

## BUSH AND CLINTON: COMPARING THE CANDIDATES

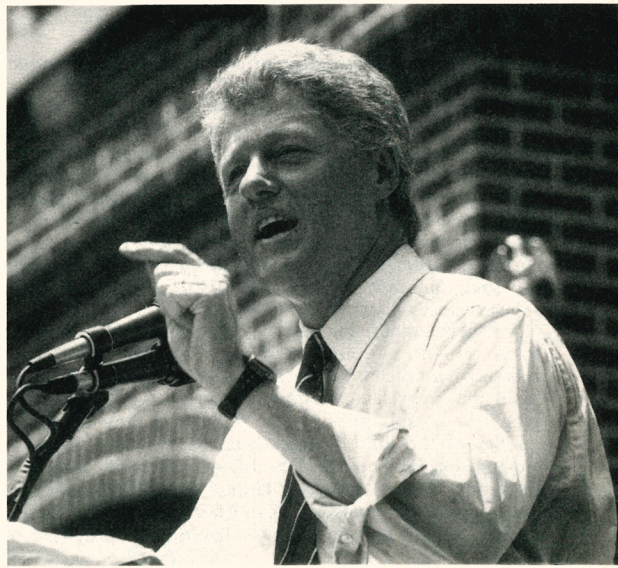
To help readers decide which Presidential candidate to vote for, *PHYSICS TODAY* asked President Bush and Governor Clinton to reply to ten questions on issues of science, technology, arms control, energy and the environment, and government participation in R&D. This is the fifth time, beginning with the 1976 election, that we have published the views of the major party candidates on such subjects. The responses from this year's rivals are not simply "sound bites" similar to those Americans have become accustomed to hearing on television. The answers in most instances contain meaningful substance.

In their replies the candidates also reveal their agreements and differences. On energy policy Bush advocates a mostly traditional mix of energy sources, including nuclear power, while Clinton prefers greater use of natural gas, and he would reduce demand for oil and electricity and restrict nuclear power entirely. Both propose shifting funds from defense R&D into civilian and dual-use R&D, especially for such "critical technologies" as advanced materials,

manufacturing processes and information and telecommunications, but they differ on how much, how fast and under whose direction the changes should take place. The positions of the candidates on this subject help illustrate deep ideological differences. Clinton, who believes in activist government, is inclined to move more rapidly than Bush to make cuts in defense and to shift the weapons laboratories into joint ventures with industry. A Clinton Administration would create a civilian research and technology organization, modeled on the Defense Advanced Research Projects Agency, as the keystone of a technology policy for the nation. The President, by contrast, is reluctant to do this. He argues that government usually botches the job of picking winners and losers among new technologies and, instead, prefers to eliminate excessive regulations and taxes that tend to trip up market forces, which work best when left alone.

Though President Bush has access to many sources for advice on science and technology, his principal adviser is D. Allan Bromley, who also pro-

vided background and analysis during the first campaign four years ago. In addition, Bush on occasion sits in on monthly discussions by his Presidential Council of Advisers on Science and Technology, created and headed by Bromley. PCAST consists of 12 members, including Solomon J. Buchsbaum, senior vice president for technical systems at AT&T Bell Laboratories; Ralph Gomory, former senior vice president at IBM and now president of the Sloan Foundation; John P. McTague, vice president for research at Ford Motor Co, and David Packard, chairman of Hewlett-Packard. For advice on environmental matters, Bush calls on William K. Reilly, administrator of the Environmental Protection Agency and a family friend, who, with his wife, attends private dinners and film shows at the White House, and on Michael R. Deland, chairman of the White House Council on Environmental Quality. While Reilly has declined to accuse Clinton and his running mate, Al Gore Jr, of being environmental extremists, Deland has taken potshots at the Democratic contenders in press



conferences and public speeches during recent weeks.

Most of Governor Clinton's advisers on issues involving science and technology are less well known. One of the central figures is Thomas Schneider, a partner in the Washington law firm of O'Connor and Hannan and co-chairman of the candidate's national finance committee. He also operates Restructuring Associates, which sells management advice to major corporations and helps locate venture capital for start-up high-technology firms. Schneider got his law degree at Harvard and studied organizational management at Oxford, but he did not encounter Clinton there. Instead, they met in 1983 as members of the Renaissance Group, an informal clan of like-minded people who gather each New Year's holiday at Hilton Head, South Carolina, for tennis, golf and discussions of public policy problems. Clinton, Schneider and their families often vacation together.

