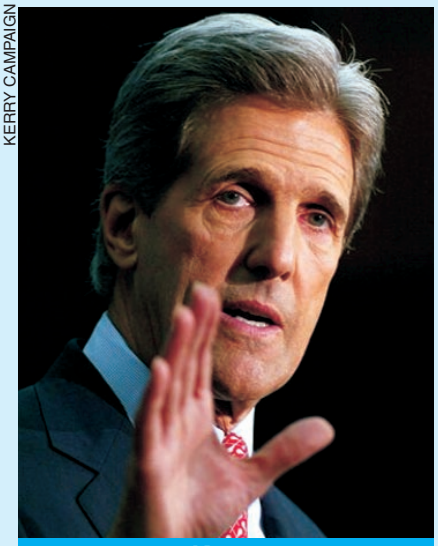
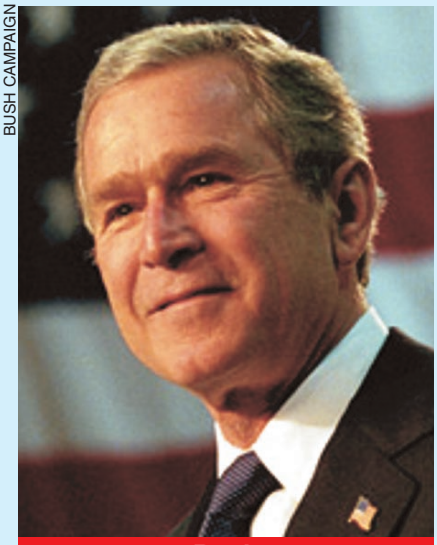
SPECIAL REPORT

KERRY CAMPAIGN



Kerry

BUSH CAMPAIGN



Bush

Presidential Candidates Speak Out on Science Policies

During the 2000 presidential election, in that time before the September 11th terrorist attacks, the stump speeches of George W. Bush and his Democratic opponent, Al Gore, focused on protecting Social Security, saving American education, expanding Medicare, raising or lowering taxes, and readying the military. If science was mentioned at all, it was usually in the context of missile defense, global warming, or Gore's role in creating the internet.

With the exception of the debate over stem-cell research, science remains a background topic in the current campaign. Democratic candidate John Kerry has occasionally highlighted US science policy and used it against President Bush, charging that the administration has put politics and ideology ahead of science. "Let scientists do science again," a headline on the Kerry election website says.

Bush has responded, primarily through his science adviser, John Marburger, by pointing to the 44% increase in federal R&D since fiscal year 2001 and the record $132 billion in the administration's FY 2005 R&D budget. "Kerry ignores President Bush's record science investments," reads a headline on the Bush reelection website.

Kerry answers by noting that most of the R&D money is going for weapons systems and defense spending related to the war in Iraq, not basic science programs. Marburger and other administration officials point to several R&D initiatives, including new nanotechnology centers, the Moon/Mars space initiative, and the program to develop hydrogen fuel technology.

In an effort to get the candidates to specifically address questions of interest to the science community, PHYSICS TODAY has continued a tradition begun in 1976; it asked Bush and Kerry nine questions covering a range of science topics. Their answers, sometimes direct and sometimes vague, show fundamental differences on several key issues.

On missile defense, Bush says his request of $10 billion in FY 2005 for development and deployment of such a system fulfills a pledge he made to the American people. Kerry says we should not be "falsely comforted by an untested and unproven defense system."

On global warming, Kerry talks of both near- and long-term programs to deal with the problem. Bush promotes his "comprehensive climate change strategy." The candidates also address a host of other issues ranging from space exploration to energy policy.

Jim Dawson

1 Missile defense: The present administration is requesting more than $10 billion this year for development and deployment of a missile defense system. Many scientists say the system, given current and foreseeable technology, cannot be effective. What proof of effectiveness should be required before the system is fully deployed? Given the low-tech nature of terrorist attacks and the limited missile capabilities of North Korea and other hostile nations, does missile defense continue to be a wise investment?

