state & society

Record Federal R&D budget continues energy emphasis

There are several big winners in the battle for FY 1976 federal R&D funds including fusion-power R&D, the Nuclear Regulatory Commission, NSF National and Special Research Programs, the National Center for Atmospheric Research and advanced isotope-separation technology. In addition the Zero Gradient Synchrotron at Argonne National Laboratory, considered a candidate for a major cutback (PHYSICS TODAY, January, page 117), has survived with increased funding. The proposed Proton Electron Positron Project at Stanford, however, did not fare so well—there is no provision for it in the new budget.

The overall R&D request is the highest ever, up 15% from last year's $18.8 billion to an FY 1976 level of $21.6 billion. An additional $1 billion is obligated for R&D facilities. A major increase is noted for the new Energy Research and Development Administration, which has requested $2.35 billion for R&D, 24% more than the corresponding pre-ERDA agencies requested last year. The National Science Foundation is requesting an increase of 11% over the FY 1975 program of $697.1 million. The NASA budget request is described by administrator James C. Fletcher as "lean but manageable." Obligations would increase by $300 million to $3.5 billion for FY 1976.

ERDA programs. The largest share of energy R&D money continues to be channeled into nuclear energy. Support for fusion-power R&D in ERDA will increase 41% in FY 1976 to $120 million (Table 1). Of this amount $64 million will be allotted to confinement systems, a jump of over $22 million from last year. "The increase in fusion funds reflects a judgment that the fusion program is a very important component of the nation's long-range energy program," according to ERDA's John Teem, acting deputy assistant administrator for Solar, Geothermal and Advanced Energy Systems.

The increased funds for fusion confinement will go primarily toward development of the Doublet III at General Atomic in California and the Poloidal Diverter Experiment at the Princeton Plasma Physics Laboratory. Princeton will also be the recipient of an additional $7.5 million for the initial funding of the Tokamak Fusion Test Reactor; the funds will pay for architect engineering studies and long-range procurement items. TFTR, expected to cost $215 million by 1980 when it is due to begin operating, "will be an important step in a long-range development program leading towards a fusion demonstration power plant by the turn of the century," says Edward A. Frieman, associate director of PPPL (see PHYSICS TODAY, October, page 77). Another $9.6 million appears in the budget for continued construction of a $25-million high-energy laser facility at the Lawrence Livermore Laboratory to test the use of lasers in achieving fusion.

Fission is also a beneficiary of the increased emphasis on nuclear-power de-

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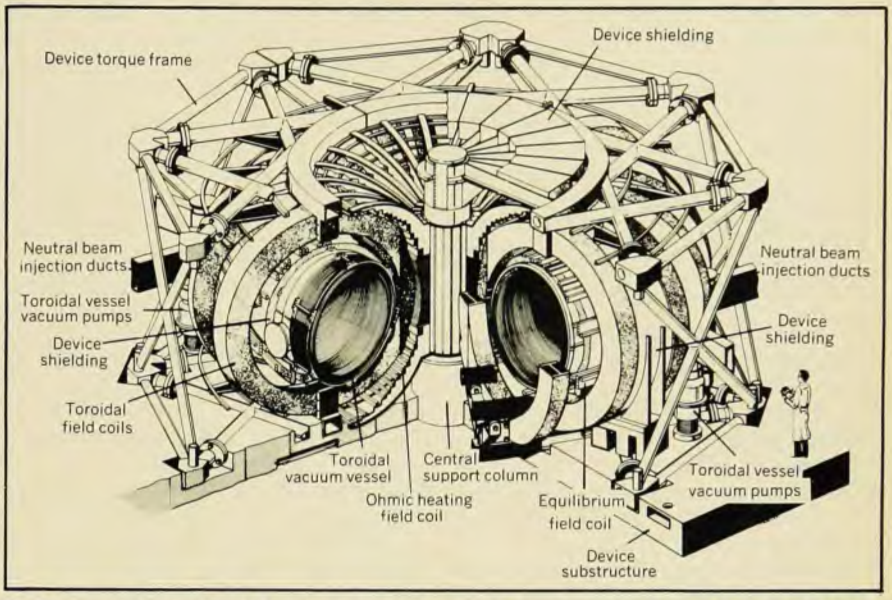

The Tokamak Fusion Test Reactor is one of several fusion programs that are expected to receive initial or increased funding for FY 1976. TFTR is scheduled for operation by 1980.

Too many West German physicists

A German Physical Society (DPG) manpower survey points to a large oversupply of research-oriented physicists in traditional fields in West Germany during 1975–1990. The report, *Zum Angebot und Bedarf an Physikern in der Bundesrepublik Deutschland bis 1990* shows a projected demand for physics personnel of 1100 per year from now into the early 1980's with a decline to around 600 by 1990. However, the supply pool increases from 1200 per year in 1971 to approximately 3200 in 1990.

There were several reasons stated for the decline in demand. Since 1964 there has been a marked drop in the birth rate. This will result in a lower student population and, assuming a constant interest in physics as compared with other studies, fewer teachers will be needed in schools and universities. A near-zero increase in the number of teachers in high schools is expected to come in 1982; the same situation is anticipated for colleges and universities four years later. Another reason for a decline in demand is that new research institutes are not planned and the growth rates at other institutes are slow (compared with earlier decades) because programs are developed already.