Schneider's title in the campaign is science and technology coordinator. He is assisted in Washington by Richard Bradshaw, a former foreign service officer in Europe and Washington, who spent the last four years in the international policy office of the National Science Foundation. Even though science isn't anywhere near the top of Clinton's agenda in an election dominated by the economic recession, Bradshaw has lined up a network of some 30 scientists and engineers to prepare background papers on such topics as space programs (covering Space Station Freedom and Russia's Mir station), particle accel-

erators (the Superconducting Super Collider and its competitor, CERN's proposed Large Hadron Collider) and the benefits and risks of a nuclear test ban and of a missile defense system.

What's more, a coalition of scientists and engineers for Clinton-Gore was organized in September by Marvin Goldberger and Harold Brown, each former presidents of Caltech. Brown, who served as defense secretary in the Carter Presidency, hasn't been close to the Clinton organization, but is almost certain to be included on a Defense Department transition team if the governor is elected. Goldberger admits that members of the coalition haven't been asked to feed ideas or advice to Clinton or his campaign office.

If a man is known by the company he keeps, Clinton is clearly a high-technology junky. He has attracted a Who's Who of business leaders whose companies didn't exist a decade or two ago. Within this group are John Sculley, chairman and CEO of Apple Computer; John Young, president and CEO of Hewlett-Packard; Mitch Kapor, former CEO of Lotus; Ben Rosen, CEO of Compaq Computers; and Robert Goldman, CEO of AI Corp.

Clinton's closest advisers are economists, including Robert Reich of Harvard's John F. Kennedy School of Government, and Ira Magaziner, president of SJS Inc, business management consultants based in Providence, Rhode Island. Like Clinton, both Reich and Magaziner were Rhodes Scholars at Oxford. Reich, Magaziner and Schneider are all proponents of a national industrial policy that would use government funds and tax policies

to support key technologies. Other advisers, most notably two investment bankers, Roger Altman of the Blackstone Group and Robert Rubin of Goldman Sachs, profess a robust respect for entrepreneurial capitalism and an equally robust skepticism of government bureaucracy.

*The Wall Street Journal's* Alan Murray wrote recently that according to those who know Clinton's advisers best, Magaziner is "the most influential." It was Magaziner who devised an industrial policy, the so-called Greenhouse Compact, for the state of Rhode Island in the early 1980s. Murray claimed that it proved "a political disaster," and voters eventually rejected it four to one. Magaziner was in the news again in 1989 when he was engaged by the University of Utah to testify before the House Committee on Science, Space and Technology to win government approval for a \$125-million institute dedicated to cold-fusion research. Before Congress got around to allocating any money for such an institute, hundreds of laboratories around the world failed in their attempts to duplicate the Utah experiments and the plug was pulled on cold-fusion research almost everywhere.

"A careful student of public policy himself," Murray stated in *The Journal*, "Mr. Clinton is too knowledgeable to be dependent on the ideas or ideology of any one adviser." In fact, like most Presidential candidates, Clinton is able to pick some of the best and brightest in the country for advice on science issues—just as President Bush is able to do.

—IRWIN GOODWIN

## BUSH

1. *It has been the conventional wisdom, ever since Vannevar Bush wrote a report in 1945 called "Science—the Endless Frontier," which inspired the creation of the National Science Foundation, that scientific research is the pacemaker for new technologies and economic progress. Yet, for the past five or six years, support by the Federal government and private industry for research, particularly in the physical sciences, has not kept pace with the levels in Japan or some countries in Europe. What would your Administration do to ensure adequate government funding for scientific research and to stimulate companies to sponsor more research?*

I view support for science and technology as a vital investment in our national future. My Administration has acted on its conviction that research and development yield new knowledge, products and processes that over the long term result in economic growth and an improved quality of life for all Americans. The overall level of support for R&D in the US still exceeds that of Japan, Germany, France and the United Kingdom combined. Recognizing that investments in R&D form the foundation for the exploration of the new frontiers, I proposed to

*continued on page 103*

## CLINTON

1. *It has been the conventional wisdom, ever since Vannevar Bush wrote a report in 1945 called "Science—the Endless Frontier," which inspired the creation of the National Science Foundation, that scientific research is the pacemaker for new technologies and economic progress. Yet, for the past five or six years, support by the Federal government and private industry for research, particularly in the physical sciences, has not kept pace with the levels in Japan or some countries in Europe. What would your Administration do to ensure adequate government funding for scientific research and to stimulate companies to sponsor more research?*