Bush Our policy is to develop and deploy, at the earliest possible date, a weapons system that would defend the United States homeland against nuclear attack, including ballistic missile defenses drawing on the best technologies available. Early in my administration, I called for the examination of the full range of available technologies and basing modes for missile defenses that could protect the United States, our deployed forces, and our friends and allies.

The FY 2005 Defense Appropriations Act provides $10 billion that I requested for systems to defend against the threat from ballistic missiles. Later this year, the first components of America's missile defense system will become operational, and we are on schedule for the next stages of the project. My administration will develop and deploy the technologies necessary to protect our people, fulfilling a pledge I made to the American people more than four years ago.

Kerry A missile defense that works is a wise investment, but one that pours money into defenses at the expense of other immediate national security needs is not. And that's what this administration has done.

Missile defense should be one element of a comprehensive national security strategy. But a single-minded focus on this technology and the threat it is designed to meet ignores the very real danger of terrorism and

our greatest danger—terrorists with weapons of mass destruction.

John Edwards and I will be committed to developing a missile defense system that works, is fully tested, and geared to the threats we face. But I will refocus our efforts on preventing the spread of nuclear, biological, and chemical weapons and dramatically accelerating the security of nuclear weapons and material in Russia and around the world. We will not sit by, falsely comforted by an untested and unproven defense system, while these threats continue to fester.

2 Climate change: Virtually all reputable research in recent years has reinforced the scientific conclusion that global warming is a real and growing crisis caused, at least in part, by the burning of fossil fuels. Do you accept that scientific consensus? Under what circumstances would you regulate carbon dioxide and other greenhouse gas emissions?

Bush Global climate change is a serious long-term issue. In 2001, I asked the National Academy of Sciences (NAS) to provide the most up-to-date information about the science of climate change. The academy found that considerable uncertainty remains about the effect of natural fluctuations on climate and the future effects climate change will have on our environment.

My administration is now well along in implementing a comprehensive climate change strategy to advance the science, expand the use of transformational energy and carbon sequestration technologies, and mitigate the growth of greenhouse gas emissions in the United States and in partnership with other nations. I created the new US Climate Change Science Program (CCSP) to refocus the federal government's climate research programs, for which my 2005 budget seeks nearly $2 billion to fund research across the federal government. The NAS endorsed the CCSP strategic plan, noting that it "articulates a guiding vision, is appropriately ambitious, and is broad in scope."

I also committed the nation to a goal of reducing American greenhouse gas intensity by 18% over the next 10 years, which would prevent more than 500 million tons of carbon emissions through 2012. To help achieve this goal, I created the Climate Vision program in 2003 to reduce the growth of greenhouse gas emissions by energy-intensive industrial sectors. Participants in the Climate Vision program account for between 40 and 45% of US greenhouse gas emissions. I have strongly supported over $4 billion in tax incentives for renewable and energy-efficient technologies, including wind and solar energy and hybrid and fuel-cell vehicles. Also, in April 2003, my administration raised the fuel economy standards for light trucks and SUVs [sport utility vehicles] for the first time since 1996, saving 3.6 billion gallons of gasoline. And in my 2003 State of the Union [address], I announced a $1.7 billion hydrogen fuel initiative to accelerate research that could lead to hydrogen-powered, no-emission vehicles within a generation.

Additionally, my administration is participating in robust international partnerships to promote clean, renewable, commercially available fusion energy and to construct the $1 billion FutureGen project, which will test the latest technologies to generate electricity, produce hydrogen, and sequester greenhouse gas emissions from coal.

Kerry I recognize the risk of climate change, and I have outlined a balanced set of programs that will have impact both in the near term and over the long term. My plan will also provide balanced support for technology that can increase the efficiency and cut greenhouse emissions in transportation systems, buildings, and industry that are attractive to consumers and US producers. Our programs will encourage the use of renewable fuels such as ethanol and renewable electric generation that produce little or no net greenhouse gases. I will expand the production tax credit for wind and biomass energy to cover the full array of renewable energy sources and increase Department of Energy (DOE) research into renewable energy sources and their applications. And I will propose an aggressive program of research, standards, and incentives to accelerate electric generation from renewable energy. Clean coal technology can play a critical role, given technology to cut carbon dioxide emissions.