The supply. The size of the pool is governed, first, by the number of students entering college and the proportion of those going into physics (2.8% of those qualified for college over the last 15 years). Approximately 70% become qualified physicists (roughly MS or PhD level) taking an average of 6.5 years. There are efforts underway to shorten this average period to 4.5 years.

The demand. The study cites five categories where physicists are needed: business and industry, colleges and universities, research institutes, schools, and other fields. The total number of physicists is 14 000 with an additional 9000 high-school physics teachers. Business and industry currently employ 8000 trained physicists, some of whom do not work in physics. It is expected that there will be 150 new positions per year, and together with the number needed to replace retirees and others lost through attrition, 220 physicists per year will be needed in the next few years with the need growing to 350 per year for 1986–90.

The need for college and university professors is expected to grow from 760 now to 1400 by 1985 if the university-student population increases as it is projected to—from 2900 starting students per year now to 4760 in 1985. The number of research associates should also grow—from 1400 to 2500. The need is estimated at 100–150 per year until approximately 1985 when there will develop a surplus of college physics personnel.

The annual need by research institutes will be approximately 150 physicists, the survey shows, based on a DPG canvass of 13 institutes that employ 2175 physicists. In high schools the demand for physics teachers depends on the number of students, with the peak demand occuring in 1975 (over 350 new teachers needed). Approximately 250 will be needed per year during the rest of this decade and a negative demand in probable after 1980. Birth rates for the coming years will have to be known before estimates of high-school demand can be made for 1985–90.

It is difficult to assess the number of physicists working in non-conventional positions—such as in administration, medicine and patents. The best guess is that there are 1500 in this group. The annual need might be 150, keeping in mind a high additional need in a field such as health.

What can be done? The report notes that the large oversupply of personnel in traditional physics fields will probably results in a decline in the number of students starting out in physics. Nonetheless, employment hardships are expected over a long period. Some of the DPG recommendations include:

- Course work in universities should be oriented toward applied physics, so that students will be as versatile as possible and able to move into new fields.
- Intensive counselling should be available, even for high-school students. Information for such efforts should be available from the data base.
- The data base to follow changes in supply and demand of personnel and other professional concerns needs to be continued, although outside financial help is needed. —RAS

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velopment. Funding for fission-power-reactor R&D is expected to increase by 15.5% to $443.7 million. The focus of this increase is on development of the liquid-metal fast-breeder reactor which would receive $261.3 million in FY 1976, up from $250 million this fiscal year. In addition $80.5 million is requested for continued construction of the Fast Flux Test Facility in Richland, Washington, in support of LMFBR.

Funds for advanced isotope-separation technology would more than double, reaching $24.2 million in the FY 1976 budget plan, to accelerate the development of high-power lasers for use in uranium-isotope separation. This approach promises significant reductions in the cost of isotopically enriched nuclear materials compared with current gaseous diffusion and centrifuge technologies.

Although nearly 60% of direct energy R&D funds are going to nuclear energy, all areas of the ERDA budget are benefiting this year by the Administration's emphasis on achieving energy independence. Daniel Miller, acting director of the division of physical research, told us that ERDA's physical research budget for FY 1976 (Table 1) is a "budget we can do a lot with." It is expected to increase by 11% in FY 1976 to $312.5 million. In high-energy physics, funds are planned to be 13% above the FY 1975 level, which is considerably better than last year's situation when funds increased by only 6%.

No PEP. In keeping with the President's moratorium on new programs (except those related directly to energy), the FY 1976 budget does not request funds for the Proton Electron Positron storage ring project, which is jointly proposed by the Stanford Linear Accelerator Center and the Lawrence Berkeley Laboratory. PEP was recommended as the next logical step in the US program by the High Energy Physics Advisory Panel (PHYSICS TODAY, September, page 77). At budget briefings science adviser H. Guyford Stever admitted he was "disappointed at the failure to fund PEP, especially in view of the exciting new work in elementary particles." Despite this, SLAC Director Wolfgang Panofsky noted that the overall increase in funds for SLAC appears "quite encouraging" because it is the first time in the past seven years that a decline in real purchasing power at SLAC may be reversed.

Even though PEP was not funded, the Zero Gradient Synchrotron at the

Table 1. ERDA physical research and fusion power R & D

Physical research program	(millions of dollars) FY 1975 (est.)	FY 1976 (est.)
High-energy physics total	131.5	148.3
Batavia Accelerator	35.4	42.6
Alternating Gradient Synchrotron	25.0	27.8
Zero Gradient Synchrotron	14.0	15.3
Stanford Linear Accelerator Center	24.8	27.6
Bevatron	1.6	0.6
General research and development	30.8	34.4
Nuclear sciences total	71.7	78.1
Medium energy	23.4	26.8
Heavy ion	18.0	20.1
Low energy	19.9	20.1
Theory and separated isotopes	10.4	11.1
Material sciences	39.8	43.6
Molecular sciences	38.6	42.5
Physical research total	281.6	312.5
Fusion power R&D program		
Operating budget total	85.0	120.0
Confinement systems	41.6	64.0
Development and technology	24.9	32.0
Research	18.5	24.0
Capital equipment	19.8	16.0
Construction	0.5	8.2
Fusion power R&D total	105.3	144.2