The science policy instituted nearly 50 years ago has paid tremendous dividends to our nation. It has made the United States a world leader in science; enabled America's university education and research system to become the best in the world; allowed us to supply ourselves and other nations with skilled scientists and engineers; and provided a range of technologies for academia, industry and the government on a scale that no single company or laboratory could have accomplished alone. This Federal support of science research is crucial and, indeed, should

*continued on page 105*



BUSH *continued from page 102*

Congress for fiscal 1993 a budget of \$76 billion for R&D. If my proposals are enacted by Congress, Federal support for the conduct of basic research will have grown from \$10.6 billion to \$14.3 billion since 1989. Total civilian R&D funded by the government will have increased by 45% over that same period. Our priorities for technological research include advanced materials and manufacturing processes, biotechnology, aeronautics and surface transportation, energy and the environment, and information and telecommunications.

Federal funding increases are only one measure of this commitment. I have also organized special Presidential initiatives in areas of particular promise and importance through my National Technology Initiative, which has opened up new and exciting opportunities for R&D collaboration with the private sector. In addition, the Administration's program of Cooperative Research and Development Agreements, known by the acronym CRADA, gives Federal scientists and engineers incentives to explore commercial applications for their work. Since last December, the number of CRADAs has increased 57%.

We will continue to advocate, propose and strive for passage of increased Federal R&D budgets.

Potentially far more important as an impetus to American scientific research, however, is private-sector investment in R&D. I will continue to press for passage of legislation that would encourage private investment in R&D by making the research and experimentation tax credit permanent. I will also press for reductions in taxes on capital, which discourage investment and research. The Administration is encouraging additional private-sector investment in R&D through increased emphasis on cooperative cost-shared research conducted under CRADAs and through consortia such as the US Advanced Battery Consortium.

*2. With the end of the cold war, weapons research and development are being scaled back. The 1990 Budget Enforcement Act, however, prevents the transfer of funds from defense to domestic programs. One of the so-called peace dividends might very well be the expansion of research in the nuclear weapons laboratories into nondefense programs that would advance the country's technologies, possibly in collaboration with manufacturing companies. Would this be a priority for you?*

We have started doing what you suggest and are increasing our efforts in that regard. The end of the cold war has given us an opportunity to change not only our foreign policy but also the structure and purpose of our national defense infrastructure. Our challenge now is to make those national assets, laboratories and human potential available for peaceful, civilian and commercial ends. The expertise and facilities in the nuclear weapons laboratories represent a major national resource, and the effective use of this resource for both defense and nondefense use is certainly a high priority objective of this Administration. To this end, Energy Secretary James D. Watkins and other senior Administration officials have worked to expand the use of CRADAs to bring industry into partnerships with Department of Energy laboratories for jointly developing technologies to strengthen the nation's industrial base.

As overall defense spending decreases, it is vitally important that we maintain a healthy level of defense R&D funding in order to ensure technological superiority. We have proposed that a larger share of the smaller defense budgets in the future should be allocated to R&D. The continued strengthening of relationships between the

Department of Defense and the academic community is also particularly important in this regard.

*3. Would your Administration help convert defense manufacturing to civilian production—that is, without subsidizing inefficient companies and without destroying the whole military-industrial partnership that has worked so well? How would you do this?*

The reality is this: We cannot maintain a production capability for everything that we might desire in the event of a war. We will continue to work to guarantee an adequate defense industrial base, especially to support those critical manufacturing processes that would be difficult to reconstitute if allowed to end. My Administration's approach is based in part on the fact that a significant portion of the country's manufacturing base already serves a dual function, supporting both defense needs and civilian production. This integration is particularly evident, for example, in the microelectronics sector, where it results in many efficiencies. The Defense Department is fostering additional integration of the military and civilian manufacturing bases through its acquisition policy.

In addition, through efforts such as the National Technologies Initiative, CRADAs, the Advanced Technology Program at the Department of Commerce and the new Advanced Manufacturing Initiative, which was announced last March, we have sought to produce an environment in which private industry and government labs, along with their resources, are encouraged to cooperate and transfer technologies.

