

understanding of the present and past nature of APS, of the present and future outlook for physics and physicists, as discussed, for example, in the Bromley report, and then to suggest relevant action that APS should take.

Krumhansl's group found that changes in APS are needed and that these result primarily from the changes in the environment for science that have taken place in recent years. FAPS found that problems that have arisen recently are principally that "physics and physicists appear to have become generally less useful for non-academic careers," that "there has been an overproduction of physicists" and that "there is a general lack of public credence in science." While these points were not surprising, the question was what should APS do.

The committee found that useful changes could be made in APS that would enable the society to deal with these problems without any drastic changes in the APS charter or tax status. In particular, FAPS reports that lobbying and political action could be done usefully by individuals, not by the society, and that professional matters, such as employment, insurance and pension funds and guidelines for employment "can best be worked out in common with other societies and AIP."

Changes that the committee did recommend are the establishment of a Professional Concerns Committee, a Committee on Education, a Special Programs Committee, an "Education-Manpower" reserve fund, and the appointment of a few additional staff members to assist the officers of the society.

The Professional Concerns Committee would prepare plans for the maintenance of services in AIP that would cover manpower data, rosters of women and minorities in physics, the preparation of a Directory of Industrial Physics Institutions complementary to the *Directory of Physics & Astronomy Faculties*, and the continuation of the present employment services. The committee would also examine the activities of other professional societies including industrial portable pension plans and see to the completion of the "Guidelines for Employers" that is being drafted by the APS Forum. From time to time the Professional Concerns Committee would supervise the issuance of "realistic statements on 'Physics as a Career'."

The recommended Committee on Education would aim to influence the style and extent of graduate education in physics, help students to relate better to employment in industry and technology, supply solutions for the problem of continuing education for practicing physicists, develop a partnership with the American Association

of Physics Teachers in areas of interest to APS and AAPT and would encourage members of APS to work to explain the uses and purposes of physics to the general public.

The Special Concerns Committee that was recommended would arrange symposiums and information programs on interdisciplinary physics, applied physics and various topics relating physics to subjects of social or technological interest and arrange publication of the proceedings. It would also help to develop and administer programs for industrial internships, congressional fellowships and other related programs, and it would maintain lists of physicists interested in advising the public or Congress on matters of concern to physicists.

The report noted that it is not commonly recognized that the staff of APS is really quite limited, consisting of only the secretary, treasurer, assistant treasurer and secretarial staff. Additional staff members were suggested because of the present heavy burden of work and because of the expected increase of work for them as some of the recommendations of FAPS are carried out. A few additional experienced physicists are needed. A deputy secretary would help the secretary with the technical preparation of the APS *Bulletin*, the planning of meetings, liaison with AIP and handling of important correspondence. An executive aide would work on the projects that either the council or the president feel are necessary. Such projects could include the preparation of annual reports by the divisions of APS covering new developments in physics, noteworthy division activities, and reports on the activities of AIP and AAPT committees by members of APS serving on them. The FAPS report also recommends that the president should arrange for annual meetings between representatives of APS and federal science policy makers, including officers of the National Science Foundation, the American Association for the Advancement of Science and the National Academy of Sciences. All the information gained from these reports and meetings should be transmitted to the APS membership and to the physics community at large.

At the New York meeting APS Council action was taken to set up the Professional Concerns Committee and the Education Committee; an "Education-Manpower" reserve fund was set up. Sidney Millman of Bell Laboratories was appointed as a staff consultant to APS to assist in the new programs and staffing problems. The Special Concerns Committee has not yet been established; however, its objectives are being studied by the Forum on Physics and Society, which will make further

recommendations at the April meeting of the council.

The FAPS committee acknowledges that more money will be needed if these recommended programs are going to be implemented, and accordingly, it has suggested an increase in dues. The APS Council responded to this by a change in dues structure that will allow members to pay for the programs they want to see put into operation (see PHYSICS TODAY, April, page 84).

—SMH

Ancker-Johnson nominated to Commerce science post

Betsy Ancker-Johnson has been nominated by President Nixon to be Assistant Secretary of Commerce for Science and Technology. If approved by the Senate she will succeed James H. Wakelin Jr, who was Assistant Secretary until last August. Ancker-Johnson is currently Academic/Science Advisor to the Research and Engineering Division of the Boeing Company in Seattle, Washington and is head of Advanced Energy Systems for Boeing's Aerospace Group. She has also been an affiliate professor of electrical engineering at the University of Washington since 1964.

The Assistant Secretary of Commerce for Science and Technology is responsible for the National Bureau of Standards, the Office of Telecommunications, the Patent Office and the National Technical Information Service.

Ancker-Johnson's work at Boeing began in 1961 when she joined the company's Scientific Research Laboratory. Before coming to Boeing she worked at RCA's David Sarnoff Research Center and for Sylvania Electric Products. Previous to this she was a junior research physicist and lecturer in physics at the University of California at Berkeley.



ANCKER-JOHNSON

Her research interests include solid-state physics, plasmas in solids, microwaves and molecular electronics, ferromagnetism and nonreciprocal effects, and x-ray studies of imperfections in nearly perfect crystals. For the past year she has been manager of a small group studying the application of science and technology to large-scale societal needs.