My plan would encourage energy efficiency with programs such as updated fuel efficiency standards, new tax incentives for automakers to build the new, more efficient automobiles of the future, and tax incentives for families to purchase more energy-efficient cars, trucks, and SUVs.

3 Science investment: There is concern in the science and economic communities that the US is losing its world leadership in the sciences, which they say bodes ill for future economic growth and global competitiveness. To address that concern, should the US increase funding for basic science, and should the administration fully fund the 2001 bill, signed by the president, to double NSF's budget? How would you reinvigorate science education for US-born students? What is the role of foreign scientists and students in the US scientific enterprise?

Bush Including my FY 2005 budget request, total federal R&D investment during the first term will have increased 44% to a record $132 billion in 2005. My FY 2005 budget request commits 13.5% of total discretionary outlays to R&D, the highest level in 37 years. In the context of the overall economy, federal R&D spending in the FY 2005 budget is the greatest share of GDP [gross domestic product] in over 10 years. Funding for basic research, the fuel for future technology development, is at an all-time high of $26.8 billion in FY 2005, a 26% increase over FY 2001.

Funding for NSF during the four years of my administration has increased 30% over FY 2001 to $5.7 billion in FY 2005. NSF's broad support for basic research, particularly at US academic institutions, provides not only a central source for discovery in many fields but also encourages and supports development of the next generation of scientists and engineers. Moreover, in fulfilling its mission, NSF has used its funding efficiently and effectively.

As for the American scientific enterprise, it is important in this information and technological age that our students receive a first-rate science education, just as they receive quality instruction in reading, writing, and math. The federal government has no control over local curricula, and it is not my job to tell states and local boards of education what they should teach in the classroom. Nevertheless, the No Child Left Behind Act, one of my proudest legislative achievements this term, is improving our schools and, consequently, the teaching of science. NCLB requires, for the first time, assessments in science to give us better information about how our students are performing and how to improve instruction in science.

I have also proposed creating the Presidential Math and Science Scholars Fund to provide $100 million in grants to low-income students who study math or science. This will ensure that America's graduates have the training they need to compete for the best jobs of the 21st century.

I also value the contributions that foreign scientists and students make

to our nation's scientific enterprise, while recognizing the importance of safeguarding our security. We will continue to welcome international students and scientists while implementing balanced measures to end abuses of the student visa system. My administration has already achieved several notable successes in reducing delays now being experienced by some visa seekers. We have increased security while speeding up the clearance process; approximately 1000 backlogged applications have already been cleared out.

Kerry For three years, the Bush administration has squandered America's leadership in the world, putting politics before science and doing nothing to create jobs while our workers fall further behind. The administration has proposed cuts for scientific research and grossly distorted and politicized science on issues from mercury pollution to stem-cell research. This approach not only limits the research that our scientists are doing today, it undermines important discoveries of tomorrow and threatens America's critical edge in innovation. I will reverse this course by restoring America's scientific leadership, helping find new cures, moderating healthcare costs, and developing new technologies that will create good jobs. I will boost support for the physical sciences and engineering by increasing research investments in agencies such as NSF, the National Institutes of Health, DOE, NIST, and NASA. This funding will help with the broad areas of science and technology that will provide the foundations for economic growth and prosperity in the 21st century.

4 Nuclear weapons: Does the US need to develop a new class of nuclear weapons to deal with the changing threats of the 21st century? Is there any circumstance in which you would support the resumption of nuclear testing?

Bush The Nuclear Posture Review, released by my administration in January 2002, noted that the nation's nuclear infrastructure had atrophied since the end of the cold war and that the evolving security environment requires a flexible and responsive weapons complex infrastructure. To that end, my FY 2005 budget reflects an increase over the 2004 enacted level in the weapons activities account, which encompasses the stockpile stewardship programs. There is no current need for testing due to the sophistication of computer modeling and other new technologies, but we must maintain the capability to test in case such testing becomes necessary in the future to ensure the safety and reliability of our defensive arsenal. We have not identified any need for developing new nuclear weapons.