*4. Over the past several years, there have been several recommendations for creation of a civilian DARPA. Its purpose would be to select critical commercial technologies for increased government support, with the goal of improving America's global economic competitiveness. Has the time come to initiate something like MITI in Japan or the Framework program in the European Community?*

This Administration does not support the creation of a Federal agency that would select commercial technologies for increased government support. We consider such an approach to be counterproductive. Private sector companies and entrepreneurs are far better situated than government agencies to identify and select promising new technologies for civilian commercial markets.

In discussing the creation of a civilian DARPA, I think it's useful to remember that DARPA has been such a success in advancing defense technology because it has always had a single customer and project manager—namely the Department of Defense. In the absence of such a specific customer, the mission of a civilian DARPA would be unfocused and would certainly be subjected to intense political pressures toward technological faddishness, with the accompanying inefficiencies that would surely result.

The success of MITI in picking winning technologies may have been exaggerated. MITI does many things, some of which it has done very well, but its record in choosing technologies has been uneven at best. We are committed to an effective technology policy for the US, not simply mimicry of someone else's.

A unique American characteristic of our technology prowess is the participation of small, entrepreneurial firms in the frontiers of technology. Such companies have been responsible for a disproportionate amount of job creation and product innovation.

Our approach has been to build on the diversity of talent and expertise that our various Federal agencies possess, capitalizing on our technological strengths to produce the next generation of generic, precompetitive

technologies, and then to encourage the private sector to do what it does best—transform these technologies into new products and create new markets for them. Initiatives in advanced materials and processing, in advanced manufacturing, in biotechnology research and in high-performance computing and communications are examples of our approach. These initiatives represent true national programs in which 15 to 20 Federal agencies work together in a coherent fashion in cooperation with the private sector to expand our country's technology base.

*5. Very large and costly science projects, such as particle accelerators and space facilities, serve as visible symbols of the nation's commitment to research and its leadership in particular fields. But in this era of tight budgets, should projects of such enormity be undertaken by several countries from the outset, using Space Station Freedom or the ITER magnetic fusion program as cases in point?*

This Administration believes strongly that there should be early and sustained consultation with the international science community and corresponding governments on proposals for very large, long-term scientific projects. Specific efforts of our Administration have resulted in international agreements for magnetic fusion research and for Space Station Freedom. The Administration has played a key role in establishing the Organization for Economic Cooperation and Development megaproject forum, which will be an important vehicle for exchanging information about potential future megaprojects.

I have acted on my conviction that major investments are required to construct the facilities needed for future advances in fields ranging from high-energy physics to climate research. And I have balanced these investments with increased support for ongoing research conducted by individual research scientists.

*6. Many scientific questions, such as those dealing with environmental degradation and climate change, cannot always be answered within national borders. What should the US do to make sure that prudent measures are taken for the sake of the entire Earth?*

Our country has played the leading role in international climate change research and in formulating prudent responses based on scientifically and economically reliable data. The climate change treaty that I signed in Rio de Janeiro last June requires nations to develop detailed action plans that specify what steps will be taken to respond to potential climate change and quantify the expected results. The treaty requires that all contributing factors be dealt with, not just CO<sub>2</sub> emissions, and that these action plans be open to public scrutiny and updated on a regular basis in response to new scientific and economic information. So far only the United States and the Netherlands have begun to implement such action plans. Ours will reduce net greenhouse gas emissions by 7% to 11% below projected levels for the year 2000, without imposing unwarranted costs on the US economy. Precisely because the scientific questions about environmental degradation and global change often cannot be answered within national borders, the Administration is providing leadership by mounting what is by far the largest and most comprehensive internationally coordinated research program in the world. The US Global Research Change Program combines myriad Federal efforts, including space-based and ground-based observation of the Earth, and coordinates these internationally. My Administration has invested nearly \$2.6 billion in climate research—far more than any other nation and

more than all other countries combined over the last three years. An additional \$1.37 billion is proposed for fiscal 1993, a sixfold increase over the 1989 level. Another example of US leadership is the formation of the Inter-American Institute for Global Change Research, which was announced in May 1992. The US is now promoting the establishment of similar institutes in the Pacific region and in Europe and Africa to meet the challenge of global stewardship.

