Taking a long view

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By reaching for the Moon, Americans financed an incredible string of technical innovations. Would the U.S. have enjoyed its lead in microelectronics without this early investment?

Since I've spent much of my career in space research, I'm often asked if NASA (the National Aeronautics and Space Administration) is worth the tax dollars that go to the agency. I see this question as part of a larger one: should money be spent on research, development, and technology when the payoff is not clearly identified and other, near-term problems are pressing?

I'll answer this question with some examples. Imagine it's nine years ago. If you could buy General Motors stock to hold in your retirement account, would you do it? Today, the answer would most likely be no. You know how things now stand at General Motors.

Hint: But in 1997, General Motors was doing very well. Sales, earnings, and profits were all up. A hint of the trouble to come, however, can be found by comparing the 1997 General Motors annual report with Toyota's report from the same year. The General Motors report provided in-depth coverage of organizational and financial initiatives (two top priorities were "getting common" and "running lean"). GM's stock buyback plan and increased dividend got prominent mention. In contrast, the Toyota report focused extensively on technology and research. Toyota announced that its first hybrid gasoline-electric car would go on the market that year. From this historical vantage point, it's clear who had the right long-term strategy.

The space program offers another example. On July 15, 1969, the day before the scheduled Apollo 11 Moon launch, the Louis Harris organization released a poll. The good news for NASA was that 51% of the public supported landing a man on the Moon. The reason this bare majority was good news was that the approval rate for a Moon landing had been only 39% just one year earlier. Today, of course, we are used to seeing the Apollo program celebrated in movies, millennium retrospectives, and even television commercials. Looking back, it's hard to imagine that on the eve of that great triumph, the program was so half-heartedly supported by the American people.

Tempting: But Apollo has bred much more than national pride. By reaching for the Moon, Americans financed an incredible string of technical innovations. In 1968, the engineers who had developed the integrated circuits for the Apollo guidance computer were ready to move on to other projects. Two of them started a new company. That company, Intel, and others like it, have by now paid the American economy back several times over for the initial investment of tax dollars in Apollo. Last year, total revenues for Intel were approximately 2.4 times NASA's budget. It's tempting to speculate about what might have happened if microelectronics hadn't been such an important factor for the defense and aerospace fields. Would the United States have enjoyed its long and significant lead in microelectronics without the government's early investment in research?

Similarly, the success of the biotechnology industry depends on knowledge that continues to be gained through basic, government-funded research—much of it conducted by faculty members at medical schools all across the country. How many of today's clinical innovations are rooted in that research?

There are even local examples of commercial enterprises based on technology that initially was used in government labs or for government projects. The Hanover-based company Fluent provides computational fluid dynamics (CFD) software and services for a variety of applications. CFD allows a computer to model the complex behavior of fluids like air, water, or blood. Before there was a commercial market for CFD products, NASA was an important driver for developing this technology for projects like the space shuttle and other aerospace vehicles. Today, offshoots of that development help pay salaries and send money through our local economy in the form of mortgage payments, tax revenues, and grocery bills.

Tenuous: So even though support for the Apollo program was tenuous in 1969, in retrospect we can appreciate how the knowledge and skills gained from the project have fueled the economy. On the other hand, while General Motors' managers in 1997 might have felt they were making the right near-term decisions, we now know that they were shortchanging the future. At Toyota, in contrast, the 1997 annual report stated the company's priorities unequivocally: "Our market position has benefited from unwavering, aggressive expenditures on new products and technologies."

Today, as a nation, we are faced with some serious choices. With a war in progress, the baby boom generation ready to retire, and federal spending on health care likely to skyrocket, it may seem as if government funding for research and development should take a back seat to other pressing needs. Also, the economy is doing well and solid corporate earnings suggest we aren't experiencing a technology deficit. Perhaps the safe bet is to focus research only on things that are practical, applied, and likely to be commercially viable.

But at a time when stiff competition from around the globe is a reality for the United States, taking the safe bet may be the riskiest course of action. History shows that our success depends on strong, decisive support for agencies—including NASA—that support our technical and scientific base by performing basic research, fostering innovation, and seeding the future for us and for our children. ■

The "Grand Rounds" essay concerns a topic of interest to the Dartmouth medical faculty. Buckey, an associate professor of medicine, is a former astronaut who flew aboard the space shuttle Columbia *on the 1998 Neurolab mission. He currently performs research on space physiology and medicine at Dartmouth-Hitchcock Medical Center and leads the technology development team for the National Space Biomedical Research Institute.*