For decades, the United States dominated the technological revolution sweeping the globe. The nation’s science and engineering skills produced vast gains in productivity and wealth, powered its military and made it the de facto world leader.

Today, the dominance is eroding. In 2002, the nation’s high-technology balance of trade went south, and it never came back. By 2007, the annual gap between high-tech exports and imports had grown to $53 billion. The gap this year is expected to be the largest ever — approaching $60 billion.

Both presidential candidates, in their careers and in their campaigns, have made detailed arguments for how the nation should deal with technology rivals, sharpen its competitive edge and improve what experts call its “ecology of innovation.”

Yet their visions are strikingly different. They diverge mainly on the appropriate role for the federal government in education, in spending on research, and in building, maintaining and regulating the complex infrastructure on which innovation depends. The visions both face tough questions on their viability amid the nation’s deepening financial crisis.

Senator John McCain, the Republican nominee for president, seeks to encourage innovation by cutting corporate taxes and ending what he calls “burdensome regulations” that he says inhibit corporate investment. But Mr. McCain has also repeatedly gone up against business if he sees a conflict with national security, for instance, in seeking to limit sensitive exports.

In Senator Barack Obama’s view, the United States must compete far more effectively against an array of international rivals who are growing more technically adept. Mr. Obama, the Democratic nominee, looks to the federal government to finance science, math and engineering education and the kind of basic research that can produce valuable industrial spinoffs.

The personal styles of the candidates also contrast. Mr. McCain says his leadership of the Senate commerce committee has versed him in technology issues, but he also jokes about his ignorance of personal computers and e-mail. Mr. Obama, an avid BlackBerry user, commenced an aggressive drive for campaign donations over the Internet.

Mr. Obama embraces the theory of evolution and argues that the teaching of intelligent design and other creationist ideas “cloud” a student’s understanding of science. While Mr. McCain says he personally believes in evolution, he has also said children should be taught “all points of view.”
Mr. McCain has written five books, starting in 1999, but none discuss in any detail how the nation might respond to technical rivals — a central theme of Mr. Obama’s second book, published in 2006. Mr. Obama posted a detailed set of technology proposals on his Web site late last year; Mr. McCain did so in recent months.

It remains to be seen how the candidates would pay for their proposals.

At the request of The New York Times, the Information Technology and Innovation Foundation, a nonpartisan research group in Washington, estimated the annual costs of the plans and put Mr. Obama’s at $85.6 billion and Mr. McCain’s at $78.8 billion, excluding his proposed reductions in corporate taxes.

“The pressures of an unfolding fiscal crisis make these priorities recede on the list of what politicians want to do,” said Robert Reischauer, director of the Congressional Budget Office from 1989 to 1995.

Nevertheless, there is wide agreement among economists and other experts that the capacity to innovate is central to growth, quality of life and success in the global marketplace — a point on which the candidates agree.

“If we don’t have an innovation agenda, if we don’t invest in science research, if we don’t provide encouragement for our kids to pursue careers in math and science, I don’t see where our country can go economically in the future,” said John Edward Porter, a Republican former congressman who is the board chairman of Research!America, an advocacy group.

Several experts faulted both campaigns for failing to give the innovation issue higher visibility, despite their many plans and proposals.

“I understand the immediate pressures and vicissitudes of elections,” said Charles M. Vest, president of the National Academy of Engineering and former president of the Massachusetts Institute of Technology. “But I’d like to see them raising the discussion on this, which is absolutely fundamental to the future of jobs and the economy.”

Restoring the nation’s competitive edge is urgent, said Norman R. Augustine, a former chief executive of the aerospace giant Lockheed Martin who led an influential innovation study by the National Academies.

“If we don’t wake up,” Mr. Augustine said in an interview, “there’s a high chance that the generation of children we’re leaving behind will have a much lower quality of life.”

McCain as Committee Leader

The golden age of American invention began after World War II, when the government and industry poured big money into research and produced advanced goods like the transistor, the laser, new drugs, fiber optics, new kinds of jets and spacecraft, modems and the desktop computer. All were exported in vast quantities.

Signs of trouble appeared in September and October of 1995, when the nation registered its first negative balances of trade in advanced technology goods, according to the Foreign Trade Division at the Census Bureau.