The US is also taking the lead to help the world community fashion intelligent, cost-effective policy measures to deal with global environmental concerns. Based on research conducted largely by Americans, our country leads the world in phasing out ozone-depleting chlorofluorocarbons—from our ban on CFCs in aerosol propellants in 1978 to the accelerated phaseout by 1994 that I announced last February. We are now contributing \$50 million to the fund to assist developing countries in avoiding CFC use and \$25 million to help developing countries inventory their greenhouse gas emissions and identify response options. Our policy responses to global environmental risks must reflect prudent judgment of relative priorities. That is why I have acted so decisively on CFC cuts; offered a new Forests for the Future Initiative to help countries halt the tragic loss of the Earth's forests; and taken prompt action to ban ocean dumping. That is also why I insisted on a climate convention that emphasized concrete national actions encompassing net greenhouse gas emissions rather than rhetorical targets aimed only at one slice of the issue. And that is why I refused to sign the sadly flawed Biodiversity Convention, which would perversely discourage the greatest hope for biodiversity—the coming wave of private-sector investment in its conservation. Instead, the US will work for needed biodiversity research and will encourage real biodiversity conservation.

*7. What is your position on developing alternatives to fossil fuel sources—that is, making greater use of solar energy, say, or wind and geothermal power, and, of course, more energy conservation? Would you advance these alternative energy programs with tax incentives or other schemes?*

My Administration's record in both renewable energy and energy conservation is better than most people recognize. Alternatives to fossil fuel energy sources and increased conservation are both key ingredients of our National Energy Strategy. Alternative energy technologies can serve both as sources of electricity and as substitutes for petroleum transportation fuels.

For electricity generation, I have strongly supported both nuclear power and solar and renewable energy in my budget requests and in the energy strategy. During my term I have steadily increased the budget for solar and renewable energy. My fiscal 1993 request is 67% higher than the Congressional appropriation I inherited in 1990. I have also increased conservation R&D spending with my request for fiscal 1993 being more than double the appropriation in fiscal 1989. In certain areas the increases have been even more dramatic. For instance, my current budget request for electric vehicles represents a 450% increase over the fiscal 1989 appropriation, and my request for biofuels R&D and alternative fuel utilization as a substitute for gasoline and diesel fuel is more than five times the appropriation when I entered office. So I have kept its funding essentially level over the past four years.

We have supported selective energy efficiency regulations, and we strongly support expanded energy labeling of both industrial and consumer products, so that buyers can make informed decisions. We prefer not to steer markets artificially with tax incentives. It is our experience that intentionally distorting the energy markets is generally



counterproductive.

Altogether, my National Energy Strategy contains more than 100 initiatives, whose implementation is a shared responsibility with the American public, the private sector, academia and all levels of government. I believe that our proposals represent a more cost-effective and sensible approach to protecting our environment and reducing our need for fossil fuels than the more extreme actions in competing proposals.

**8. An abundance of fuel for nuclear power plants will soon be available from dismantled weapons. Indeed, this may be the only practical means of disposal. Moreover, nuclear power stations emit no greenhouse gases to pollute the atmosphere. Yet no nuclear plants have been started in the US in more than a decade. What is your view on the future of nuclear power? And in connection with nuclear safety, should we be helping to make sure that nuclear power reactors in the former Soviet Union and Eastern Europe are safe to operate?**

My Administration believes that nuclear power, as perhaps the most promising technology capable of supplying large amounts of electricity without direct emission of air pollutants or greenhouse gases, must play a significantly enhanced role in generating electricity in the future. I strongly support the development of the next generation of safer, less costly nuclear power plants. To this end, we have worked to bring forward legislation that would enable nuclear power to compete with other technologies on a level playing field, and DOE is supporting development of safer reactor and waste disposal technologies.

We should certainly help improve the safety of nuclear reactors in the former Soviet Union and Eastern Europe. Indeed, we have been working on this daunting problem since the Chernobyl disaster in 1986. Our current program features the \$25-million reactor safety initiative announced by the Secretary of State, James Baker, in Lisbon. It includes short-term operational safety measures as well as establishment of two training centers. This problem is so vast in scope that we agreed on a multilateral effort to address it at the G7 economic summit last summer in Munich. In addition, proceeds from the sale of Russia's highly enriched uranium to produce commercial power may be used in part to promote reactor safety.

