

revitalize science and technology as a way of advancing US industrial competitiveness. Other construction projects include two new starts: the 6-7 GeV synchrotron light source at Argonne National Laboratory, for which \$40 million is proposed, and the Compact Ignition Tokamak at the Princeton Plasma Physics Laboratory, with some \$5.5 million designated for a project that will ultimately cost \$445 million upon completion, now anticipated in 1997. DOE planners and OMB have postponed another possible start, the Relativistic Heavy Ion Collider planned for Brookhaven, for at least another year—though some funds would be made available for R&D.

The department is asking for a 9.3% increase for high-energy physics research, which would bring this program to \$133 million, and a 9.9% rise in nuclear physics to raise it to \$97.7 million. The latter increase would enable DOE to enhance support for nuclear theory and for researchers preparing to use the 4-GeV Continuous Electron Beam Accelerator Facility, being built at Newport News, Virginia. Total spending for high-energy physics, which includes operating the national labs, constructing detectors and developing other equipment, but excluding the SSC (which is given its own category in DOE's budget), would go up 10.2% to \$616.2 million. Nuclear physics would rise in 1990 by 14.7% to a total of \$299.3 million.

But the Basic Energy Sciences program is earmarked for a modest increase of \$40.7 million, slightly more than compensating for inflation. This diverse program includes superconductivity research and geoscience investigations that look at the

global warming phenomenon.

NASA. The request for the space agency totals a whopping \$13.3 billion, up from \$10.9 billion this year. A dominant factor in the increase is the \$1.1 billion added to the budget for the space station. Congress decreed last year that \$550 million in fiscal-1989 funds for the project could not be spent before 15 May of this year, so that the new Administration would have time to review the concept. While a candidate, Bush voiced his enthusiasm for a manned space station, and his statements since indicate that he will proceed with it. But a "white paper" by a committee of the National Academies of Sciences and Engineering asking NASA to look hard at the rationale and scope of the station could raise questions in Congress and make the project vulnerable in a year of fiscal constraints.

Elsewhere in NASA's budget, funds are included for a start on the CRAF/Cassini mission to Saturn and its moon Titan—a project that will be conducted jointly with the European Space Agency.

Department of Defense: Last year, military analysts forecast that the Pentagon's fiscal 1990 budget would have to grow by at least 4% above inflation to pay for new arms programs already in the procurement pipeline, and even bigger increases would be needed in subsequent years. However, in Bush's revision of the Reagan request for 1990 the increase amounts only to the inflationary 4%. Many of the cuts in Reagan's original \$309 billion request are in slowdowns to the rate of procurements, which would tend to increase the cost of weapons in the long run. Richard B. Cheney, the new Defense secretary, has said he is

making real cuts, which are bound to shape US military policy and spending outlays for years to come.

Of the \$44 billion proposed for R&D, most would go to development and testing, with only \$930.1 million, or about 0.3% of the department's entire budget, for basic research. Even that sum is suspect, because most of the research is in the 6.2 and 6.3 categories that cover work applicable to DOD's mission. About half of the so-called basic research goes to universities.

The largest increase in R&D would be directed to the Strategic Defense Initiative, which would soar by 54% to a stunning \$5.6 billion in 1990. Work on nuclear power systems for space and directed energy weapons is channeled through the DOE budget at \$311 million, down \$25 million from the current year's program. There is little likelihood that Congress will enact such a massive increase for "Star Wars." In fact, the testimony by Cheney and SDI's new director, Lieutenant General George Monahan, suggest that DOD would be pleased to get as much as it got last year—about \$4 billion.

The Universities Research Initiative, a basic research program that supports multidisciplinary studies at universities, would edge up a mere 1% to reach \$96.1 million. The Reagan budget showed \$299.7 million, a 29.9% increase over 1989, for the NASA-DOD National Aerospace Plane—the proposed ultrasonic "Orient Express," as Reagan refers to it. On the development side, Sematech would receive \$100 million, the second installment of the DOD obligation to support semiconductor manufacturing technologies.

—IRWIN GOODWIN

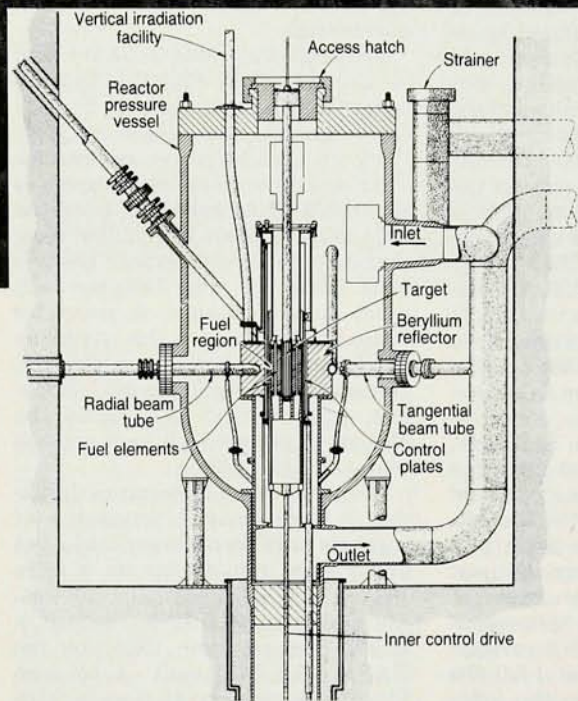
WATKINS'S DECISION TO RESTART HFIR HERALDS NEW ERA FOR DOE REACTORS

In his first appearances before the Senate Budget Committee last 15 March and, a week later, before the House appropriations subcommittee on energy, Energy Secretary James G. Watkins provided a surprise: DOE plans to restart the High Flux Isotope Reactor at Oak Ridge National Laboratory, which was shut down in 1986 over worries about its safety. The House subcommittee appeared puzzled by Watkins's announcement. The issue of DOE's troubled reactors wasn't on the agenda of the hearing, nor is HFIR a component in the nuclear weapons production troubles

