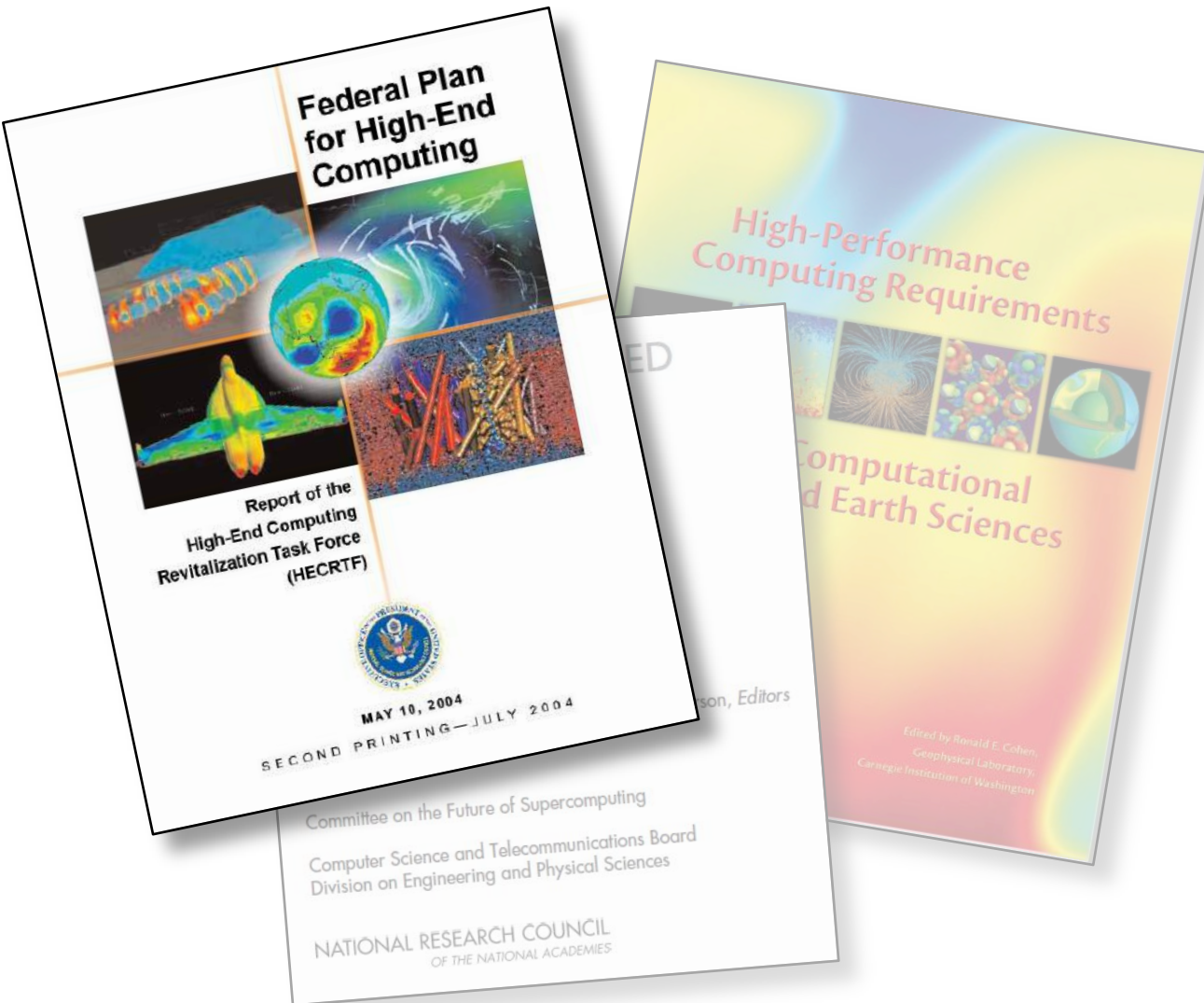
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- » ***Federal Plan for High-End Computing***, High-End Computing Revitalization Task Force Report, Executive Office of the President of the United States (2004)
- » ***High-Performance Computing Requirements for the Computational Solid Earth Sciences***, Geophysical Library, Carnegie Institution of Washington (2005)
- » ***Getting Up to Speed: The Future of Supercomputing***, Committee on the Future of Supercomputing, Computer Science and Telecommunications Board Division on the Engineering and Physical Sciences, National Research Council (2005)

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“ In the past decade, **computer modeling and simulation** of physical phenomena and engineered systems have become widely recognized as **the ‘third pillar’ of science** and technology – sharing equal billing with theory and experiment. ”