Though often approving of business and deregulation, he could reverse course if the issue impinged on what he saw as national security. An early initiative of his sought to restrict American exports of certain high-tech goods, even as the Clinton administration pushed for trade liberalization.

“It’s critical that safeguards are in place,” he said in opening a 1998 hearing on missile and satellite exports to China. Later, Republicans charged the Clinton administration with dangerous irresponsibility in allowing the Chinese to import high-performance computers. Getting the export issue right, Mr. McCain said at a hearing in 2000, is “one of the greatest challenges of our time.”

The drive helped tighten export regulations. But technology analysts faulted the attack as political and the tightening as unnecessary.

James A. Lewis, an export specialist at the Center for Strategic and International Studies in Washington, wrote in 2001 that the new system “expends enormous resources on trivial and unimportant security risks” and threatens to damage important sectors of the economy, like the defense industry. The Republicans “closed off space exports,” he added in an interview this month. “So, many countries started their own space programs to get around the export controls.”

Domestically over the years, Mr. McCain’s committee sought to spur things like Internet development, the private space industry and the commercial licensing of federally owned inventions.

But in 2002, for the first time, the nation registered negative balances of trade in advanced technology goods for a whole year. “Time to wake up,” Representative Donald Manzullo, an Illinois Republican, said as he led a hearing in July 2003 on preserving the defense industrial base.

Mr. McCain, who held no hearings on the issues, did push for new innovations. For instance, he introduced a bill in 2005 to limit heat-trapping gases that sought to spur the development of green technologies.

A few months later, the National Academies issued its influential report “Rising Above the Gathering Storm.” The academies, the nation’s most eminent scientific and engineering organization, called for an urgent effort to strengthen American competitiveness.

The report said industries like chemical, semiconductor and automotive were growing in other countries while comparable American efforts atrophied. The patent office issued most of its information technology patents to foreigners. The United States ranked 17th among industrialized nations in high-school graduation rates, and the country had become “a net importer of high-technology products,” many from China.

The report added that corporations were cutting back on basic research and eliminating in-house laboratories.

Among other things, it proposed that the government finance 10,000 scholarships for math and science teaching careers and 30,000 scholarships for college-level study of science, math and engineering; increase
the basic research budget by 10 percent a year for seven years; and establish programs to make broadband available nationwide at low cost.

Representative Sherwood L. Boehlert, a New York Republican who was chairman of the House science committee, praised the report at a hearing and said, “Complacency will kill us.”

Outlook in Obama Book

In October 2006, Mr. Obama, who had been elected to the Senate from Illinois two years earlier, published his second book, “The Audacity of Hope: Thoughts on Reclaiming the American Dream.” He wrote of visiting Google headquarters in Mountain View, Calif., where, among other things, he saw a map of the world with lights showing where Google searches were going on. Swaths of Africa and South Asia were dark. But so were portions of the United States, he wrote, where “thick cords of light dissolved into a few discrete strands.”

Many of the engineers Mr. Obama met at Google were from Asia or Eastern Europe. “As far as I could tell, not one was black or Latino,” he wrote. His guide told him that finding American-born engineers of any race was getting so hard that American companies were setting up shop abroad, in part for access to talent.

America, Mr. Obama wrote, cannot compete with countries like China and India simply by cutting costs and shrinking government. “If we want an innovation economy,” he added, “one that generates more Googles each year, then we have to invest in our future innovators — by doubling federal funding of basic research over the next five years, training 100,000 more engineers and scientists over the next four years, or providing new research grants to the most outstanding early-career researchers in the country.”

He acknowledged that his plan would cost about $42 billion over five years — “real money, to be sure, but just 15 percent of the most recent federal highway bill.”

The next year, Mr. Obama joined other senators to introduce a bill that built on the recommendations of “The Gathering Storm.” It eventually drew 69 co-sponsors from both sides of the Senate aisle; Mr. McCain was not among them.

Mr. Obama then offered amendments to the bill intended to increase federal support of science education, particularly among women and underrepresented minorities. “If we do not tap the diversity of our nation,” he said on the Senate floor, “we will diminish our capacity to innovate.”

The Senate passed the bill 88 to 8. Mr. McCain abstained. President Bush signed the bill, the America Competes Act, into law. But Congress has yet to finance its programs, estimated to cost about $43 billion for the first three years.

