

matech's appropriation was another compromise between the House bill, which zeroed out the program, and the Senate allocation of \$89.6 million.

The Veterans Affairs, Housing and Urban Development and Independent Agencies appropriations bill was stalled for a month and a half over a dispute concerning 17 riders imposed by House members that would limit the enforcement powers of the Environmental Protection Agency. When the bill's conference report finally reached the House floor, it was sent back to the House-Senate committee for changes—most notably, the addition of \$213 million for veterans' health care programs. Even so, the bill is in peril of the President's veto, because it still eliminates funding for his pet national service program and has major reductions in

housing and environmental programs.

Nevertheless, research did quite well in the conference agreement, all things considered. NSF would receive a total of \$3.18 billion, of which \$2.27 billion would fund research and related activities and \$585 million would go to education and human resources programs.

In the VA/HUD appropriations bill, NASA would get a total of \$13.82 billion, which is more than either the House or Senate bill contained. Mission to Planet Earth would receive \$1.26 billion, slightly less than the Senate level but much higher than the House allocation. All ongoing missions in the Office of Space Science would be fully funded, and funds are included for several new starts, including SOFIA Stratospheric Observatory for Infrared Astronomy), SIRTf (Space Infrared

Telescope Facility) and the Solar-Terrestrial Probes. Life and microgravity sciences are slated to get \$484 million, essentially the same as in fiscal 1995. Academic programs would receive \$102.2 million, exactly the same as last year, though \$16.5 million less than the President's budget request. The space station would get \$2.1 billion, which is the same amount as last year.

"Everybody knows at some point there is going to be an end game," a senior White House official acknowledged. "Everybody knows we're going to have to give up something. The hope here is that science will not suffer and end up skint."

An official at one science agency said, "There will be a deal and we will be at risk. We know that only too well."

IRWIN GOODWIN

Senator Bennett Johnston Talks About Physicists in Politics

*A*mong the 23 House members and 12 senators who have decided not to seek reelection in November is Senator J. Bennett Johnston Jr, a four-term Louisiana Democrat known as a power broker on energy and science issues. Johnston earned the characterization by doing what he does best: mastering the technical details of arcane topics, forging bipartisan coalitions to back his approach and negotiating trade-offs and compromises with his opponents. As chairman of the Senate's Energy and Natural Resources Committee and the appropriations subcommittee on energy and water development and as a member of the Appropriations Committee, he is, at the age of 63, one of the chamber's most influential lawmakers. What distinguishes Johnston from many of his colleagues is his skill in applying political policies to some contentious real-world problems, such as deregulating oil and gas prices, establishing a nuclear waste dump in Nevada and championing the Superconducting Super Collider.

Physics will lose a dedicated advocate when Johnston retires at the conclusion of this 104th Congress. He announced his intention on the Senate floor last year in a voice choked with emotion: "There are rhythms and tides and seasons in life," he said. "I've been fortunate in my life to sense the rhythm and sail it full tide, and now I believe that the season for

a new beginning approaches."

On energy and science issues Johnston has been a force to be reckoned with ever since he came to the Senate in 1973. A graduate of Louisiana State Law School and a former practicing attorney in Shreveport, he decided as a Washington legislator to delve into the minutiae of science and technology matters. He almost single-handedly navigated a landmark energy bill through the rocky shoals of the Capitol in the 102nd Congress. As the *National Jour-*

nal once put it: "[Johnston is] an undisputed master of the give and take . . . happy to give his adversaries something to take away from the table. But they've learned to read the fine print as carefully as he's composed it."

Johnston first demonstrated his finely honed political judgment in 1972, just months after he lost the race for governor of Louisiana by fewer than 4500 votes. Taking advantage of his name recognition after the election, Johnston, who had then served four years in both the State House and State Senate, entered the Democratic primary for the US Senate seat in a long-shot bid against Allen J. Ellender, then chairman of the Senate's powerful Appropriations Committee. When the 81-year-old Ellender died of a heart attack just three weeks before the primary, Johnston won easily. Johnston's election for a fourth term in 1990 became a hot topic in the news media as he fought off a serious challenge by a former Ku Klux Klan leader and overt Nazi sympathizer, David Duke. Johnston won 54% of the vote to Duke's 44%, the slimmest margin of victory in his Senate career.

