the fusion community took place in Washington to hear reports on the studies. Then the AEC Fusion Power Coordinating Committee, which is a successor to the CTR Standing Committee, had to decide whether or not to go ahead with the TFTR for the FY 1976 budget. The decision was to go, Hirsch told us, a decision that was heartily endorsed by the fusion audience, including former skeptics such as Rosenbluth, Coppi, Gottlieb and Fowler. Coppi felt encouraged by the tone in which the TFTR program was being proposed—that it would be undertaken in a realistic and scientific spirit.

The Fusion Power Coordinating Committee, headed by Hirsch, consists of his three technical assistant directors, and the fusion directors of the four major fusion laboratories: Fowler (Livermore), John F. Clarke (Oak Ridge), Gottlieb (Princeton) and Fred Ribe (Los Alamos). In addition, acting as consultants were Tihiro Ohkawa (Gulf General Atomic), Zalman Shapiro (Westinghouse), Sidney Fernbach (Livermore), Robert W. Bussard (Cerberonics Corp, San Diego), Solomon J. Buchsbaum (Bell Labs) and Edward Creutz (NSF).

The two-component scheme employs heating by an energetic neutral beam—one component is the resulting energetic ion component and the other component is the lower-energy bulk plasma. The energetic ion component reacts with the bulk ions as they thermalize, and, according to calculations, one can achieve breakeven with an $n\tau$ of 10^{13} cm^{-3} sec.

Both the Oak Ridge and Princeton–Westinghouse design studies called for a tokamak with neutral-beam heating. Oak Ridge proposed using superconducting coils, whereas Princeton–Westinghouse proposed water-cooled copper coils. The Oak Ridge design called for a larger torus than Princeton–Westinghouse and a somewhat lower plasma current at roughly the same cost. In the Oak Ridge proposal, it was emphasized that one could hope to obtain half the thermonuclear reactions from the bulk plasma and half coming from the energetic ion component. The Princeton–Westinghouse proposal, on the other hand, stressed that breakeven could be obtained entirely with two-component reactions or alternatively in the mode proposed by Oak Ridge.

Subsequent to the committee's recommendation, the Division of Controlled Thermonuclear Research chose to build the machine at Princeton, and have the university act as principal contractor, with most of the construction being done by industry, not necessarily Westinghouse. Estimated cost is about $200 million, including escalation.

The Princeton design in many ways is a bigger version of the Princeton Large Torus, which is expected to be completed in September 1975. The TFTR would have a major plasma radius of 270 cm. Its minor radius would be 95 cm, slightly more than twice the radius of PLT. The biggest discharge the TFTR could achieve is 2.5 megamps. In practice, because the experimenters want to achieve the highest temperatures, they plan to run at 1–1.5 megamps, thus reducing the plasma radius to about 60 cm, keeping the plasma away from the walls. At first, experiments would be done with a hydrogen plasma at 5–10 kV, where it is expected that an $n\tau$ of 10^{13} cm^{-3} sec would be achieved. At this time, the plasma transport and its gross stability would be studied.

At a later stage, the experimenters would work with a bulk plasma of tritons heated by ohmic heating to about 5 kV (with peak temperature of 8 kV) to prevent the tritons from being slowed down by the electrons before they can interact with the deuterons. Then neutral beams of 150-kV deuterons would be shot into the bulk plasma. Furth notes that one can also experiment with D–D and D–He^3 reactions. But the reaction that gives the biggest power is D–T. He expects that the power density would be about the same as that in a full-fledged reactor—3 W/cm^3. One would expect roughly 10 MW of neutrons in power output (and about 2 MW of alpha particles) for an input of 10 MW in neutral beams. This output would occur for a few tenths of a second every five minutes. If one counts the required magnet power, however, which is several hundred megawatts, one is far from breakeven. In a working reactor, Furth says, superconducting coils would surely be used.

Beyond the tokamak torus would be neutron shielding. The building to house the TFTR would be shielded, and have a remote-handling capability so that D–T can be run on a regular basis, to study burning physics. The amount of tritium on the site is expected to present no radioactivity problems—about 1 gram (10^4 curies) at any one time.

