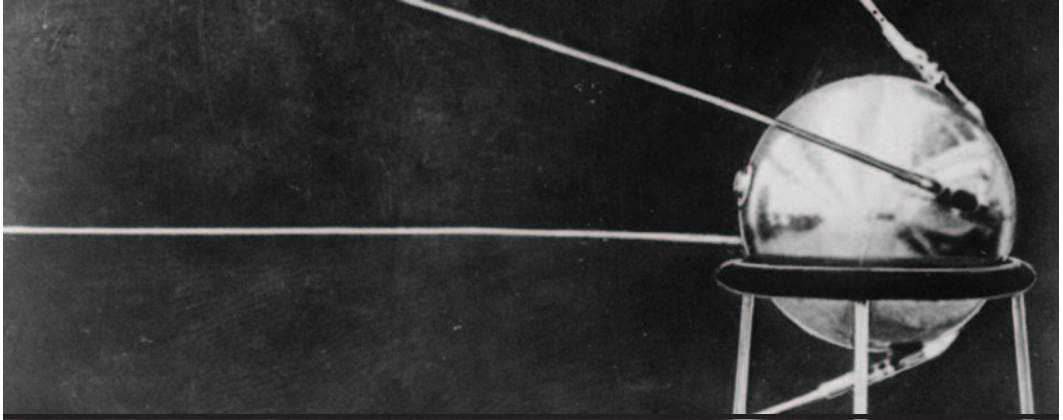


NEW FRONTIERS



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A New Scientific Resolve

Reflecting Forward on Sputnik's 50th Anniversary

By Vinton Cerf

REFLECTING FORWARD ON OUR nation's incredible ability to respond swiftly to complex scientific challenges, one can't help but begin with the shock of the Soviet Union's Sputnik launch 50 years ago. Suddenly, there was a new star in the firmament, its radio signal sounding like the ominous ticking of a clock toward Armageddon. If the Soviets could put a satellite in orbit then they could potentially launch nuclear-tipped intercontinental ballistic missiles in the future.

Just over a decade later the United States mobilized the basic science, the requisite technologies, and the financial and policymaking wherewithal to carry Neil Armstrong and Buzz Aldrin to the Earth's Moon. This stunning sequence of events and actions spell out in forceful and compelling terms the ability of the United States to marshal its resources to respond to national and international challenges.

That we were able to do so is an inspiring lesson that should be applied to the challenges we now face in the 21st century.

Fortunately for humankind, our nation's advanced science and technology can be harnessed to respond to a very different set of threats than those posed by the Cold War. Even better, all of humanity itself is our common ally in this quest.

Today, quicksilver globalization powered at unprecedented speed by the advent of the information technology revolution leaves our planet choking on the fumes of rapid global economic growth and all the attendant ills of global climate change. Yet these same forces transforming the global economy in myriad ways also enable each and every one of us to be part of the solution.

Modern communications technologies invite us to think of cooperation rather than competition as

the venue for new ideas and new wealth. It is widely recognized that while material assets such as factories provided the leverage for the creation of value in the industrial age, information is the new coin of the realm. And unlike industrial infrastructure, which could benefit only one user at a time, access to information is not a zero-sum game.

As John F. Kennedy (the president who was arguably elected by Sputnik) liked to say, “A rising tide lifts all boats.” As we look to solve global problems we need to take a more imaginative, less adversarial approach to generating the products and arrangements that will make for a more livable planet. Our national response to Sputnik 50 years ago should inspire us today to transcend national boundaries—moving beyond competition as the framework of human achievement.

Global climate change is a planetary threat that the United States cannot do less than meet head on with the same kind of determination and leadership that placed us on the Moon. Global warming is our 21st century Sputnik. Former Vice President Al Gore has been tireless and immensely persuasive in his efforts to draw attention to this problem. Yet it is time for scientists, technology leaders, financiers, and public policymakers to take the same kind of concrete, swift steps embraced by our country 50 years ago—steps that can result in a new flourishing of creativity and ingenuity emblematic of great scientific endeavors.

Remember, sweeping scientific inquiry informed by smart policymaking carried us to the Moon, but the many ancillary results of that mission are part and parcel of our world today. New materials needed for re-entry into the atmosphere and for protecting human life during space walks found their way into commercial products. Significant computing power was brought to bear in the design and planning of space systems and missions and the analysis of rocket engine performance.

Or consider the command and control of the complex Apollo missions. Computers for command and control led directly to the invention of the ARPANET and the succeeding Internet. Management

practices for complex systems found their way from the space program into the private sector, enhancing productivity and scalability of enterprises.

Indeed, at age 15, and already a science fiction junkie, I would benefit directly from the enrichment programs stimulated in large measure by the Sputnik launch. Introduced to computers in 1958 via the Semi-Automated Ground Environment tube-based computer at System Development Corp. in Santa Monica, California, I found myself using computers at the University of California, Los Angeles while a senior in high school and taking every computing course I could at Stanford University as an undergraduate student.

In 1965 I went to work for International Business Machines Inc. as a systems engineer and returned to graduate school at UCLA where I ended up working on the ARPANET project funded by the agency that was formed in response to Sputnik. I graduated and joined the faculty of Stanford University and, together with Robert E. Kahn, designed the basic architecture and protocols of the Internet.

This led to my joining ARPA as a program manager and eventually principal scientist in the Information Processing Techniques Office that was founded in 1962 by J.C.R. Licklider of the Massachusetts Institute of Technology.

This confluence of events in my life (and in the lives of many other American scientist and engineers) is no accident. Fifty years ago the United States rose to the challenge. Similarly, resources dedicated today to the challenge of global warming will ensure innovation continues to flourish across our planet.

In fact, many of the steps that can be taken to respond to the serious dislocations global warming will cause make eminently good independent economic sense. The development of high mileage internal combustion engine cars, or alternative clean-energy vehicles such as hybrid automobiles or all-electric cars, would reduce pollution and dependence on oil imports. The research needed to achieve this objective could be led by the American automobile industry and even subsidized by a civil-

ian equivalent to DARPA. And just imagine what other benefits would flow from a dedicated wave of research into lighter and stronger materials, more efficient and lighter weight batteries or fuel-cell systems, and alternative fuel sources.

The same multiplier effect holds for other scientific endeavors into a variety of green technologies, among them: reduced energy light sources; more efficient heating and cooling designs and technologies; better mass transit systems; higher speed and more widely available communication services to support working from home; more effective traffic control systems to reduce congestion (and wasted energy); improved desalinization methods to cope with the loss of fresh water from mountain snow pack and glaciers or underground aquifers; global power grids to transport electricity from areas of excess to areas of need.

Indeed, a post-Sputnik-like response to climate change would inevitably spur innovation in seemingly unrelated terrain brought on by global warming, such as preparing for the inevitable increase in diseases caused by the side effects of severe weather and storm surges. Moreover, successful results could become the basis for valuable international

economic trade since the uses for these ideas are not bound to their domestic origins.

The National Science Foundation, for example, could accelerate the development of curricular material to emphasize science, mathematics, and engineering in the interest of responding to climate change. The Internet can be used to disseminate this material and to share information globally to speed the research that is needed. Prize programs could be established to encourage research and experimentation in areas of specific need.

Considering the consequences of not responding to this planetary challenge, it seems inescapable that the United States can and must take a leadership role. We consume more resources and generate more greenhouse gases per capita than any other country. Other countries may soon exceed, in absolute terms, our contribution to global warming, and it is in our best interest to develop alternative technologies and to share them widely.

We responded effectively to Sputnik, and this is even more important. We can do it again. **SP**

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