Since Huey Long's time as governor and then US senator in the late 1920s until his assassination in 1935, Louisiana politics has been a struggle between reformist and conservative forces, populists and demo-



JOHNSTON: Power broker on energy and science.

gogues. Johnston is identified as a moderate conservative who is both parochial and progressive on various issues. He was an early backer of the Strategic Petroleum Reserve, whose salt-dome storage sites are in Louisiana, and he saw that support vindicated in the Persian Gulf War. He advocated statehood for Puerto Rico. He favored oil drilling in the Arctic National Wildlife Refuge and raising CAFE gas mileage standards for autos, but gave in to opponents of each so that the Senate could abolish controls on natural gas and remove the windfall profits tax on oil. On the Appropriations Committee he supported higher education and R&D programs and secured more than \$100 million to create five major national research centers at universities in his state. He was outspoken against the Strategic Defense Initiative as ill-conceived and wasteful.

Johnston coveted the position of Senate majority leader in 1986 and again in 1988, but both times he was frustrated. After the Republican takeover of Congress in November 1994, some Senate Democrats looked around for a challenger to Tom Daschle of South Dakota for the post of party leader, but they ignored Johnston, who had wanted the job. The White House failed to support Johnston in his bid after he led the Senate to defeat President Clinton's proposed energy tax based on Btu content and then pushed amendments requiring cost-benefit analyses for environmental bills and comparative risk assessments of government environmental regulations—even before the Republican "Contract with America" was drawn up by Newt Gingrich and his cohorts.

Johnston's efforts on behalf of the SSC were nothing short of heroic. For more than three years he made the SSC his personal crusade against formidable opposition in the Senate and gave up only after the House refused to accept the conference report on the 1993 Department of Energy appropriations bill that would have funded building the huge machine. He refused to force reluctant Senate appropriators to continue battling House members. "The SSC has been lynched," he declared at the time. (See *PHYSICS TODAY*, February 1994, page 87.)

On 13 November Johnston met with Washington editor Irwin Goodwin in the senator's flag-draped office on the ground floor of the Senate's Hart Office Building for an unrestricted interview. The edited version follows:

Q. Some say that you know more about physics than any member of the Senate and until Vern Ehlers [a research physicist elected to Congress in

1993 (see *PHYSICSTODAY*, January 1994, page 37)] came into the House more than any member of that body. How did you attain this distinction?

A. Well, I don't know whether I know more than anyone in Congress, though I'm probably more interested in physics than are my colleagues. My appropriations subcommittee on energy and water has funded the physics efforts of the country for several decades. So it's a natural interest of mine to know about physics as well as my duty as a legislator.

Q. I've been told that some members of the physics community actually tutored you in the field, particularly in particle physics.

A. Oh, I have had some wonderful and patient teachers: Leon Lederman, Burt Richter and Pief [Wolfgang K. H.] Pan-

A. Because I think only the Federal Government can support this type of pure research. It is not a profit-making activity, although that kind of research can lead to technological developments in areas we know not of. Early in the life of the project the government in Washington made a commitment to it. We should have completed it. We were halfway into the funding of it, and the information put out on the funding was very wrong. Opponents of the project said it was going to cost another \$6 billion or more. The net cost to the taxpayer was then about \$2 billion.

Q. You mean about \$2 billion more than had already been spent?

A. No, the net cost of completing the SSC compared to the termination cost would have been only about \$2 billion.

'The scientific community should realize that the political process is somewhat imperfect and we don't have a huge pot of money that can be divided according to some agreed on universal wish list'

ofsky. Those are my three top tutors. There's also an astrophysicist who wrote the book on ripples in space: George Smoot of Berkeley.

Q. For a lawyer and legislator, you seem to have an uncanny knack for choosing an impressive group of physics teachers. I've heard you at Senate hearings taking five to ten minutes out of the political give-and-take to deliver a mini-lecture to some senators or to question a witness on some esoteric point in physics. You can ask some tough questions.

A. I'm interested in understanding where the universe came from and where it is going. I find high-energy physics a fascinating field, and it's also a subject that comes up frequently before both of my committees because of the budgets, the laboratories and the issues involved. I'm interested in the search for the elusive Higgs boson, which high-energy physicists hope to find if it exists at all, and, like them, I also hope the search produces surprises.