"Why build the TFTR before the PLT is finished?" we asked Furth. The TFTR is a mild extrapolation beyond PLT (PLT is expected to have an $n\tau$ of 10^{13} cm^{-3} sec at 2–3 keV)—both machines are expected to run at about 1 megamp. TFTR, however, will be bigger so that the plasma will be hotter and have less impurities. Its hardware is very similar to PLT. Detailed experimental results from PLT will be available while the TFTR is still in the design stage and can be taken into account in optimizing the design. Furth is optimistic about the prospects. In fact, the TFTR design is such that it would be possible to handle plasmas with an $n\tau$ of 10^{14} cm^{-3} sec should the physics be very favorable. —GBL

Project Sherwood

Project Sherwood was one of the early names for the AEC's controlled thermonuclear fusion program. According to Paul McDaniel, who was formerly head of the AEC Division of Physical Research, about 1951, when the project was still new, James Tuck asked for more money to support a small CTR project at Los Alamos. By reallocating money from a project that was being phased out at MIT's Hood Laboratory, McDaniel thought he could give Tuck the additional funds. When McDaniel suggested this approach to Thomas Johnson, then director of the Division of Physical Research, Johnson remarked, "We are obviously robbin' Hood to pay Friar Tuck; so we must be operating in Sherwood Forest. So let's call this Project Sherwood."

Institute of Acoustics formed from two UK groups

An Institute of Acoustics has been established in the UK upon the merger of the British Acoustical Society and the Acoustics Group of the Institute of Physics. R. W. B. Stephens of Imperial College London is the first president.

Although the Institute of Acoustics is independent in every respect, its headquarters is located at the IOP headquarters (47 Belgrave Square, London SW1X 8QX, UK), and secretarial and other services are provided by the IOP for a fee. Initially, the membership of the Institute is expected to be around 800.

Noel Hinners succeeds Naugle in NASA post

Noel W. Hinners has been appointed associate administrator for space science at NASA, succeeding John E. Naugle. Hinners has served at NASA since 1972, first as deputy director and chief scientist for Apollo Lunar Exploration in the Office of Manned Space Flight and then as director of Lunar Programs in the Office of Space Sciences. The latter office, with an annual budget of approximately $550 million oversees 25 unmanned spaceflight programs. There are three sections of the office—physics and astronomy, planetary programs, and lunar programs. Some of the projects include Pioneer and Mariner planetary satellites, the High Energy Astronomical Observatory, Small Astronomy and Small Scientific Satellites and the Orbiting Solar

continued on page 80

Hinners

continued from page 78

and Orbiting Astronomical Observatories.

Before coming to NASA, Hinners served as head of the lunar science exploration department of Bellcom, Inc. He received his PhD in geology from Princeton University in 1963 and is editor of *Geological Research Letters*. Hinners received the NASA Exceptional Scientific Achievement Medal in 1971 and was chairman of the Apollo Site Committees for Apollo 12–17 missions.

Scientists in the House

continued from page 77

ergy. He has a master's degree in chemistry from Washington State University (1949) and served for 20 years as a research chemist at the AEC's Hanford project in Richland, Wash. He also has a political background—he was in the Washington State Legislature from 1956 to 1970. During his tenure in Congress, he has been closely involved with energy matters including chairmanship of a 1971 House task force on energy, and he wrote the $60 million solar-heating and cooling demonstration act and a geothermal demonstration bill.

Martin received his PhD in chemistry from Princeton in 1960 and then joined the chemistry faculty at his undergraduate alma mater, Davidson College, where he became associate professor in 1964. Martin reported to us his feelings about his first term in Congress: "While there has been a great deal to learn and absorb in these two years, I feel I have been equipped for the challenge. My training and experience in science has been a great asset to me as a national lawmaker. Fortunately, in January 1973 I was appointed to two committees through which I have been able to utilize my scientific background—Interior & Insular Affairs, and Science & Astronautics. Since a large part of the work in Congress is done in committees, I was glad to have the opportunity to delve into specific areas that interest me and for which I have a certain amount of understanding." Martin reports that much of his time has been spent on researching the area of new energy resources and trying to balance the energy/environment trade-off.

