a Science Committee bill that headed off the annual attempt by deficit hawks to ground NASA's participation in the international space station. More recently, they were allied in making sure the Russian government lived up to its agreement to provide components for the station. But Brown firmly opposed military uses of space. In the mid-1980s, he spoke out loudly and often against President Reagan's "Star Wars" concept of a space-based defense against ballistic missiles. Brown also had been an outspoken critic of US involvement in the Vietnam War and voted consistently against military spending bills in the last years of the war.

Rita Colwell, NSF's director, called Brown "the wise man of science in Congress." Throughout his long tenure on the Science Committee, she said, "he was the most articulate spokesperson for continuing investments in science and technology for the nation's long-term well-being."

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NSF Funds Five New S&T Centers, the First New Ones in Eight Years

At its meeting on 29 July, the National Science Board, the governing body of the National Science Foundation, approved five new science and technology centers (STCs), committing almost $94 million over five years to support their interdisciplinary research, educational outreach, and technology transfer. The five centers are the first new ones selected in the past eight years and bring to 28 the number of such centers operating under the agency's auspices.

NSF established its STC program in 1987 and modeled it on the uniqueness, flexibility, and diversity of the engineering research centers, the first of which had been selected three years earlier. At the time, academics accused NSF of usurping the role and funds of individual investigators by introducing the STCs. Nevertheless, the formula was viewed as an instant success. A review by the National Research Council found the first batch of centers "sufficiently protean to respond to new ideas, techniques, and relationships, inside and outside the universities."

NSF went on to create biotechnology centers and supercomputing centers, and the Defense Department and NASA set up mission-related centers of their own. In 1997, the STC program was modified to emphasize the special contributions that collaborations among a critical mass of research scientists and graduate students bring to specific problems of science and technology. By providing long-term, stable funding to the centers, NSF has encouraged risk taking and ensured a solid foundation for attracting the cali-

WASHINGTON BRIEFINGS

In Desperate Need of a Jump START Just two months after Presidents Bill Clinton and Boris Yeltsin agreed to open negotiations on a START III treaty, and only two weeks after Vice President Al Gore and Prime Minister Sergei Stepashin announced that they would jump start the arms control process before the end of August, those objectives appeared to be in reverse gear again. On 9 August, Yeltsin unexpectedly fired Stepashin, the fourth prime minister he has dismissed in the past 17 months, and appointed in his place Vladimir Putin, another former KGB officer. Putin, the chief of Russia's Federal Security Bureau (FSB), the internal security and counterintelligence agency that succeeded the KGB after the Soviet Union was dismembered, has little experience in political and economic affairs, and none in diplomacy.

You might think that a treaty intended to reduce the levels of deployed strategic nuclear warheads by half would have a fairly good chance of being approved in the Kremlin, as it was on Capitol Hill. But you would be wrong. Since START II was signed by Clinton and Yeltsin in January 1993, further movement has been at a standstill.

For six years, Russia's lower house of parliament, the Duma, still dominated by Communists, has refused to ratify the treaty. All those years, the Clinton administration and the Senate have stood at the sidelines, watching the meltdown of Russia's economy and military. START II, which calls for limiting the number of deployed warheads to between 3000 and 3500, is considered by both sides to allow for too large a nuclear weapons arsenal today, let alone for the 21st century. Russia's defense minister, Igor Sergeyev, has stated publicly that his country is likely to have no more than 500 deployed strategic warheads by 2012 because it can't support a larger stockpile. In the past year, senior Russian military officials have acknowledged that 58% of the country's ballistic missiles are well past their operational life span and that 70% of its early warning satellites are either beyond their expected life or in serious disrepair. Yeltsin has suggested or actually stated on several occasions over the past four years that he is ready to negotiate START III, which would reduce warhead force levels to between 2000 and 2500. The Clinton administration and many members of the Senate have indicated their willingness to adopt the treaty quickly, perhaps designating even lower stockpile levels. They admit, though, that this is impossible until START II is formally approved by the Duma.