Q. You were the reigning champion in Congress of the Superconducting Super Collider. If it's true, as [Thomas P.] Tip O'Neill, who was House Speaker a decade ago, used to say, "All politics is local," why did you go all out for the SSC even before companies like General Dynamics and Babcock and Wilcox decided to build superconducting magnets for the machine in your state?

Had it been finished, I think our investment in it would have led to great discoveries and great benefits. Now, of course, high-energy physicists in our country have been tripped up. I wish them well at CERN over in Geneva, but I am not too hopeful that that's going to work out. It really is too bad, because here was a field of basic science where we could have found some answers to some deep riddles and done some exciting research.

Q. What do you believe in your mind were the reasons that Congress pulled the plug on the SSC?

A. The budget-cutters were looking for easy targets—things that stood out from the pack and could be blown away. Of course, in terms of balancing the budget this was a miniscule item and just faded into background noise, but it was a big target and some House members were able to come up with silly criticisms. For example, the case was made that SSC scientists were getting together for cocktails one evening. So a few members complained, "Well, they're using the Federal money to buy drinks."

Q. There also were gripes about buying plants to decorate the offices.

A. That too. Here were some distinguished scientists who sometimes had to travel long distances, and they were criticized for having a drink and a dinner on the SSC bill. As for the

plants, these, it turns out, cost less than the plants that adorn the offices of the GAO [Government Accounting Office], which had made the original criticism. It was just those silly sorts of things, but the press and some members of Congress were able to glom onto those and make it appear that the expense was wasteful and that to condone these things suggested mismanagement.

Of course, any time you design something as complicated as a particle accelerator for the first time, you're going to have some false starts, as indeed [happened] with the initial design of the magnet. It's not that the magnet didn't work. The project leaders thought that in the design phase they had better have a larger margin of error, and so they increased the aperture. This added to the final cost. But the critics called this a cost overrun.

It was, in fact, a redesign before the magnet went into production. It was done to ensure the accelerator worked to the specification and satisfaction of the physicists. Instead, the SSC and its managers were subjected to a public relations job, and it was very sad for me to see that happen. It was sad that scientists, including physicists, helped defeat the project. Some of the scientists were saying, "Let's take that science money and put it on applied physics" or "Let's use the funds for more important science." We tried to tell these scientists that there's not a pot of science money that is fungible. Money for the SSC can't just be transferred to a different project. At the end of the SSC debate they learned that its demise hurt all of science, not just high-energy physics.

Q. Would it have helped to have the White House—meaning the President and his Office of Science and Technology Policy—more active and outspoken in defense of the SSC?

A. Oh, sure. Absolutely.

Q. Were you upset that the Clinton White House didn't provide more support for the SSC?

A. The Clinton Administration was nominally for it, but it was perfectly obvious that it was not going to spend any political capital on it at all. Some would say they opposed it by "condemnation with faint praise." I was a little disappointed in that, yes. It's something that should have been done. I'm just sorry that we didn't have the leadership. There was almost no leadership in the House for it. There were a lot of opponents of the project coming out of the woodwork.

Q. You said there were physicists who led the attack on the SSC.

A. Some, yes.

Q. Are you convinced that the internecine warfare among physicists had

an effect on the SSC?

A. Of course. When distinguished scientists, including a Nobel Prize-winning solid-state physicist from Princeton, Phil Anderson, speak against the SSC, it undermines confidence in the project. Anderson made statements that were probably stronger than even he believed, but he could not recall the words after they were spoken, and we were challenged time and time again with his remarks. He preferred to have the money used elsewhere. Funds authorized for the SSC no longer go to high-energy physics or anywhere else in science research.

Q. I recall Alvin Trivelpiece, who headed the Energy Department's Office of Energy Research at the time, saying that the physics community was "circling their wagons and shooting in at themselves." All this in-fighting must have had a bearing on the outcome in Congress.

'Unfortunately, the Congress is particularly bereft of knowledge in science. So we must rely on the scientific community'

A. The SSC won in the Senate year after year.

Q. You led the fight for the SSC in the Senate and it must have helped to have Pete Domenici [of New Mexico] and Frank Murkowski [of Alaska] and others on your side.