**9. Given the collapse of the USSR and the reemergence of extreme nationalism and ethnic conflict in parts of the world, what should be the US position on nuclear arms control and nuclear nonproliferation? Is the conclusion of a comprehensive nuclear test ban treaty an important objective now?**

My Administration has made arms control and nonproliferation a top priority, and we will continue to do so. Through hard work and historic opportunity, we have agreed to dramatic reductions in nuclear arsenals and the text of a Chemical Weapons Convention. We have witnessed the increased membership to over 150 countries in the Nuclear Non-Proliferation Treaty, and we have strengthened the controls on exports of nuclear weapons technology. Russia and the United States have also agreed to dilute Russian weapon-grade uranium to reactor-grade to ensure its peaceful use as a nuclear fuel. Because many dangers remain, however, I recently launched a comprehensive nonproliferation initiative calling for even greater nonproliferation efforts, in concert with our allies.

Technology that has been developed at Federal laboratories will play a key role in inspection, verification and other aspects of our nuclear arms control and

nonproliferation activities. The principal remaining rationale for nuclear testing is to ensure the safety and reliability of weapons currently in the inventory. Here too, the work of our laboratories can help assure reliability and safety of weapons and thus serve to limit the amount of testing that will be needed.

**10. The number of American students willing to endure the rigors of education in science, math and engineering has declined in recent years. The problem is particularly acute for female and minority students. Many American students who choose to pursue a career in science arrive at college poorly prepared by comparison with students from other countries. What can your Administration do to improve the situation?**

I disagree with the premise that female and minority students are not "willing to endure the rigors of education in science, math and engineering." They can and will compete if given the challenge and the opportunity to succeed. In my Administration we have sought to expand these opportunities for all of our students, requesting a 7% increase to \$2.1 billion for mathematics and science education in fiscal 1993 and more than doubling spending at the elementary and secondary levels in these areas during my Administration. Improving achievement of American students in mathematics and science is a cornerstone in my efforts to strengthen and reform American schools. To this end, my Administration developed for the first time (a) a comprehensive baseline inventory of Federal programs that affect mathematics and science education at all levels, (b) a set of strategic priorities to guide future Federal actions in this area, and (c) objective standards against which performance can be measured. Reports on these respective accomplishments, setting forth the Presidential initiative on mathematics and science education, were included with the 1992 and 1993 budgets.

The Administration is now building on this work to develop a strategic plan to guide Federal activities in mathematics and science education over the next five years and beyond. This effort is in support of wider efforts to obtain the national education goals enunciated by the nation's governors and the President. Through the America 2000 strategy, we expect to achieve these goals in an effective and efficient manner.

**CLINTON** *continued from page 102*  
continue to grow.

Nonetheless, Federal research dollars should be allocated more toward civilian R&D. Currently, 60% of the Federal R&D budget of \$76 billion is devoted to defense programs and 40% to nondefense programs. This level of support for defense R&D is a holdover from the massive arms buildup of the 1980s. With the aim to restore a more even balance between the two, my Administration would reinvest every dollar that we cut from defense R&D into civilian R&D and into generic industrial technologies.

In addition, as one step to stimulate private investment in civilian R&D, we will enact a permanent extension of the R&D tax credit.

**2. With the end of the cold war, weapons research and development are being scaled back. The 1990 Budget Enforcement Act, however, prevents the transfer of funds from defense to domestic programs. One of the so-called peace dividends might very well be the expansion of research in the nuclear weapons laboratories into nondefense programs that would advance the country's technologies, possibly in collaboration with manufacturing com-**

*panies. Would this be a priority for you?*

Yes, this would be a priority. The weapons laboratories, as well as many other government laboratories, have built up a superb base of research consisting of knowledge, facilities and human resources that should be put to work to enhance the country's competitiveness in the international marketplace. To this end, I would ensure that a significant portion of these laboratories be assigned to joint R&D efforts with industry and academia, and, further, give the lab directors the responsibility to make this happen.

**3. *Would your Administration help convert defense manufacturing to civilian production—that is, without subsidizing inefficient companies and without destroying the whole military-industrial partnership that has worked so well? How would you do this?***

Above all, we must put people first. There are a number of initiatives that we should undertake to ease the impact of reduced defense expenditures on the scientists, engineers, factory workers and technicians who are displaced by defense cuts. We need to redeploy these people, their skills and the technologies that made our defense industry second-to-none during the cold war to the commercial infrastructure industries that we'll need so that we can compete in a global economy. To do that we must create a partnership among government, business, labor and education—as our competitors do.

