

## U.S. losing a Sputnik moment

U.S. supercomputing lead is in danger due to declining budgets, Congress is warned

By [Patrick Thibodeau](#), Computerworld

In October, 2010, China built the world's fastest supercomputer, and three months later President Barack Obama, in his State of the Union speech, said that America was facing a Sputnik moment.

Obama renewed calls for [higher levels of R&D spending](#) to meet a range of science challenges in biomedical research, clean energy and information technology. He pointed to the nation's competitors, [China in particular](#) and [started the debate](#).

But the ongoing budget dispute between Congress and the White House that led to sequestration has brought federal R&D spending to its lowest level in 40 years, the American Association for the Advancement of Science said earlier this month.

Among the projects threatened by budget cuts is U.S. development of an exascale computer, a system that would be roughly 1,000 times more powerful than today's supercomputers.

Last week, while Congress was mostly preoccupied with hearings on the IRS scandal, some of the leading U.S. supercomputing researchers told a House energy subcommittee hearing that China, Japan and Europe are investing heavily in building next-generation systems, and may beat the U.S. in the race to exascale.

At current levels of investment in research projects, U.S. vendors are not likely to reach an exascale performance level until "the middle of the next decade," Rick Stevens, associate laboratory director at Argonne National Lab, told lawmakers.

"This is a problem for us if we want to maintain our leadership," said Stevens. Japan is spending \$1.1 billion on an effort to develop an exascale machines by 2020, "and China has announced a goal to reach exascale before 2020," he said.

The U.S. needs to boost current HPC funding by \$400 million a year to achieve the goal set by China, said Stevens. "At that funding level we think it's feasible -- not guaranteed, but feasible -- to deploy a (exascale) system by 2020," he said.

Stevens also noted that he made the same recommendation a few years ago "when we had more runway."

Stevens said the research community and top tech vendors are ready to develop an exascale system. "We just need the resources and the commitment," he said. The funding can't come from cannibalizing existing programs, he added.

It is expected that China will regain the lead in the Top 500 supercomputing list this year. The system will likely be based on U.S. components, but China is also developing its own chips and other components to be used in future designs, said Stevens.

There have been longstanding rumors that China will announce its latest system in time for next month's release of a new Top 500 supercomputing list.

Today, the world's fastest supercomputer is at Oak Ridge National Laboratory in Tennessee. The Cray system was running at nearly 18 petaflops, according to last November's Top 500 list.

The U.S. today has a clear lead in supercomputing, both in terms of number of systems and the capability of its vendors.

But building an exascale system, or a 1,000 petaflop system, poses many challenges, led by power usage. Building such a system today by extrapolating present technologies would take about 1 GW of power, or about the total output of one power plant.

An exascale system will need processors, memory and network components that use considerably less power, as well as better programming models so applications can scale across millions of cores. Resiliency, the ability to operate without interruption as components fail, is also a key research issue.

The U.S. national laboratories run by the Department of Energy use the largest systems, in part to meet their mission to keep track of the nation's nuclear weapons stockpile. Instead of underground testing, the U.S. uses supercomputers to simulate its weapons and to see how they are faring and wearing in storage.

"It's very important that the United States maintain the key intellectual property" for supercomputers, said Dona Crawford, associate director for computation at Lawrence Livermore National Laboratory, at the hearing "If we control that, we have the high ground for the standards space."

"I would not want to cede that to another country," said Crawford. "I cannot trust U.S. nuclear weapons technology to a system built in China, say. That's untenable."

For now, there is no budget proposal in Congress to push exascale ahead. The White House did not include an exascale specific spending request in the recently released 2014 budget.

"The U.S. research community has repeatedly warned of the potential and actuality of eroding U.S. leadership in computing and in high performance computing," said Daniel Reed, who served on the White House science advisory committee during President George W. Bush's administration.

"And many of these warnings have been largely unheeded," Reed told lawmakers at the hearing.