A. It was gratifying to have that support in the Senate.

Q. Were you disappointed that more physicists weren't speaking up for the project?

A. I thought that the whole scientific community should have been stronger than they were. They've got to realize that when we initiate these projects the worst thing we can do is to start and stop without good reason—just sort of change our minds in mid-life. They need to understand that this is an argument against getting anything started, because people remember back to the SSC. The scientific community should try, first of all, to realize that the political process is somewhat imperfect, and second, that we don't have a huge pot of money that can be divided up according to some agreed on universal wish list. By the way, if the scientific community ever got together to allocate such a potful of money, if that were possible, I don't believe scientists would have much better success than did the Congress in deciding on the highest priorities, because each sci-

entist thinks his field is the most important for understanding nature and benefiting society. That's the human condition, I guess, and that's the way we all think.

Q. Senators and representatives haven't been reluctant to set agendas on social or economic matters. Why not science subjects?

A. Unfortunately, the Congress is particularly bereft of knowledge in science. So we must rely on the scientific community and especially on those who are best able to speak knowledgeably and understandably about on issues with scientific components. Pief Panofsky is one of those. He has advised Presidents on technical subjects ranging from arms control to the Stanford Linear Accelerator. And people of that substance are very, very valuable to the country. We need to raise a new generation of those people to whom we can turn for advice on issues of national

defense, of global climate change, of environmental waste disposal and so on. We need scientists we can call on to bring their experience and judgment to bear on essentially political decisions that we make all the time. It seems that high-energy physics has produced more of those kinds of advisers than [has] any other field I know of.

Q. Is that because of their connection with the country's defense, beginning with the Manhattan Project?

A. That may be part of it—their experience with atomic weapons and the sense of responsibility that came with that work. But also because they are articulate and thoughtful. Richter, Lederman and Panofsky have a gift for explaining things and for making sound judgments. In contrast to them I know a computer scientist who can't tell you the time of day. He insists on telling you first how the clock works.

Q. The National Academy of Sciences is notorious for saying "on the one hand you might do this and on the other hand there is this option."

A. In the Energy Policy Act of 1992 I asked the Environmental Protection Agency to have the National Academy of Sciences study whether spent nuclear fuel might be stored near Yucca Mountain in Nevada. The report that came back to us ["Technical Basis for Yucca Mountain Standards," released last 2

August] was almost incomprehensible.

Q. For more than 20 years Congress was able to call on its Office of Technology Assessment for a study of the sort you asked for. Were you disappointed that OTA fell victim to the budget ax wielded by this Congress?

A. Yes. I have not been a great consumer of OTA's work, but I believe the agency did good work and was a source of expertise that was objective. I hate to see a useful scientific organization like OTA eliminated.

Q. On another topic, you opposed funding President Reagan's Strategic Defense Initiative, more familiarly known as "Star Wars."

A. I did indeed.

Q. Did you seek advice for your decision from scientists?

A. Yes. I talked to a lot of scientists. I think most scientists were against the SDI program, not because it was impossible to make something work in space—we know that our scientists and engineers and their counterparts in the old Soviet Union can do that—but because of the enormous cost of it. If we wanted to shoot down intercontinental missiles, it would have been a lot cheaper to do that from ground level at much less expense. There was the so-called Nitze test [named for Paul Nitze, former deputy secretary of Defense and arms control negotiator], which asks: Does it cost more for them to build a new missile than for us to shoot one down? If the SDI didn't pass that test, then we would be on the losing end. We never even came remotely close, by a factor of ten, to passing the Nitze test.

Q. Were there some philosophical or ideological grounds on which you opposed the SDI, aside from the technical and the budgetary ones?

A. No. I think if we could have an affordable astrodome over the United States, sure, and if it would work, sure. Anyone would like that, but it was not affordable, and it would not work in a way that it couldn't be defeated by an equally smart enemy. SDI was renamed the Ballistic Missile Defense Organization, and we are still proceeding with this mad program to this day, as if the threat the Defense Department is spending all this money on is the way that some country would unleash a nuclear weapon on this country. Why would somebody want to shoot a ballistic missile armed with a nuclear warhead at us? The missile would have a return address plainly written on it. It's much easier and cheaper to smuggle a nuclear weapon in a piece of luggage or a bale of marijuana. Those are a greater threat to this country than a terrorist group or rogue nation launching a sophisticated missile with a

nuclear warhead. And it would be a lot harder to know who did it.