There are several ways to start this process. One would be an expansion of the current GI bill benefits to enable military personnel to take a one-year educational leave of absence with pay to train for critical civilian professions before officially beginning their retirement. Another would be to create an educational fund, administered by the National Science Foundation, to provide grants for professionals formerly engaged in defense work to master the latest developments in fields involving critical technologies. We would also encourage states to offer incentives such as alternative certification programs for military personnel who retire to take jobs in critical professions such as education, health or law enforcement.

In addition, the Clinton-Gore Administration would increase investment in civilian R&D and manufacturing technologies to help create millions of high-wage jobs for a high-skill workforce.

**4. *Over the past several years, there have been several recommendations for creation of a civilian DARPA. Its purpose would be to select critical commercial technologies for increased government support, with the goal of improving America's global economic competitiveness. Has the time come to initiate something like MITI in Japan or the Framework program in the European community?***

The time has clearly come for our country to have a national economic strategy and, more specifically, a technology policy to help address the problems of declining US technological leadership and economic competitiveness. One of the steps we propose is to establish a civilian technology agency, which can be designed by drawing on years of experience with existing successful technology programs, such as those developed by DARPA and the National Institute of Standards and Technology's Advanced Technology Program.

An important role of the civilian technology agency would be the support of research and development in areas at the frontiers of technology that could lead to new commercial products. Another key component would be the development and diffusion of state-of-the-art manufac-

turing capability throughout US industry. The agency we have in mind would work closely with industry in choosing the technologies to support, to assure that industry is genuinely committed and that the technologies being investigated have commercial potential.

**5. *Very large and costly science projects, such as particle accelerators and space facilities, serve as visible symbols of the nation's commitment to research and its leadership in particular fields. But in this era of tight budgets, should projects of such enormity be undertaken by several countries from the outset, using Space Station Freedom or the ITER magnetic fusion program as cases in point?***

It is important for the US to maintain its position of leadership in science. Under current economic conditions, however, it only makes sense for nations to share the costs of the very large and costly science projects that ultimately benefit all people and all nations.

**6. *Many scientific questions, such as those dealing with environmental degradation and climate change, cannot always be answered within national borders. What should the US do to make sure that prudent measures are taken for the sake of the entire Earth?***

We missed a great opportunity at the Earth Summit in Rio de Janeiro last June to exert international leadership on global environmental issues. Rather than opposing the efforts made there by many other countries, we should have helped shape and then signed the Earth Charter, Agenda 21, the Forest Principles, Climate Change and Biodiversity Conventions—and, in so doing, conveyed our commitment to a world in which each nation's environmental performance is the concern of its neighbors.

**7. *What is your position on developing alternatives to fossil fuel sources—that is, making greater use of solar energy, say, or wind and geothermal power, and, of course, more energy conservation? Would you advance these alternative energy programs with tax incentives or other schemes?***

A new energy policy is crucial to our nation's economic and environmental well-being and to reducing our dependence on foreign oil. A major component of this energy policy will be to greatly expand the use of renewable energy sources.

Utility regulations should be changed to make energy efficiency more profitable for both utilities and consumers. This would include adoption of "least-cost planning," which factors environmental, social and economic costs into fuel-use decisions and is currently employed by utility companies in 17 states. Revenue-neutral incentives that reward energy savers and penalize energy wasters can promote the development and use of a variety of energy efficient technologies, including more efficient cars.

Increased R&D into renewable fuels and energy efficient technologies can be performed by a new civil advanced projects research agency, modeled after DARPA, and with the end of the cold war, the national labs can shift gears into more research on commercial renewable energy projects. Finally, the tax code should be changed to create greater incentives for renewable energy.

**8. *An abundance of fuel for nuclear power plants will soon be available from dismantled weapons. Indeed, this may be the only practical means of disposal. Moreover, nuclear power stations emit no greenhouse gases to pollute the atmosphere. Yet no nuclear plants have been started in the US in more than a decade. What is your view on the future of nuclear power? And in connection with nuclear safety, should we be helping to make sure that nuclear power***



reactors in the former Soviet Union and Eastern Europe are safe to operate?

I do not support increased reliance on nuclear power. There is good reason to believe that we can meet our future energy needs through increased energy efficiency and use of natural gas and renewable energy without having to face the uncertainties of nuclear waste disposal.

Unsafe nuclear power reactors in Eastern Europe and the former Soviet Union are a serious concern. As a nation we should be providing what technical expertise we can to help make sure such reactors are safe to operate. We also should be helping the countries of Eastern Europe and the FSU become more efficient users of energy, so that they can gradually reduce their reliance on nuclear power.