Kerry No, and a Kerry–Edwards administration will stop this administration's program to develop a new class of nuclear weapons. This is a weapon we don't need, and it undermines our ability to persuade other nations to forego development of these weapons.

5 Nuclear proliferation: There is serious concern among many experts that terrorists could release radioactive materials, or even detonate a nuclear device, in a US city. Do you believe the US is doing enough to secure and control existing stockpiles of nuclear weapons and fissile material both in the US and elsewhere?

Bush No administration in history has done more to secure and control nuclear weapons and fissile material than mine. US weapons and materials are exceptionally secure and both the Department of Defense

and DOE are working to make them even more so. My administration has substantially increased funding to secure weapons and material in the former Soviet Union and has accelerated by two years the schedule the previous administration prepared for security upgrades in Russia. We are working with Russia to end the production of plutonium and to eliminate enough weapons plutonium for thousands of weapons. Outside the former Soviet Union, my administration established the Global Threat Reduction Initiative to eliminate or secure fissile and radiological material worldwide. We have already removed weapons material from several countries. Most recently, our policies resulted in Libya abandoning its long-standing quest for nuclear weapons.

To guard against so-called dirty bombs, we led the international community in a global effort to account for, secure, and dispose of excess radiological sources that could be used in such devices. We initiated activities in over 40 countries on this effort, as well as with international organizations like the International Atomic Energy Agency. Through the Proliferation Security Initiative, the Container Security Initiative, and the Second Line of Defense program, we have dramatically improved our ability to interdict materials that could be a threat to us and to our friends and allies.

Finally, my administration launched the G-8 Global Partnership—a $20 billion initiative to support arms reduction, nonproliferation, counterterrorism, and nuclear safety projects in the former Soviet Union. This extraordinary mobilization of the international community is leading to a safer, more secure world.

Kerry Our nation's highest priority must be preventing terrorists from gaining access to nuclear weapons and the material to make them. We must work in a global partnership with other nations to prevent the spread of these deadly weapons. Unfortunately, the Bush administration's policies have moved America in the opposite direction. They have alienated the allies we need to advance our security. Even after September 11th, they have not done nearly enough to secure existing stockpiles and bomb-making materials. They sat on the sidelines while the nuclear dangers from Iran and North Korea have increased. Our security requires an immediate change of course. I have proposed a comprehensive strategy to

▶ safeguard existing stockpiles of dangerous weapons and materials, including an acceleration of programs to secure all nuclear weapons and materials within the former Soviet Union, and at research reactors in countries outside the former Soviet Union, within four years.

▶ end production of new fissile material for nuclear weapons by negotiating a global ban on production of new material.

▶ reduce existing stocks of nuclear weapons and materials by ending development of the new generation of nuclear weapons, accelerating reductions in US and Russian nuclear arsenals, and reducing stocks of dangerous highly enriched uranium in Russia.

▶ end nuclear weapons programs in hostile states, including by prioritizing negotiations with North Korea to ensure the complete, irreversible, and verifiable elimination of its nuclear weapons program and leading a global effort to prevent Iran from obtaining the materials necessary to build nuclear weapons.

▶ enhance international efforts to eliminate illegal trafficking networks by toughening export controls, stiffening penalties, and strengthening law enforcement and intelligence sharing as well as improving the proliferation security initiative.

▶ appoint a presidential coordinator to prevent nuclear terrorism who will focus exclusively on directing a top-line effort to secure all nuclear weapons and materials around the world and prevent a nuclear terrorist attack.

6 Energy policy: More than two decades of discussions and proposals still have not resulted in a comprehensive US energy policy. Looking 25 years into the future, what do you believe the US energy mix should be? How would you move the US in that direction?

Bush Reliable and affordable energy is critical to America's economic, national, and homeland security. We will be more prosperous and more secure when we are less dependent on foreign sources of energy. The passage of a comprehensive and balanced national energy policy has been one of my top priorities. During my first six months in office, I proposed a national energy policy that would modernize our energy production and distribution systems, reduce our dependence on foreign oil, promote efficiency and conservation, increase domestic production from all forms of energy including renewable energy sources, and continue to strengthen our economy and create new jobs. We will continue to work with Congress on the energy legislation needed to carry out the remaining recommendations.