Q. In hearings that you either conducted or attended in the last two or three years, you seem to have lost your enthusiasm for the Energy Department's magnetic fusion program. Why has this happened?

A. I am for fusion energy and for fusion research, but I think the country needs to make up its mind whether it wants to try to commercialize fusion or to run a basic science research program. If it is the latter, then [the program] should be scaled back. There is no need to pretend that we're going to do all these great things and spend a lot of money on it. But if we are going to try for commercialization, to determine whether fusion energy can produce electricity at a competitive price without environmental risk or plant breakdowns, then we have to make some fundamental decisions. Do

wake up some morning arguing that it's just too costly. We need to make some hard decisions now before we allocate \$2 billion or maybe \$3 billion to fusion facilities.

Q. Aren't the Europeans having second thoughts about ITER largely for financial reasons?

A. I think that's true. I think you need to get it to the top of the decision-making pyramid, because these are decisions of the moment. Am I enthusiastic about fusion? I am enthusiastic but skeptical, and I think we ought to get our best scientists and engineers to try to make a careful judgment on the chances of producing commercially affordable fusion energy.

Q. DOE has made several studies of the future of magnetic fusion and there always seem to be some committee members who argue for more basic research and others who contend that we need to look at other approaches

'The country needs to make up its mind whether it wants to try to commercialize fusion or to run a basic science research program'

we want to do it internationally? Are we willing to do it all ourselves? I think the answer is that it has to be done as an international collaboration. And if that's our decision, then we need to begin negotiations leading to that. But if you ask Bill Clinton about it, the chances are that he hasn't given it much thought. He hasn't thought about whether this country would be willing to put up more than \$10 billion over a period of 20 years. We need to face that question.

Q. Doesn't the time scale work against a program of that sort? After all, the machine itself wouldn't be built until perhaps 2025. Commercial fusion power wouldn't be available for a decade or more afterward.

A. I think you could build either machine before 2025. I believe we need to make a decision about fusion, but we never really focused at the appropriate level on that decision. The decision about building a TPX [Tokamak Physics Experiment at the Princeton Plasma Physics Lab] depends on going ahead with ITER [the International Thermonuclear Experimental Reactor]. It's this lack of mental and fiscal discipline as to how you make these decisions that compounds the problem of fusion energy. I don't want to see another SSC. I don't want us to go along spending \$10 billion or more and

instead of putting all our chips on the tokamak.

A. There are still some who say those things. You know, a lot of the people in the scientific community would like to do research forever. If you are in laser inertial confinement fusion, then that's what you want to do—you don't want to build ITER. I would welcome a definitive study.

Q. Has the time come when big science projects like ITER and the SSC should only be done by an international collaboration?

A. I believe that is clearly so. It is especially true for fusion, because whatever benefits come from fusion will have international implications, and so the industrialized countries that will benefit immediately ought to pay for the R&D. The negotiations for an ITER machine are likely to be prolonged and difficult, and the country in which the main tokamak is built will probably have to put up most of the funds—maybe as much as 60% of the total. Are we willing to put up 60%? Would Germany or Japan?

Q. Isn't that the big question for all magascience projects?

A. Right now there are really only two such projects: ITER or something like it in fusion and the Large Hadron Collider at CERN. The future of neither is assured at this point, even as

an international venture.

Q. What about space exploration, not by robot spacecraft but by humans?

A. The United States has a lot of momentum with the space station, but beyond that, international collaboration will be essential.

Q. One of the paradoxes in all this is that in a democracy the elected leaders and legislators may not stay the course for megaprojects that take 10 or 15 years for research, design and construction. Members of Congress and of the Executive branch come and go. Are politicians willing and able to make decisions when they know they won't be around to reap the benefits and rewards of their risk-taking and far-sightedness?

A. That's why I think there needs to be a fundamental change. In the past we've eked out these decisions in an iterative process where you start off with a small amount of money to do a preliminary design, and then you commit to items requiring long lead time and then, before you know it, the bow wave hits, and there's a huge amount of money needed in one year, and you've never had the national debate to determine whether to do it. In the case of the SSC, we had something of a national debate. You need to have both houses of Congress and the President absolutely committed. That's why I offered legislation that would require this commitment to a magnetic fusion program. We couldn't get that. We need the discipline of solemn commitment.