**9. Given the collapse of the USSR and the reemergence of extreme nationalism and ethnic conflict in parts of the world, what should be the US position on nuclear arms control and nuclear nonproliferation? Is the conclusion of a comprehensive nuclear test ban treaty an important objective now?**

The end of the cold war leaves two great tasks for American arms control policy: firstly, to halt the spread of nuclear, biological and missile technologies to countries that do not have them; and secondly, to turn the legacy of the cold war into an effective strategy for the post-cold war era. Toward that end, nonproliferation will be a high priority of intelligence agencies in the Clinton-Gore Administration. We should ratify the Strategic Arms Reduction Treaty and the follow-on agreement of June 1992. And through a phased approach, the US should lead the effort to achieve a worldwide comprehensive test ban.

In an effort to stop nuclear proliferation, we must demand that other nations tighten their export laws and strengthen enforcement of policies regarding nuclear weapons, and lead a strong international effort to impose sanctions against companies or countries that spread these dangerous weapons. And we must bolster the International Atomic Energy Agency's capacity to inspect suspect facilities through surprise inspections in member countries. Without question, the US must strengthen safeguards to ensure that key nuclear technology and equipment are kept out of the grasp of any

would-be aggressor.

**10. The number of American students willing to endure the rigors of education in science, math and engineering has declined in recent years. The problem is particularly acute for female and minority students. Many students who choose to pursue a career in science arrive at college poorly prepared by comparison with students from other countries. What can an Administration with you at its head do to improve the situation?**

To encourage students to choose study in the demanding fields of science, math and engineering, we need to ensure not only that they arrive at college academically prepared, but also that they have some assurance that jobs in these fields will be available for them upon graduation. It is no accident that improvements in K-12 education are an important part of the national economic strategy we have proposed for this country.

My commitment to educational reform can best be seen by my record as governor of Arkansas. One component of my reform was to add more math and science courses to high schools and to seek improvement in math and reading test scores. In the past decade, we have made great strides. While only 5100 students were enrolled in advanced math courses in 1983, more than 75 000 were enrolled in 1991. While the percentage of high school seniors who went on to attend colleges in Arkansas was under 38.2 in 1982, by last year the percentage increased to 51.3. In addition, Arkansas now ranks fifth in the nation in the ratio of computers to students in schools.

In the first 100 days of a Clinton-Gore Administration, we'll give Congress and the American people a real educational reform package. This package would include fully funding Head Start and other programs; establishing tough national standards and a national examination system to measure if those standards are met; and working to achieve by the year 2000 what the nation's governors set forth at their 1989 education summit in a report titled "National Education Goals"—one of those goals being that students should be knowledgeable in math, science, language, history and geography when they graduate from any American high school.

## HOUSE COMMITTEE AND CARNEGIE PANEL SEEK MORE RELEVANCE FROM RESEARCH

With the end of the cold war and with the dismal outlook for the funding of science and technology, a critical mass is developing in Washington that traditional assumptions about government support of research must be reexamined. Demands that publicly funded research should yield more immediate economic and social benefits come from highly placed yet strangely disparate sources—from Frank Press, president of the National Academy of Sciences, to Barbara Mikulski, the Maryland Democrat who heads the Senate subcommittee that rules over the budgets of the National Science Foundation and NASA. The directors of two agencies principally engaged in basic research, NSF and the National Institutes of Health, are

crusading to remake themselves more relevant (PHYSICS TODAY, September, page 53). The latest clamor for relevance comes from George E. Brown Jr, chairman of the House Committee on Science, Space and Technology, and from a task force of the prestigious Carnegie Commission on Science, Technology and Government.

When he released his report on the "health of research" on 15 September, Brown insisted that he was not arguing for more "directed" programs, such as those funded by the Department of Defense and Department of Agriculture. He was concerned, he stated in a brief introduction to the staff-written report, that while government support had contributed to "the world's most innovative and

productive scientific research system," this did not ensure that the US could deal with "wide-ranging societal crises... in our educational system, our environment, our manufacturing sector, our health care system, our inner cities, our financial institutions, even our system of government." As Brown put it, "This paradox—growing knowledge, accompanied by growing societal crises—implies a complex, nonlinear relationship between advances in knowledge and advances in society."

Brown's report is in itself the introduction to a far-reaching examination of some dogma: that research performed by individual investigators is the best way to produce new ideas; that basic research should be carried