George Brown has served in Congress the longest of this selected group of incumbents—he has been in the House from 1963 to 1971 and from 1973 to date. (He ran unsuccessfully for the Democratic nomination for a Senate seat in 1970 and therefore was not free to vie for a place in the House.) He received his bachelor's degree in physics from UCLA in 1946 and subsequently did graduate work in physics and other areas. For approximately ten years he was an electrical engineer for Los Angeles County and was elected to the California State Assembly in 1958. As a member of the US House of Representatives, he is serving on three subcommittees of the House Science and Astronautics Committee: Science Research and Development, Energy, and Space Science and Applications. Also during his stay in the House, he was closely involved in the work to establish the Congressional Office of Technology Assessment.

First-time scientist-candidates. Wood is not being subtle about his scientific background in his campaign literature—his slogans include "More science for Congress" and "Send a scientist as your Representative." As far as his background is concerned, he shows a long record of teaching and federal service in technical areas. He received his PhD in physical chemistry from Stanford University in 1939 and taught at Harvard and Cornell during 1941–51. He then worked at Wright Field, Dayton, Ohio (1951–58), at NASA (1958–61) and at the Air Force Office of Scientific Research where he was director of physical sciences (1961–70) and director of electronic and solid-state sciences (1970–72). He wrote to us: "In 1972, stimulated partly by a wish for change and for new challenges, and partly because of distress at deteriorating government policies and lack of foresight, I took an early retirement from the federal service and have spent the time since in the study of national problems. I decided to seek the office of United States Representative in the hope that the people of the district may agree with me that my special technical background and experience in government will be valuable to them in the Congress."

Inflation is likely to be a major campaign issue in the coming election. Wood outlines two needs to help stabilize the economy—the need to stop the high interest rate and the necessity to gear pay increases to the productivity of our national industrial establishment.

Seielstad, a fifth scientist running for Congress, is a radioastronomer and has done nearly all his work at CalTech's Owens Valley Radio Observatory. He received his bachelor's degree from Dartmouth in 1959 and his PhD from CalTech in 1963. He decries the limited variety of interests and professions represented in Congress—his campaign literature cites figures of 221 lawyers and 155 businessmen and bankers in the House, and only a handful of scientists.

How does he consider that his scientific background equips him for public service? "First, my outlook toward the solution of problems, next, my understanding of both the potential and the limits of science and technology in our society, and lastly, my appreciation of their importance to our national economy."

In the course of his campaign, Seielstad has received the endorsement of the Democratic Party (he won a two-man primary in June) and of other groups including the California Teachers Association, the National Education Association and several labor groups. He has spoken out on many issues—he favors a system of national health insurance and proposes that the most important means to reduce inflationary pressures is to use our resources more efficiently. He also favors a minimum income tax for all (so that the wealthy cannot totally avoid paying tax), elimination of the oil-depletion allowance and reduced foreign tax credits. —RAS

Applications due now for White House Fellowships

Applications for twenty fellowships are now being accepted for 1975–76 with those appointed serving under top government officials in the executive branch. Young professionals, age 23 through 35 at the start of the program (1 September 1975) who are not employees of the executive branch of the Federal Government are eligible. Applications must be postmarked by 2 December. Further information and applications are available by phone (202-382-4661) or by mail from the President's Commission on White House Fellows, Washington, D. C. 20415.

in brief

American scientists are invited to apply for expense-paid visits to the USSR and Eastern European countries during the 1975–76 academic year. Completed applications are due 21 November; information is available from NAS, Commission on International Relations, USSR/EE, Washington, D.C. 20418.

A Senate Special Committee on Science Policy report, *A Science Policy for Canada Vol. 3: A Government Organization for the Seventies* is available from Information Canada, Ottawa, for $3.00.

OSA sponsored meetings on optical fabrication and testing will be held 8–9 November in Hartford, Conn. and 10–11 November in Rochester, N. Y. Write to OSA, 2100 Penn. Ave NW, Washington D. C.20037 for details.

The Bartol Research Foundation of the Franklin Institute is celebrating its 50th anniversary. □