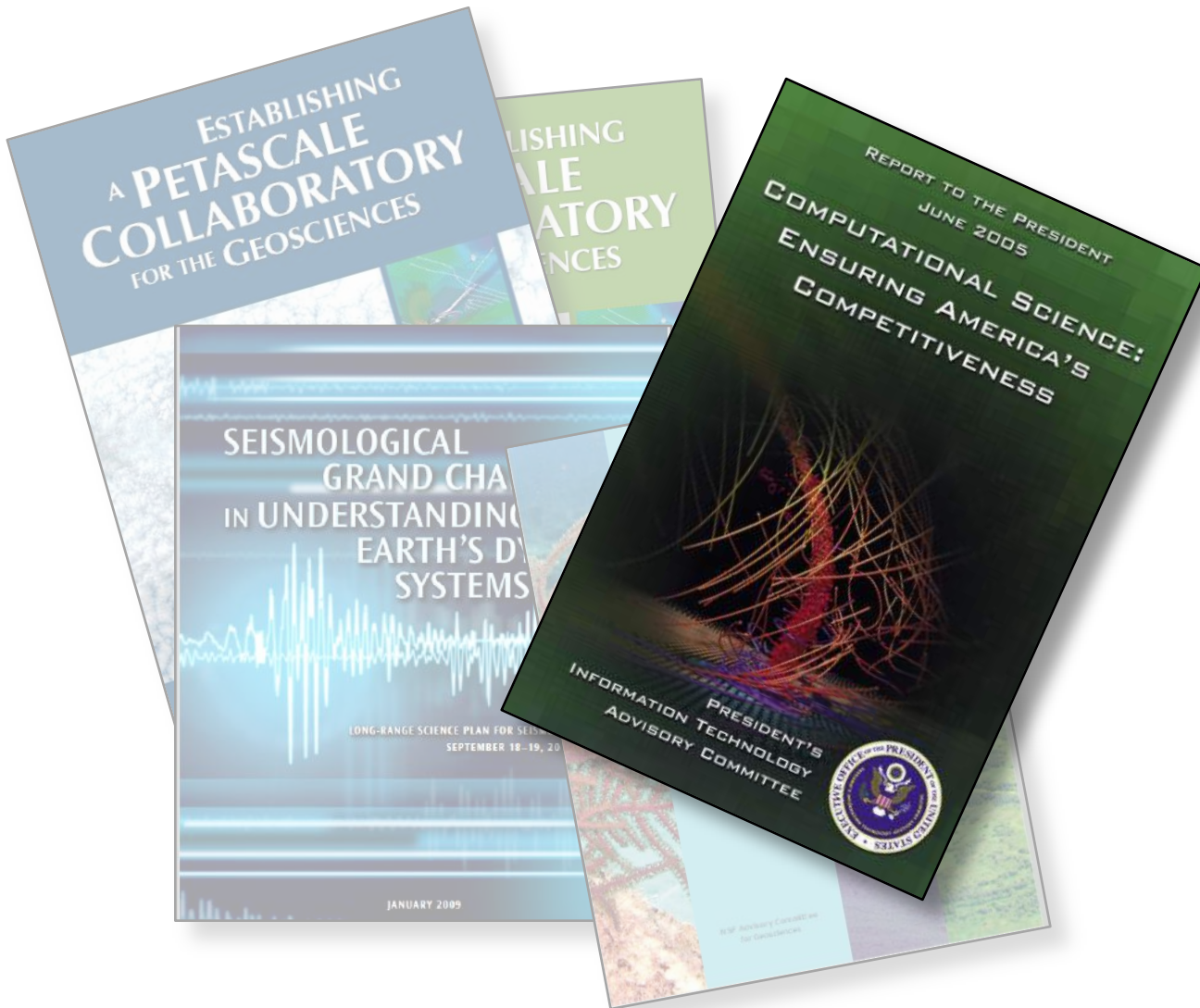
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- » **Establishing a Petascale Collaboratory for the Geosciences**, Parts A and B, A Proposal to Develop Dedicated Geoscience HPC Center (2005)
- » **Computational Science: Ensuring America's Competitiveness**, Information Technology Advisory Committee Report, Executive Office of the President of the United States (2005)
- » **Seismological Grand Challenges in Understanding Earth's Dynamic Systems**, Long-Range Science Plan for Seismology Workshop, IRIS report to NSF (2009)
- » **Geo Vision Report**, National Science Foundation Advisory Committee for Geosciences (2009)

Modern Research Requires Advanced Computing

“ The use of **advanced computing** capabilities to understand and solve complex problems – has become **critical to scientific leadership, economic competitiveness, and national security.** ”



Modern Research Requires Advanced Computing



- » **Information Technology and the U.S. Workforce**, The National Academies of Sciences, Engineering, and Medicine, Advisory Committee for Cyberinfrastructure Task Force on Software for Science (2011)
- » **Synergistic Challenges in Data Intensive Science and Exascale Computing**, Data Subcommittee Report, Office of Science, Department of Energy (2013)
- » **The Vital Importance of High-Performance Computing to U.S. Competitiveness**, Information Technology and Innovation Foundation (2016)
- » **Future Directions for NSF Advance Computing Infrastructure to Support U.S. Science and Engineering**, The National Academies of Sciences, Engineering, and Medicine (2017)

Modern Research Requires Advanced Computing

“ Software is a critical and pervasive component of the cyberinfrastructure for science and engineering.

It is the software that binds together the hardware, networks, data, and users such that new knowledge and discovery result from cyberinfrastructure. ”



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Research Leadership Will Require Advanced Computing

- Computing across all fields of scholarship is becoming ubiquitous: digital technologies underpin, accelerate, and enable new transformational research in all domains.
- Researchers continue to integrate an increasingly diverse set of distributed resources and instruments directly into their research and educational pursuits.
- Access to an array of integrated and well-supported high-end digital services is critical for the advancement of knowledge.
- SCEC needs advanced computing to support contemporary science, that involves an integrated and coordinated assemblage of software, computers, supercomputers, visualization systems, storage systems, networks, portals and gateways, collections of data, instruments and personnel with specific expertise.
- Advanced Computing capabilities will provide research capabilities that empower modern science and engineering research and education