Q. There seems to be some debate in the House over the future of the national labs within DOE and NASA.

A. We're going to fight for the laboratories. If we were starting from ground zero today, we might not organize our national laboratories they way they are. But they are there—the best in the world. They do things that no other laboratories in the world can do. I believe we should keep them and redirect some of their activities toward technology transfer. I think that will be difficult to do—to work for the benefit of the entire country. But I believe it can be done.

Q. Do you believe the so-called cultural gap between the labs and commercial companies can be closed so that the research done in government labs can contribute to products of daily life?

A. There are a lot of cultural problems to overcome at both ends. There also are cultural advantages in having all those smart people in a confined place where they can interact and have that mental fermentation that has worked so well in the past. The laboratories are the crown jewels of our defense and energy and space programs. I'm help-

ing in the fight to keep them robust.

Q. DOE has been criticized in independent studies and GAO reports for mismanagement and overmanagement. Can Congress correct those problems?

A. We've had hearings, of course, and we are working on DOE to get them to change their bad old habits. The same criticisms were made as long as 25 years ago. We hauled out records even older than 25 years and found the same complaints against the Atomic Energy Commission. Those accounts read like descriptions of what's wrong today.

Q. Admiral [James D.] Watkins, when he was Energy Secretary several years ago, was concerned about the accountability of the managers and scientists in the labs. He believed the department had to maintain firm control over the labs. Do you agree?

A. If Washington seeks to maintain a

an independent judgment about the value of fusion, for example, I think you have to steep in that culture and follow that technology over a period of years. You can't bring in a real-estate developer in his first term in the House of Representatives and have him understand these things, and we haven't yet elected a physicist or chemist to be chairman of the energy and water appropriations subcommittee. I strongly oppose term limits. I strongly oppose the whole idea of a quick turnover in Congress; otherwise, you almost guarantee that you're not going to have people with the depth of knowledge and judgment and expertise that they need, whether it is in science or in foreign affairs or in defense matters. Occasionally you will have someone who stays too long and is maybe past his prime, to put it mildly, but that is much less of a problem than having the whole Congress made up of neo-

'If we were starting from ground zero, we might not organize our national laboratories the way they are. But they are there—the best in the world'

firm hold on the laboratories, you get mired down in red tape and delay, and by the time Washington gets around to making a decision the scientific opportunity may have come and gone, because so much research and technology has a short half-life. The laboratories need to be able to move out quickly. But there are all those layers of decision-making that were designed to cure the problem that Admiral Watkins was talking about. So where is the right balance? We've overbalanced in terms of overmanagement, and in my view we now need to underbalance. But scientists need to be accountable. There must be some middle ground between the freedom to do research, to make discoveries and to develop new knowledge and to be accountable for the cost and output of their work.

Q. Congress is experiencing another "changing of the guard." Both the House and Senate will have many more new faces after the elections in November. Does that bode well or badly for science?

A. I think it bodes very badly for science. In my case, what I know in science has been learned since I became a senator. It takes time to learn how the scientific community works, how the labs work, about the value of different technologies. In order to have

phytes who have come in and are just getting their eyes open and having somebody explain to them what inertial confinement fusion is. When that happens, you shortchange the Congress, the country and, most particularly, all of science.

Q. Was the SSC a victim of what you term the neophyte factor?

A. It was lynched by the know-nothings, by people who knew little or nothing about high-energy physics and who talked about quarks with a derisive smile.

Q. Looking back on your years in the Senate, what do you consider your major accomplishment for science?

A. Well, before the SSC was defeated, winning its approval in some tough battles on the floor of the Senate. I think that for three years we had tough battles. That was the greatest accomplishment. Strengthening our national labs was another achievement. Getting approval for CEBAF, which we used to call the Warnertron, after Senator John Warner [of Virginia], who worked tirelessly to get it for his state. I'm proud that we've kept the high-energy physics program healthy in a declining budget market.

Q. What about your greatest disappointment in Congress?

A. Losing the SSC. ■