Rise in energy R&D leads the way in 1975 science budget

The energy crisis may have a silver lining for many researchers as the FY 1975 Administration budget request for energy-related research has sharply increased over FY 1974 levels. Federally-sponsored research and development could be funded 10% more for FY 1975—for a total outlay of $19.6 billion. Of this, $1.8 billion would be earmarked for energy-related research and development, an 80% increase over the FY 1974 allocation of $999 million. The largest portion of this energy money would be allotted to the Atomic Energy Commission ($932 million).

The FY 1975 National Science Foundation budget request is for $788.2 million, $141.8 million more than last year. Of this increase, $137.9 million is directly in support of the accelerated national energy R&D program.

Edward Creutz, NSF assistant director for research, spoke to us about the meaning of additional energy funding. "The purpose of the increased energy-related research funding is to enhance our understanding of energy-related phenomena not only for currently conceived applications, but for future use in energy developments, only some of which are now foreseen. These are certain areas of science where it is quite clear that more knowledge would help us plan for and face problems of energy supply, transportation, transformation and use."

To coordinate energy research activity at NSF, Creutz indicated that an Energy Related General Research Office (ERG) would be formed. "This office will have no program budget itself," he said, "but will coordinate the energy-related proposals that come from outside after they have gone through the appropriate technical section office."

Large increases in research funding are budgeted for several NSF RANN programs including solar-energy research (an addition $36.8 million) and for location of geothermal resources (an added $16.6 million). The total budget for the RANN program will also be greatly enhanced, with $75.1 million for FY 1974 and $148.9 million for FY 1975.

Other projects for which NSF would provide increased funds include an additional $8 million for accelerated development of the Very Large Array for radio astronomy as part of $10 million more for the four major National Astronomy Research Centers and the National Center for Atmospheric Research. (FY 1975 request is $52.5 million.) NSF support this year is also expected for research in the polar regions, in the oceans and to provide for US participation in the 45-nation International Geodynamics Program.

The NSF physics section budget request is 23% more than for FY 1974

CREUTZ

(Table 1). This large increase, according to section head Marcel Bardon, has two major causes—the first is the $2.6 million in new money for energy-related work. This is money that did not exist last year and should provide new opportunities during FY 1975. The other major increases come in elementary-particle and intermediate-energy

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French spending on nuclei and particles holds steady

Nuclear and particle physics in France are in a steady-state situation at a time when the rest of French physics is expected to be getting increased funds. So we were told by Jean Teillac, director of IN²P³, the Institut National de Physique Nucléaire et de Physique des Particules, which controls roughly half the money spent for French nuclear and particle physics, that portion of the science budget funded through the Ministère de l'Education nationale. The other half of the French nuclear and particle-physics budget is administered by CEA, the Commissariat à l'Energie Atomique.

Chatting in his Paris office with Teillac and his assistant, Jean Yoccoz, we learned that the emphasis in particle physics these days is in preparation for the 400-GeV Super Proton Synchrotron (SPS) at CERN. In nuclear physics, two major efforts are being mounted: conversion of the Saturne accelerator from high to intermediate-energy physics and construction of a large heavy-ion accelerator.

In France the Commission de la Recherche pour la Preparation du Plan has recommended for the sixth plan (1971–75) that nuclear and particle physics increase by 5%. In fact the increase has been 6–7%, but because of inflation the real increase is 0.5–1%. For the rest of physics, the plan calls for a 10% increase, again not taking into account inflation. Teillac expects that over the next five years there will be at most an increase of 1% in the number of jobs in nuclear and particle physics. While the number of physicists will essentially remain stable, he hopes that the money for each physicist will increase. He expects that the share that nuclear and particle physics gets out of the total physics pie will remain the same.

In 1973 the total French expenditure on nuclear and particle physics, including salaries, was about 600 million francs. Of this the contribution to CERN was 180–200 million francs, IN²P³ spent 200 million and CEA another 200 million francs. For each of the two agencies the money was split about the same—half for nuclear physics and half for particle physics. Taking into account the contribution to CERN, this means that France spent about two-thirds of its nuclear and particle physics budget on high-energy physics.

Manpower distribution is a different story. IN^2P^3 supports about 230 physicists in particle physics and about 410 in nuclear physics; of these 410 about 100 do applied nuclear physics in chemistry, astrophysics and solid-state physics. In addition, IN^2P^3 supports about 2000 technicians and engineers.

In particle physics, the sixth plan gave top priority to construction of the SPS. The next highest priority was for construction of a 1.7-GeV electron-positron storage ring at Orsay, which is called DCI. It is expected to be completed this year. An earlier Orsay storage ring, ACO, is a 0.5-GeV electron–positron machine.

During the fifth plan, the emphasis was on bubble chambers, and France built Gargamelle, Mirabelle and paid for ⅓ the cost of building the Big European Bubble Chamber, BEBC. Since then, during the sixth plan, the French bubble-chamber effort has been on apparatus for scanning photographs—there are now two at IN^2P^3 and one in the CEA laboratory at Saclay. The trend of French physics, Teillac notes, is away from bubble chambers and towards electronics. Now among those working in IN^2P^3 there are 110 physicists in bubble chambers and 110 in counter physics.