that haunt the Bush Administration. Watkins, whose nomination as DOE secretary was confirmed by the Senate only two weeks before the hearing, almost singlehandedly decided to restart HFIR as the first reactor to return to operation since the department's reactor crisis began in January 1987 with the closing of the N-Reactor at the Hanford Reservation. The action on HFIR is perceived as symbolic of Watkins's intention to get the ailing nuclear warhead complex cleaned up and running again after its virtually complete shutdown last year (PHYSICS TODAY, November, page 49).

Watkins's decision is seen by Tom Bevill, a powerful Alabama Democrat who heads the House appropriations subcommittee on energy, as "an important sign that the department is coming to grips with its reactor problems as a top priority." Oak Ridge's new director, Alvin W. Trivelpiece, who had been director of DOE's energy research office in 1981-1987, believes Watkins is already "making a difference."

Watkins has the strongest technical background of any DOE secretary to date and has assured Congress that he will not compromise on safety in



HFIR in woodlands

at Oak Ridge National Laboratory is depicted in diagram. It shows the reactor core surrounded by a thick ring of beryllium, which acts as a neutron reflector. The reactor is equipped with four beam tubes that extend from the core to experiments.

the operation and modernization of defense production plants. He owes his position in the Administration to President Bush's worries about the troubled defense reactors as well as to a commitment to nuclear power. Watkins was one of Admiral Hyman Rickover's "whiz kids" in the design and development of submarine reactors and was a graduate of the Oak Ridge reactor program. He later commanded a nuclear-powered attack submarine and the first nuclear cruiser. Rising to the rank of admiral, Watkins served as chief of naval operations between 1982 and 1986, before retiring. In October 1987 he was appointed chairman of the Presidential Commission on the Human Immunodeficiency Virus (AIDS).

HFIR, designed and built for a relatively cheap \$23.3 million in 1966, is a light-water cooled reactor that ran for 20 years at its design power of 100 MW. For all those years it produced high-grade radioisotopes of transuranic elements, particularly californium and curium, for scientific

and medical research, for cancer treatment, for neutron scattering studies and for tests of fusion materials for radiation damage. Its record for producing the highest thermal flux of 5×10^{15} neutrons/cm²-sec was nearly equalled by high-flux reactors at Brookhaven and the Institut Laue-Langevin. The irony of HFIR's 2½-year dormancy, Trivelpiece observes, is that it did not take part in the frenzied research in high- T_c su-

perconductivity. "It couldn't do one of the things it does best: determine the structure of materials," he says.

The troubles with HFIR were revealed in a 1986 review of all the lab's reactors, ordered by Herman Postma, then director of Oak Ridge, after the Chernobyl disaster in the USSR. The examination found HFIR's pressure vessel to be perilously brittle from 20 years of neutron bombardment. The review did not suggest any immediate danger to the reactor, which is fueled by 93% enriched uranium²³⁵, unlike the 2% to 4% enrichment in US commercial power reactors. But investigators found definite signs of embrittlement in several sample "coupons" of three types of steel that had been placed in the reactor just for the purpose of testing. As a result, Postma decided the prudent course was to shut down HFIR.

Since it was turned off in November 1986, the reactor has been subjected to some 20 different studies. The examinations, conducted by the Department of Energy, the National Research Council, the Oak Ridge management contractor, Martin Marietta, and several independent consultants, called for hundreds of corrective repairs and actions. While the pressure vessel was found to be sound enough for restarting, the examiners called for HFIR to run at reduced power and to require better trained operators. They also recommended that Oak Ridge and DOE managers should keep more careful watch on HFIR. In October 1988 Oak Ridge asked DOE to restart HFIR at 85 MW, and Robert Hunter, Trivelpiece's successor at DOE, accelerated the paperwork and advised Watkins to go ahead. In the end, however, the startup was Watkins's decision. On 18 April the machine went critical and, cautiously at first, reached 50 kW, but by early June it is expected to reach 85 MW. Even shut down, HFIR had run up a bill of \$40 million—nearly twice the cost of its design and construction.

—IRWIN GOODWIN

WASHINGTON INS & OUTS: MOVES FROM HOUSE SCIENCE PANEL; NEW POSITIONS AT NSF AND SSC

Harlan L. Watson, the top Republican staffer for energy and environmental issues on the House Science, Space and Technology Committee, has left Capitol Hill to join his mentor, Manuel Lujan Jr, the newly confirmed Secretary of the Interior. Lujan had been senior Republican on

the science committee until he decided not to run for reelection last year for his House seat from New Mexico. Watson, who is Lujan's science adviser at Interior, is one of three committee staffers to join the department. The others are **R. Thomas Weimer**, minority staff director, who