Candidates’ Platforms

Mr. McCain and Mr. Obama acknowledge the importance of scientific research. The two men, for instance, advocate making research and development tax credits permanent. They would move the presidential science adviser back into the close orbit of the White House, a position it occupied until 2001, and they support the human exploration of space.
Though their approaches differ, both call for changes in the operation of the patent office, agree that access to broadband must be expanded and advocate steps to encourage technically trained foreigners to enter and stay in the United States.

But Mr. Obama looks to encourage basic research with infusions of federal cash. Mr. McCain says easing regulatory and tax burdens will encourage private spending on research. (Experts say industry now tends to focus on near-term applications, while government finances more basic research that has greater breakthrough potential.)

Mr. Obama has proposed doubling federal financing for basic research in physics, life sciences, mathematics and engineering over 10 years. He has promised to review export rules he calls outdated and sees as having “unduly hampered the competitiveness of the domestic aerospace industry.”

By contrast, even before the current economic crisis, Mr. McCain proposed freezing, at least initially, almost all discretionary federal spending — a budget category that includes federal research efforts.

And he makes hay on the stump by citing, as an example of wasted money, a study of the DNA of grizzly bears in Montana, wondering aloud why anyone would think bears were involved in paternity suits or criminal activity. (In fact, the project, undertaken by the United States Geological Survey, intended to find ways of estimating the region’s population of grizzlies, endangered in the lower 48 states.)

The McCain campaign has said he will encourage corporate research by reducing the capital gains and corporate taxes and promoting “conditions favorable to investment.” In response to a survey by Science Debate 2008, a private group that tried to arrange a debate on science issues, he cited “burdensome regulations” as inhibiting innovation in the United States and said he would work to remove them.

“I am uniquely qualified to lead our nation during this technological revolution,” he said in the survey response, pointing to his Navy experience with advanced technologies as well as his leadership on the Senate commerce committee. “Under my guiding hand,” he added, Congress developed a wireless spectrum policy that prompted the rapid rise of mobile phones and Wi-Fi technology.

Seeking to reduce the government’s role in choosing technologies and to increase that of entrepreneurs, Mr. McCain has now proposed federal sponsorship of a $300 million prize to encourage the development of a revolutionary new battery for electric cars.

Mr. Obama supports expanding research on human embryonic stem cells. The research is regarded as a promising avenue toward novel treatments for serious diseases. But because such research involves destruction of early stage human embryos, opponents of abortion rights oppose it. Mr. Bush severely restricted the work in 2001.

Mr. McCain has voiced support for this research, but he now adds that he hopes it will soon be unnecessary to use these cells. In his response to the Science Debate 2008 questionnaire, at science debate2008.com, Mr. McCain said the nation should refuse “to sacrifice moral values and ethical principles for scientific progress.”

Mr. McCain’s campaign did not respond to repeated requests for information. According to the journal
Science, he has “no formal structure” for seeking science advice. It reports that Douglas Holtz-Eakin, a former economic adviser and head of the Congressional Budget Office under Mr. Bush, serves as Mr. McCain’s “point man” on science, having been in touch with experts on climate, space and “science in general.”

On the other hand, Mr. Obama established a science advisory committee led by Dr. Harold Varmus, a Nobel laureate who is president of the Memorial-Sloan Kettering Cancer Center. Dr. Varmus said the group’s leaders communicated almost daily with the campaign’s policy leaders. And this month, the campaign announced that 61 American Nobel laureates in science had endorsed Mr. Obama. (When Martin Chalfie, a Columbia biologist, learned last week that he had won the Nobel Prize in chemistry, he said one of the first things he did was to call one of the 61 to ask how to add his name to the list.)

Dr. Varmus acknowledged that finding the money to pay for the Obama innovation agenda “is not an easy question.” But he said Mr. Obama would focus on federal spending on high priority areas “and among the things he mentioned as being central to economic recovery are science and technology.”

Experts agree that the immediacy of the financial crisis is overshadowing the innovation debate and predict little headway until a new president has settled into office and confronts budgetary realities.

“The problem,” said Mr. Boehlert, the former chairman of the House science committee, who left Congress last year, “is that it takes an immediate investment that won’t pay immediate dividends, and people are looking for an instant fix.”

Kenneth Chang contributed reporting.
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