That appeared promising late last year when Yevgeny Primakov, then Russia's prime minister, announced that the Duma was ready to ratify, despite concerns about the US's strenuous activities to enlist countries once in the Warsaw Pact into NATO. In fact, the Duma had set the vote for Christmas Day, but called the whole thing off when the US bombed Iraq. Nonetheless, Primakov convinced the Duma leadership to agree to another date. But on the scheduled day, 2 April, the US and NATO were engaged in bombing Yugoslavia, a World War II ally, and the Duma canceled the vote again.

By the time Yeltsin sacked Primakov in May and appointed Stepashin, another former director of Russia's FSB, the Clinton administration was depressed about the chances for START II, let alone for START III. However, at the Gore–Stepashin meeting in Washington on 28–29 July, they agreed to talk in August not only about START but about US intentions to deploy a limited antimissile defense system, which Russia has insisted would violate the AntiBallistic Missile Treaty. Under the 1972 ABM treaty, the US and Soviet Union pledged not to defend their homelands from long-range missile attack so as to accept the doctrine known as mutual assured destruction or MAD. "We both understand that there are ballistic missile threats we both face that do not come from each other but from other nations," Gore said at a news conference."That is why it is important—in parallel with achieving arms control objectives—to discuss implications for the ABM treaty should the United States decide to deploy a national missile defense."

As this issue went to press, John D. Holum, the US State Department's under secretary for arms control and international security, planned to see Putin in Moscow to discuss the chances of START II in the Duma and the content of a START III agreement. "Government leaders change, yet governments continue to work with each other on issues of substance," said Holum. "As the famous dictum goes, 'Countries act in their national interest, not on the basis of one person or another.' "

The Power of One over CTBT In the Senate, one powerful committee chairman continues to forestall the entire body from voting on the Comprehensive Test Ban Treaty, which was

ber of students who are most likely to embark on careers in science and technology. In deliberating on the proposals submitted for the awards, the agency places special emphasis on the participation of women and minorities. When the latest awards are included, the centers will embrace 36 US colleges and universities, along with government labs and a few international academic institutions, taking part in the program.

Among the new STCs are two with a focus, in part at least, on physics—namely, the Center on Nanobiotechnology, whose lead institution is Cornell University, and the Center for Adaptive Optics at the University of California, Santa Cruz. The nanobiotechnology center is a partnership of Cornell, Princeton, and Oregon Health universities, and the Wadsworth Center of the New York State Department of Health. The new center's director, Harold C. Craighead, a Cornell professor of applied and engineering physics, describes it as possessing "the potential to breathe the life force of biological molecules into the silicon of electronic integrated circuits, while putting the ultra-small techniques of microfabrication to work in the study and manipulation of biological systems." Thus, using nanotechnology, this center intends to develop complex biological systems that approximate organs and tissues.

The adaptive optics center holds the promise of making ground-based telescopes as powerful as orbiting observatories and improving the diagnosis and treatment of human eye disease and other visual problems. According to Michael Turner, professor of astronomy and astrophysics at the University of Chicago, and a participant in the center, adaptive optics is "the next big technical advance in astronomy. By correcting for the blurring effect of the Earth's atmosphere, adaptive optics will allow any Earth-based telescope to see with the clarity of the Hubble Space Telescope." The center also will seek to develop new instruments for adaptive optics, such as coronographs to study black holes in galaxies and planets around nearby stars and opthalomoscopes to make possible high resolution 3-D construction of retinal blood vessels and optic nerve fibers.

The other STC awards went to:

A Center of Environmentally Responsive Solvents and Processes, led by the University of North Carolina at Chapel Hill, to develop ways of using non-toxic, inexpensive liquid carbon dioxide in place of industrial solvents.

A Center for Behavioral Neuroscience, led by Emory University, to develop an interdisciplinary approach for studying how the brain regulates behavior and how experience modifies the brain.

