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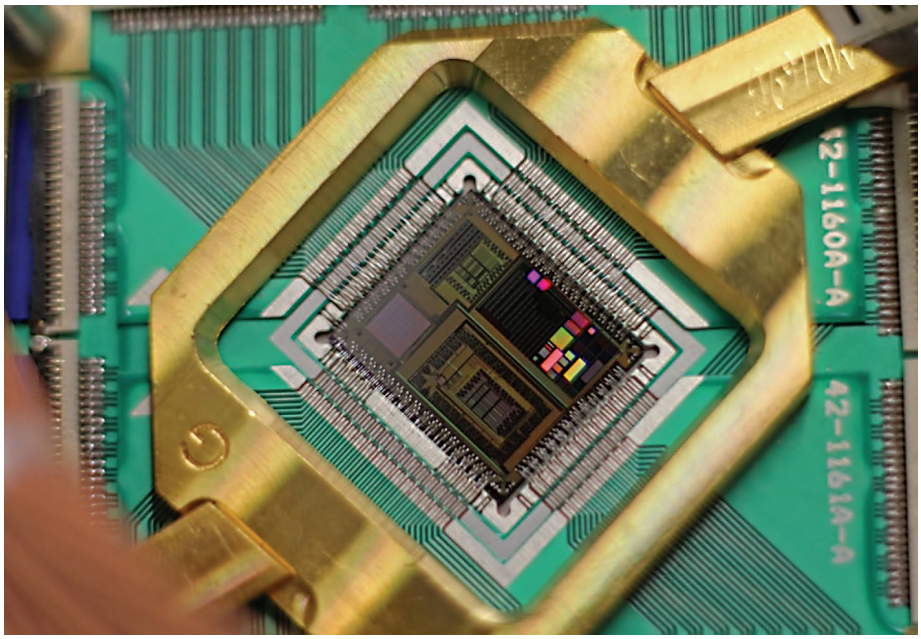
This is the most important tech contest since the space race, and America is losing



A quantum processor *Photo courtesy of D-Wave Systems Inc.*

By C. L. Max Nikias

After the Soviets launched Sputnik in 1957, we saw how federal investment in U.S. private industry and academic research allowed the United States to catch up, win the space race and hold decades of military and technology dominance. There is no doubt: America emerged victorious from the Cold War because of its investments in science and technology.

Today, the landscape of conflict is increasingly being driven by a new set of factors, which Director of National Intelligence Daniel Coats summed up as a global "competition for technological superiority." Yet our most advanced technologies are still largely based on Cold War-era inventions.

The development of quantum technology presents the United States with its new "Sputnik moment." Quantum systems promise to upend everything that came before. But once again, America has some catching up to do.

A national strategy, like the one this nation embarked on following the Sputnik launch, will help get us there. And, yes, the stakes are just that high. If not higher.

The science is famously hard to grasp, but this is what's important: Quantum tech takes advantage of quantum physics to manipulate atoms and subatomic particles in new, potentially powerful ways. For example, the speed and power of today's computers are physically limited to the transistors that carry out their functions. That's because transistors are basically on-off switches for the flow of electrons in computers (typically represented in values of zeros and ones, or "bits").

But quantum computing promises a way around this limitation through the quirks of quantum physics. Specifically,

the bits in quantum computers can exist in more than one state at a time, can influence each other instantaneously from great distances, and can act as particles and waves simultaneously. These new bits — known as quantum bits or "qubits" — create the potential to process data much faster than traditional computers.

This technology holds immense promise. It could allow us to communicate faster, more accurately and more securely than ever before — meeting not only the security challenges of tomorrow but also revolutionizing everything from code-breaking to cybersecurity to climate modeling, and opening new frontiers in medicine and materials science.

Whoever gets this technology first will also be able to cripple traditional defenses and power grids and manipulate the global economy. The surest way to deter such behavior is to win this race.

Yet, many suspect that China is already pulling ahead. Although the country's total investment is unknown, the Chinese government is building a $10 billion, 4-million-square-foot National Laboratory for Quantum Information Sciences, due to open in two years.

China has already launched into orbit the "Quantum Experiments at Space Scale" satellite. Using quantum communications technology, the satellite successfully sent "unbreakable" code from space last year.

In comparison to China's investments, U.S. government-funded research in quantum technology, stood at just $300 million a year as of 2016.

In 1958, the year after America was jolted into action by the launch of Sputnik, NASA was given an initial annual budget of less than $800 million in today's dollars. By 1962, after the United States once again came in second — this time in the race to human spaceflight — NASA's budget jumped to more than $10 billion. America never looked back.

A similar misfire in the race for quantum technology would not be as easy to overcome. If the United States is to lead, immediate investment is needed to fund advances in quantum encryption, quantum computing and quantum communication.

Some of this is already underway, but we are only scratching the surface. The National Science Foundation has listed quantum technology as one of its 10 big ideas and has made multimillion-dollar investments in secure communications research. And the U.S. Intelligence Advanced Research Projects Activity, which operates under the Office of the Director of National Intelligence, recently selected my university, the University of Southern California, to lead a consortium of institutions to build and test 100-qubit quantum machines. The largest quantum computer currently operating is a 72-qubit system built by Google.

Other institutions are breaking important ground in this area as well, including Harvard University and the University of Maryland. But these efforts will only mark a watershed if our nation prioritizes quantum research as it did aerospace and defense in the mid-20th century.

Like then, critical partnerships between academia, government and the private sector can build the human capital we need to lead in the quantum era.

But if we do not take the appropriate action, America's dominance in a technology-driven world will be short-lived. Congress should use the 2019 budget debate to form a national quantum strategy and to ensure it is funded appropriately not only next year but also in the years to come.

Our leaders did not fail us in 1957. Our leaders cannot fail us now.

University of Southern California president C. L. Max Nikias holds eight patents in digital signal processing and is a member of the National Academy of Engineering, a fellow of the American Academy of Arts and Sciences and a charter fellow of the National Academy of Inventors (NAI).