My administration has implemented nearly all of the more than 100 recommendations in the comprehensive national energy policy that did not require legislation—such as increasing electricity reliability R&D to help prevent electricity disruptions and filling the Strategic Petroleum Reserve to its capacity of 700 million barrels to provide energy security in case of major supply disruptions.

Kerry I have proposed an ambitious program of research, incentives, and standards that would sharply increase the efficiency of energy use and stimulate use of new energy sources that can ensure a prosperous and safe America while greatly reducing the risk of climate change. The program would be supported in part by a $20 billion energy security and conservation trust fund, capitalized from existing federal offshore oil and gas royalty revenues.

Unlike the Bush–Cheney policy, developed in secret by special interests, I have reached out to innovators around the country and developed a diverse portfolio of technical opportunities that can meet US needs both in the short term and for decades in the future. Given the long time required to turn over energy investments such as fleets of cars and trucks, industrial equipment, and building equipment, we must move a broad set of new technologies as quickly as possible if we have any hope of influencing US energy use in 25 years.

In the near term, many of the most promising technical opportunities involve using advanced materials, control systems, biotechnology, and other technologies to greatly improve the energy productivity of transportation, buildings, and industrial production. It's essential that the US move quickly to reduce its dependence on oil imported from the Middle East, and I will set ambitious goals for alternative fuels such as ethanol.

I will support research and incentives that will dramatically increase use of electricity from wind and other renewable resources. And I will encourage development of advanced clean-coal technology and nuclear generation consistent with high standards for environmental stewardship and security.

7 Nuclear power/radioactive waste: A recent report by MIT suggested that nuclear power is the best "clean" energy source to meet the US demand while protecting the atmosphere until renewable energy can be deployed on a large scale. Do you favor increasing the use of nuclear power? If so, what would you do with the resulting radioactive waste?

Bush I support the further development of nuclear power technologies as a clean, affordable, and realistic option to meet this nation's future energy needs. Nuclear power today accounts for 20% of our country's electricity. This power source, which causes no air pollution or greenhouse gas emissions, can play an expanding role in our energy future while meeting the environmental challenges we face with energy production.

My national energy policy contained several recommendations to encourage increased use of nuclear power and to handle the waste products that result. For example, through the Nuclear Power 2010 program, my administration is working with industry to pave the way for an order of a new US nuclear power plant within the next few years. Second, through the Generation IV International Forum, the United States is joining with countries around the globe to develop a next generation of safer, more economic, and more proliferation-resistant nuclear reactors that can also produce hydrogen and electricity. Finally, my administration has made a strong commitment to resolving the nuclear waste challenge and making the construction of a long-term geologic repository at Yucca Mountain achievable. We are moving ahead with the submission of a license application to the Nuclear Regulatory Commission at the end of this year.

This administration is also committed to exploring and investing in advanced new technologies that will profoundly change the ways we generate electricity. For example, I committed the United States to join the international fusion energy experiment, known as ITER, early in 2003. ITER is a critically important experiment to test the feasibility of nuclear fusion as a source of electricity and hydrogen. Fusion holds the promise of a nearly limitless source of energy produced without the accompanying radioactive wastes that require long-term management.

Kerry Nuclear power can play an essential role in providing affordable energy while reducing the risk of climate change; however, key challenges such as nuclear waste disposal, nuclear nonproliferation, and plant security must be met. John Edwards and I will ensure safety and sound science come first. We oppose George Bush's plan to open Yucca Mountain over the objections of independent scientists. Instead, a Kerry–Edwards administration will

▶ proceed based on peer-reviewed science. John Edwards and I do not support Yucca Mountain as a nuclear waste disposal site and will insist that nuclear waste disposal and transportation proceed only on the basis of rigorous peer-reviewed science and analysis that leads to public understanding and confidence.

▶ reject the Yucca Mountain license. John Edwards and I will immediately call upon George Bush and DOE to cease from submitting a license application for Yucca Mountain.

▶ initiate an NAS study to examine whether geologic disposal anywhere is still the best, safest option, as opposed to long-term storage and monitoring, or some other technology.