A Center on the Sustainability of Water Resources in Semi-Arid Regions, led by the University of Arizona, to examine water management issues in the greater southwestern US.

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signed by President Clinton three years ago (PHYSICS TODAY, December 1996, page 37; March 1998, page 24). The formidable lawmaker is Jesse Helms, the North Carolina Republican who heads the Senate Foreign Relations Committee. Though the CTBT has been signed by 152 nations since it was introduced by Clinton at the United Nations, it has been ratified by only 41—among them, Britain, Canada, France, and Japan.

In Japan, the only nation to have experienced a nuclear attack, the failure of the US and other countries possessing nuclear weapons to ratify the test ban treaty led the government to appoint a group of arms control experts, given the title of the Tokyo Forum for Nuclear Nonproliferation and Disarmament, to examine the current state of the CTBT. The forum's report was released at the UN on 6 August, the anniversary of Hiroshima's bombing in 1945.

The report accuses the US and other nuclear powers of undercutting decades of arms control efforts and of making the world much less safe by their inaction in ratifying the treaty and thereby preventing global arms control from unraveling further. The most immediate threat is to Asia, the report states, where China and North Korea have embarked on a series of missile tests, and India and Pakistan have exploded nuclear devices, changing the entire landscape of Asian security and stability for the worse in a year's time. The tests by India and Pakistan, says the report, will tempt other countries to break restraints against nuclear weapons. The report is especially critical of India, whose unexpected tests in May 1998 prompted neighboring Pakistan to follow suit, and "greatly compounds other nuclear dangers and makes nuclear disarmament harder to achieve." The report notes that India "considers the possession of nuclear weapons an attribute of great power status," but urges that India be denied a permanent seat on the UN Security Council in hope of discouraging other nations from condoning or rewarding India's nuclear actions.

India's tests revived the specter of nuclear war, the forum argues, at a time when Russia and the US were making deep, if slow, reductions in their nuclear arsenals, a process that forum members say should be accelerated. "We saw a deteriorating situation on just about every front," said one of the forum participants, Michael Krepon, president of the Henry L. Stimson Center in Washington, DC, a group that conducts research in arms control policy. "It was a very sobering view."

Until the Duma ratifies START II, the report asserts, there is scant hope that the next stage of cuts in long-range missiles can be embodied in a treaty any time soon. "Russia, concerned about its status, has revalued nuclear weapons." The report has an ominous coda: "At the turn of the 21st century, the momentum toward a universal and effective global nuclear nonproliferation regime generated by the close of the cold war is in danger of being lost."

Indeed, the CTBT doesn't seem to be anyone's top priority right now. A leading Senate Democrat claims that Clinton has been too involved in the Kosovo crisis to take on another foreign policy challenge, and, besides, Clinton is more comfortable with his domestic loves, including the budget, taxes, and social welfare causes. For their part, Republican senators seem intent on putting their own house in order before taking on a foreign affair. What's more, Helms is in no hurry with the CTBT. In a letter to Senate Democrats who had urged him to take up the CTBT, he chided them for their "apparent distress at my floccinaucinchilipilofication," in the English language, an 18th century term the Oxford English Dictionary defines as a mere trifling, "to be taken with an air of contempt."

Before CTBT hearings take place in his committee, Helms insists that Clinton obtain Senate approval of two other treaties: the Kyoto Protocol to deter global warming by 2007 and the ABM treaty, which is soon to expire if it is not renewed. On 20 July, a bipartisan group of nine senators, led by Joe Biden Jr of Delaware, who is the senior Democrat on Helms's Foreign Relations Committee, dragooned the president to defend the CTBT at a White House ceremony in the rose garden. The group's purpose was to challenge Helms to hold hearings on the treaty. In their remarks, the senators frequently referred to a recent public opinion poll, which showed that 82% of those surveyed now support the CTBT. It was left for Biden to make the most forceful remark: "We will be making, in my view, the single biggest mistake in American foreign policy and defense policy that this generation could make at the closing hours of this century by not acting now."

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