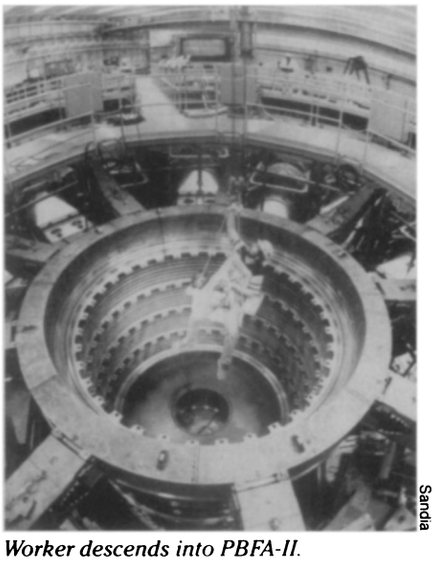
Charging their way toward fusion

Zap! The Particle Beam Fusion Accelerator II (PBFA-II) is billed by its owner, Sandia National Laboratories of Albuquerque, N.M., as the world's most powerful accelerator. It is designed to yield power in pulses, and when it reaches its design power, its pulses will surpass by several times the instantaneous power of all the world's electric generating plants combined. Finished about a month ahead of schedule, PBFA-II fired its first pulse on Dec. 11, at 70 percent of its design energy of 100 trillion watts, at 8:09 p.m., mountain standard time.

PBFA-II's completion opens a new stage on the long journey toward controlled thermonuclear fusion. As Pace VanDevender, director of pulsed power sciences for Sandia, puts it, "The world now has the best light-ion accelerator for inertial confinement fusion that can be built."



Sandia

Worker descends into PBFA-II.

PBFA-II stores up electrical energy, 3.5 million joules of it, and concentrates it into pulses 50 billionths of a second long. The pulses energize a diode that generates a beam of lithium ions. Ultimately the ions will strike a target of thermonuclear fuel. The effect of the impact will implode the target, and the implosion is expected to compress and heat the target to the point where nuclear fusions begin. At design energy, PBFA-II will deliver 100 trillion watts per square centimeter onto the surface of the target, a pellet of a few millimeters' radius.

For the next two years the experimenters expect to be busy with the means of generating and focusing the beam of lithium ions, which will come from the walls of a cylindrical diode and impinge on the target (hung in the center of the diode) from all sides. Production and focus of such an ion beam present severe technical challenges, although the experimenters were much encouraged earlier this year by unexpected successes in that endeavor with PBFA-II's predecessor, PBFA-I (SN: 4/20/85, p. 244). By 1988 PBFA-II should be ready to begin experiments aimed at igniting fusions in fuel pellets, with the ultimate hope of reactions that produce more energy from fusion than it takes to get the fusion going, which would be a net energy gain and what everybody in the controlled fusion business is looking for. PBFA-I is now being converted into the SATURN X-ray machine, which will simulate effects of nuclear weapons on various material samples.

In appearance, PBFA-II, 108 feet in diameter and 20 feet deep, looks like a lot of electrical equipment submerged in a swimming pool. Only in part of the pool is the liquid water, however; the other part is filled with oil. The liquids serve as dielectrics separating the plates of huge capacitors. PBFA-II consists of 36 power-compressing modules spaced in four layers around the pool. Each module is a series of capacitors and switches that compress the energy step by step into shorter and shorter time intervals until it gets down to 50 billionths of a second. All 36 modules feed their output simultaneously to the diode in the center of the pool.

The installation was built within its budget of $48 million. The builders managed its design so that improvements in technology could be incorporated as construction went on, and so its capabilities are up to date as of the completion. One improvement not yet incorporated is a new kind of switch that could double the power output to 200 trillion watts.

— D.E. Thomsen

Two U.S. ASAT targets join the fray

Two special target satellites launched by the Air Force on Dec. 12 were just in time to become embroiled in controversy about plans for future U.S. antisatellite (ASAT) testing. They were also late — six months behind their original schedule — a delay that had led in September to the destruction of a working scientific satellite that was on the job at the time.

Called ITVs, or Instrumented Test Vehicles, the inflatable devices were to have been orbited in June as ASAT targets, but were delayed by "technical problems." When President Reagan and Defense Secretary Caspar W. Weinberger elected to proceed with an ASAT test prior to the President's November summit meeting with Soviet leader Mikhail Gorbachev, an alternative target was selected. The replacement turned out to be the Air Force's P78-1 research satellite, whose instruments included a white-light coronagraph that had been studying the sun since 1979 (SN: 9/28/85, p. 197). A still-operational satellite was required, Pentagon officials said (though they did not detail reasons for the specific choice of P78-1), in order to "verify impact" of the aircraft-launched ASAT missile that did the deed.

The just-orbited ITV satellites, however, face another kind of adversary as well. A proposed moratorium on U.S. ASAT tests would ban the tests until next Oct. 1 unless the Soviet Union resumes testing its own ASAT system. The moratorium was being debated by congressional conferees at press time as an amendment to a Defense Department appropriations bill. If adopted, said Weinberger, the ban "in effect gives the Soviets life-or-death veto power over a vital U.S. defense program." Horse-trading over the complex appropriations bill left the outcome uncertain. *— J. Eberhart*

Additional hat for NSF Director Bloch?

While the science community buzzes with speculation about who might be asked to succeed George A. Keyworth II as presidential science adviser (SN: 12/7/85, p. 358) and director of the Office of Science and Technology Policy, the White House staff is keeping mum and offering only that lists of names are forming. Keyworth's strategy to speed the appointment of his successor has been to recommend to White House Chief of Staff Donald T. Regan that National Science Foundation (NSF) Director Erich Bloch be given the added role of interim science adviser.

Choosing Bloch "is eminently logical," Keyworth said last week in a briefing with reporters, because it would further strengthen a "close linkage" between his office and NSF, which "maintains a lot of the same priorities; NSF is the vanguard of American science policy."

Unquestionably, attending to both roles will be taxing. Keyworth acknowledges that his job has claimed about 16 hours a day over the past few years. But it's this aspect that should serve as a natural incentive to find that permanent successor quickly, he believes. Moreover, he notes, there is some precedent for this. When Nixon's White House reorganization abolished the President's Office of Science and Technology in 1973, NSF Director H. Guyford Stever's job description was rewritten to include the task of advising the President. *— J. Raloff*