▶ establish an international independent blue-ribbon panel to recommend world-class, state-of-the-art scientific methods for nuclear waste storage and disposal.

▶ secure nuclear plants from terrorist attack. John Edwards and I will improve and strengthen security at nuclear plants. In addition, we will require nuclear plants to adopt adequate plans to improve security, in-

cluding measures to reduce dangers to the public if an attack occurs.

8 National labs: Despite National Nuclear Security Administration oversight, the national weapons laboratories continue to be plagued with internal security problems, spending irregularities, and low morale. What steps would you take to improve conditions at the labs? Does the current plan of opening the labs' management contracts to competitive bids run the risk of disrupting the operations in the midst of the war on terrorism?

Bush Our national laboratories are doing great work to deal with the threats of the 21st century. These laboratories are a tremendous asset in our efforts to improve homeland security, are the source of unparalleled technological progress, and are helping America win the war on terror. With their budgets at the highest level in years, Lawrence Livermore National Laboratory, Los Alamos National Laboratory, and Sandia National Laboratories are also on the cutting edge of 21st-century defense research, like combating bioterrorism, protecting the nation's infrastructure from crippling terrorist attacks, and developing a laser that simulates the intense heat of a nuclear explosion.

This is why we spent $6.5 billion on weapons research and production in FY 2004 and why I am asking for $6.8 billion for FY 2005. We must keep morale and security high. My administration has made every effort to improve the way the weapons labs do business, and one of those efforts is allowing competitive bids like those that exist in all areas of government—including those central to the war on terror—so we can use our resources more effectively and let everyone focus on his or her own expertise.

Kerry Our national laboratories play a critical role in maintaining our nuclear weapons stockpile and assuring that our nation's nuclear weapons are safe, secure, and reliable. The national laboratories also have an important role in preventing the spread of weapons of mass destruction and in advancing science for our nation's security.

The laboratories have a proud history of advancing our nation's security, but this record has been blemished recently by poor management and sloppy security practices. Morale at the labs has been badly damaged. John Edwards and I are committed to strengthening laboratory management and oversight and restoring the morale at these critical national assets.

9 Space policy: NASA is being reorganized to reflect the president's long-term vision of manned missions to the Moon and Mars. Many scientists believe the reorganization will drain money from NASA's unmanned science missions. How do you define the relative importance of unmanned science missions versus manned exploration flights? What is the appropriate funding balance between the two?

Bush In January, I announced my vision for the future of America's space exploration program. Achieving this vision will require the combined strengths of both manned and unmanned science missions. Robotic missions will serve as trailblazers—the advanced guard to the unknown. Probes, landers, and other vehicles continue to prove their worth, sending spectacular images and vast amounts of data back to Earth. Today, we have unmanned systems on and around Mars, a system orbiting Saturn, and one on its way to Mercury. Yet the human thirst for knowledge cannot be completely satisfied by even the most vivid pictures or the most detailed measurements. We need to see and examine and touch for ourselves. And only human beings are capable of adapting to the inevitable uncertainties posed by space travel.

As we complete our work on the International Space Station, we are developing a new manned exploration vehicle to explore beyond our orbit. This vehicle will be tested by 2008 and conduct its first manned mission no later than 2014.

America will return to the Moon as early as 2015 and no later than 2020, and use it as a foundation for human missions beyond the Moon. We will begin with robotic missions to explore the lunar surface, researching and preparing for future human exploration. Manned lunar missions will follow, with the goal of living and working there for increasingly extended periods.

Kerry John Edwards and I will continue America's long tradition of leadership in aeronautics, Earth sensing, and space exploration as part of a well-balanced NASA program closely tied to broad payoff for this country. It will not tie NASA to programs such as the Bush administration's Moon–Mars Program that emerged from closely held meetings in the White House with no clear objectives or cost estimates. It will invest in bold new programs tied to priorities, set by scientific experts, in exploring weather, climate, oceans, astrophysics, and other areas. Our administration will rely on the advice of the scientific community to select the most appropriate goals for research and the most appropriate tools for achieving these goals—including the question of whether manned or unmanned missions are most appropriate to the task.