Teillac is concerned about the problem of big equipment for the SPS because the French government gave considerable money for construction of the accelerator but only a small part for beams and equipment.

In nuclear physics France has seven electrostatic accelerators, one 60-MeV variable-energy cyclotron at Grenoble, a 150-MeV synchrocyclotron at Orsay, a 300–600 MeV linac at Saclay and the heavy-ion accelerator (ALICE) at Orsay. Two MP Van de Graaff accelerators, one in Orsay and one in Strasbourg, started operating last year.

In the future, French nuclear physics will concentrate on heavy-ion physics and nuclear-structure studies with particles of 0.4–2 GeV. And IN^2P^3 will join forces with CEA to run these programs as national laboratories, a trend which Teillac expects to continue.

To do nuclear-structure physics, the 3-GeV accelerator Saturne, at Saclay, will be converted from a weak-focusing to a strong-focusing synchrotron, if all goes according to plan. Although the radius will be changed, along with the magnets, the building, beam-transport and experimental areas would remain the same. Resolution and reliability would be improved and intensity would increase by a factor of ten. Teillac hopes that the reconstruction will begin this year and last three years, at a cost of 40 million francs. At present Saturne is a CEA machine but with the new plan it would be jointly operated by CEA and IN^2P^3.

The heavy-ion accelerator is proposed for the seventh plan, which begins in 1976. For the next two years technical studies will be going on. Like Saturne, the heavy-ion machine would be a national laboratory, jointly sponsored by CEA and IN^2P^3. The machine would resemble the design proposed by Oak Ridge National Laboratory (PHYSICS TODAY, July 1972, page 18). It would consist of two sector-focused cyclotrons, each of which could be used separately. In addition, one cyclotron could act as injector for the other after the beam was passed through a stripper. Eventually, it is hoped to add a tandem electrostatic accelerator, too, which would inject into one of the cyclotrons. If both cyclotrons are used, the energy available for light nuclei will be 100 MeV/nucleon; for heavier nuclei the energy drops, so that for uranium it is only 10 MeV/nucleon.

If construction begins in 1976, Teillac expects the machine would be completed in 1980 or 1981. It would cost 150–200 million francs, including the building and beam transport.

What about the rest of Europe? Teillac feels that in general, nuclear and particle physics are in a steady-state situation. England is having a revival with plans for constructing a 30-MeV electrostatic accelerator at Daresbury. In Darmstadt, West Germany, the heavy-ion accelerator UNILAC is expected to be finished in 1975. French nuclear physicists use CERN's 600-MeV synchrocyclotron, which is now being considered for shutdown, much to the dismay of some of the smaller European nations. The Swiss meson factory, SIN, is just coming on the air, but Teillac does not expect French nuclear physicists to be using it because of the high contribution needed to participate. In fact, Teillac believes that hardly any French physicists will be doing meson physics.

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physics. Some installations, including LAMPF, the Bates Electron Linear Accelerator and the Columbia-Nevis Synchrocyclotron, which were initiated during the 1960's are now coming into operation. Money is requested for user support for these and for users at NAL. This support would represent a major new thrust particularly in intermediate-energy physics. Additional support for atomic physics projects dropped by other agencies is also expected.

The budget proposal for the NSF Division of Materials Research (Table 2) is \$45.4 million, with the largest amounts going for solid-state and low-temperature physics and materials research laboratories. Research emphases include the microscopic understanding of catalytic behavior and the development of a long-period (1-second) pulsed magnet with field capability in excess of 400 kilogauss. A more detailed breakdown of physics research in NSF's physics section and materials-research division will appear in the May issue of PHYSICS TODAY.

The NSF astronomy section is requesting an increased allocation of 20% over last year. (FY 1975 budget is \$11.5 million.) The emphasis this year, according to section head Robert Fleischer, is astronomical instrumentation, in accordance with the Greenstein Committee recommendations. Specifically under investigation will be instruments put at the eyepiece of a radio or optical telescope to increase the efficiency of catching photons.

Atomic Energy Commission. The AEC basic physical research program will also be expanded in the coming year into more energy related areas (Table 3). Additional energy-related funding is expected for the molecular and materials-sciences programs. Fundamental materials-sciences projects to be pushed, according to Daniel R. Miller, deputy director of the physical research division, include radiation damage studies, high strength materials research and superconductivity (with applicability to CTR, energy transmission, storage and distribution). There will be increased molecular-sciences research in such areas as geothermal power, hydrogen systems for energy, mathematical analysis vis-à-vis energy systems, the interaction of ionizing radiation with matter and photochemical studies.

The high-energy program has a 6% higher budget for FY 1975, but the extra money will go into the Batavia accelerator, which, Miller explained, is moving from its construction phase into its operation phase. In constant-value dollars, the other parts of the high-energy program will have lower budgets.

A 55% increase in CTR allocations at AEC will allow new projects to get underway (Table 3). CTR chief Robert Hirsch described some of the planned activity for us including the start of the Doublet-III experiment at General Atomic in California—it is a scale-up of the successful Doublet II experiment there. At Princeton the Poloidal Divertor Experiment (PDX) will involve fitting the tokamak with divertors to limit impurities. Also, the Princeton Large Torus (PLT) will be completed with funds from the FY 1975 budget and begin to operate in late calendar 1975.