Ancker-Johnson is a Councillor at Large of the American Physical Society, a member of its Executive Committee and a member of its Committee on Minorities. She is also a member of the National Advisory Committee on Oceans and Atmospheres, a member of the National Academy of Sciences Advisory Committee on the USSR and Eastern Europe, and a senior member of the Institute of Electrical and Electronic Engineers.

Roberts takes over as director of NBS

Richard W. Roberts has become the seventh director of the National Bureau of Standards. He succeeds Lewis M. Branscomb, who resigned last May. Prior to his appointment Roberts was research and development manager of materials science and engineering at the General Electric Research and Development Center in Schenectady, New York.

After completing his PhD in physical chemistry at Brown University (1959), Roberts served for a year as a National Academy of Sciences postdoctoral fellow at NBS. He joined the GE research laboratory in 1960. During these years of research he worked with ultrahigh vacuum technology, the physical and chemical properties of atomically clean metal and semiconductor surfaces, chemical kinetics and the lubrication of space-age metals.

Roberts began his career in technical

management with his promotion to manager of the Center's structures and reactions branch in 1965. By 1968 he was made manager of the Center's physical-chemistry laboratory and, later that year, also became manager of materials science and engineering. Roberts is the first chemist to head NBS.

Uranium enrichment

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future path of development for a major capital investment fundamental to the economy. By the year 2000 the investment in enrichment facilities may total some \$20 billion—about the size of the plant investment owned by General Motors.

The AEC has already taken some initial steps to encourage private participation in the enrichment business. In January the AEC announced that it had accepted seven proposals from private firms in response to a government offer to provide access to this still highly classified area for the purpose of conducting privately sponsored research and development on uranium enrichment technology. The companies accepted were Electro-Nucleonics, General Electric, Goodyear Tire and Rubber, Exxon Nuclear, Reynolds Metals, United Aircraft and Westinghouse Electric. Apparently these firms are seriously interested in competing to develop the technology needed to build enrichment facilities under contracts for customers. But it is not so clear they are eager to arrange financing themselves to own and operate new enrichment plants. An officer of one of the companies granted access by AEC explained, "The problem is essentially a financial one. The AEC is asking industry to make a capital investment of billions of dollars in a situation that still contains many uncertainties."

One problem that worries industry is that private plants would have to compete for long-term enriched fuel supply contracts with the existing government enrichment facilities, whose prices have the advantage of indirect subsidies. Also there is concern that private plants would be subject to the government's antitrust regulations, which among other things gives the government the power to control prices.

Equally uncertain is the question of whether to switch from diffusion to centrifuge separation. Of the seven companies making successful proposals, only one (Reynolds Metals) expressed interest in the gaseous-diffusion process; the other six all have emphasized work on developing the gas-centrifuge process, which has never been used by the AEC to produce enriched uranium.

This does not mean, in Quinn's view,

that these six companies necessarily favor the centrifuge approach to the exclusion of diffusion but rather that they feel there is more to be gained in doing research on the relatively young centrifuge process in contrast to the thoroughly developed diffusion method.

In either process, natural uranium (having a concentration of 0.711% U^{235}) is piped as gaseous UF_6 through the enrichment plant to bring the concentration of U^{235} up to 2–4%. In the diffusion process the uranium gas is pumped through a cascade of porous diffusion barriers, and enrichment is achieved by the slightly higher diffusion rate of U^{235} compared to U^{238} . This difference gives a theoretical separation factor per stage of only 0.4%; hence, large numbers of stages are required in series leading to the massive plant size typical of the diffusion process. (The AEC's three plants cover a total area of 270 acres.) A diffusion plant designed to enrich uranium to 4% would contain about 1200 stages in series. In addition a considerable amount of energy is consumed in maintaining the needed pressure difference across the porous barriers. The combined power level of the three AEC plants is 6100 MW at full capacity.

In the centrifuge process, the uranium gas is fed into a cylindrical rotor spinning at extremely high speeds. In this centrifugal force field the U^{238} component tends to concentrate nearer the rim of the centrifuge and the U^{235} nearer the axis. The separation factor per stage is 20–100 times that for the diffusion process, so that only 10–50 stages would be needed in a centrifuge cascade to produce 4% uranium instead of the 1200 needed for the diffusion process.

The power requirement is also less. In principle the centrifuge is a reversible process whereas the diffusion process is irreversible. In practice this means that the centrifuge process can perform the same amount of separative work by consuming only one-tenth the energy needed for the diffusion process.

The AEC and some private companies feel it is not clear yet whether the diffusion process should give way to the centrifuges. But others have more definite opinions. One of the companies granted access, Reynolds Metals, is studying the feasibility of a full-scale diffusion plant to be sited in Wyoming in the vicinity of coal fields and hence cheap electricity. In favor of centrifuges is another company with access, Electro-Nucleonics, which had been doing research and development work on gas centrifuges for several years before the AEC prohibited all private work in this area in 1967 for security reasons. "We believe there is little doubt that centrifuge separation will prove to be the most economical way to enrich



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