state & society

Bromley discusses impact of the physics-survey report

Two years ago the National Academy of Sciences Physics Survey Committee issued its final report (PHYSICS TODAY, July 1972, page 23). Recently we asked the committee's chairman, D. Allan Bromley (Yale University), what impact the report has had—upon the federal government, the physics community, the students, and the scientific organizations. Generally, the report's impact has been indirect, Bromley feels, but the recommendations have nonetheless had an effect in many ways.

One of the major contributions of the report was that it took a hard look at priorities in physics, rather than just producing a so-called "shopping list." The committee had developed a set of budgets: an exploitation budget that would exploit all kinds of possibilities, a level budget and a declining budget for each of the subfields of physics. Bromley feels that the report demonstrates that a group with widely diverse interests can agree on how the community could live, when it has to, with reduced support. The procedure has helped to give the whole scientific community somewhat more credibility in some circles, he says, and the report has been used at the highest level of government activities as a policy document. The approach used by the committee was certainly just a first cut, Bromley believes; but extensions of the concept have already been used by the Air Force Office of Scientific Research, the Office of Policy Analysis and Research of the Department of Health, Education and Welfare, and at Oak Ridge National Laboratory.

Some specific recommendations of the committee have been funded, namely the new national heavy-ion facility at Oak Ridge (PHYSICS TODAY, June, page 20) and the Very Large Array (PHYSICS TODAY, May 1972, page 17), which was also strongly advocated by the Greenstein Astronomy Survey Committee. The Bromley committee also identified other program components they felt should be emphasized over the next few years, and Bromley is told by various agency officials that these recommendations are being phased into their operations (although these value judgments are certainly not considered infallible).

Is physics support growing? Although there has been a notable increase in physics support over the past few years at NSF and AEC, it is not clear whether this has been sufficient to offset inflation. If one uses the Gross National Product deflator indices, Bromley says, it is clear that we passed through a minimum in fiscal year 1972 and are definitely on our way up again. However, if the more pessimistic consumer indices are used, the curve is still dropping, but with a lesser slope.

In the report, the committee noted that for the previous five years no new starts had been made on any significant physics facility in the US. This meant that the country was living on its facility and instrumentation capital. If this had been allowed to continue, we would have been making no allowance for the next generation of physicists. But this year the heavy-ion facility has been funded. Next year Bromley is optimistic that there will be a major new start in high-energy physics. And within a year or two he foresees a major new activity in condensed-matter physics, where for example, we have fallen behind Europe in providing intense neutron sources.

BROMLEY

continued on page 63

Debate on reactor safety shows opinion still polarized

Two scientists focused on the issues of light-water reactor safety under the aegis of the APS Forum on Physics and Society during the OSA–APS Washington meeting this April. Henry W. Kendall, a member of the physics faculty at MIT and of the Union of Concerned Scientists, argued that a sufficient level of safety has not been confirmed. Arguing that current regulations and precautions have provided a satisfactory level of safety was James S. Moore of Westinghouse Nuclear Energy Systems.

Not safe enough. Kendall began by citing the problems attending the loss of coolant at a nuclear generating plant. Molten material containing possibly 200 megawatts of heat could melt through all barriers with a possible radiation danger to the surrounding areas. The AEC requires an emergency core cooling system (ECCS) to offset the loss of coolant, but according to Kendall, "An array of design defects in present ECCS is apparent. The ECCS testing program has been narrow in scope and of a caliber very much below the capabilities of engineering science. There is a large backlog of unanswered questions about the most basic aspects of ECCS performance. It is clear that adequate experiments to confirm ECCS effectiveness have not been carried out."

Kendall also felt that insufficient studies have been made to assess the probability of various malfunctions that would necessitate ECCS use and that those limited studies covering sensitive issues and with damaging evidence have been covered up by the AEC. One study carried out for the AEC was headed by Norman Rasmussen (MIT) and includes an estimate of one limited-casualty (contained) accident per million reactor-years or one major catastrophe per billion reactor-years. The report has not been released and therefore these seemingly favorable odds have not been properly

diffuse x rays and to correlate results with radio and visible emission. A scanning modulation collimator experiment, headed by Herbert Gursky (Smithsonian Astrophysical Observatory) and Hale Bradt (MIT), is expected to determine precisely the celestial position of selected cosmic x-ray sources and to investigate their size and structure. Lawrence Peterson (University of California at San Diego) and Walter Lewin are principal investigators on a hard x-ray and low-energy gamma-ray experiment.

Bromley report

continued from page 61

Since World War II, the US has set the style and pace for research in almost all areas of physical science, Bromley told us. If we decided, for some reason, to defer building a facility or concentrating on some topic, the subject remained virtually untouched until at some future time we decided to resume work. This is no longer true. Although we still have the strongest physics enterprise in the world, Bromley says, different countries, by being selective, have focused on various salients of the field and moved ahead strongly. This problem was not sufficiently emphasized before the report, he feels, and the identification of the problem has had a significant impact in Washington.

If we decide to drop back in one subfield, we are ignoring the tight interrelationship among the subfields of physics and throughout all of science. A technique developed in condensed-matter physics appears the next day in nuclear physics, then in the study of neutron stars, then in hadronic physics, Bromley remarks. And if an idea is developed elsewhere, if we are not working on the frontier, there are real problems in picking up the idea promptly. Furthermore, if we want to do applied physics, we must already be doing good basic physics. The only difference between the two, Bromley feels, is the motivation of the person who is doing the work.

The report urged that there be multiple support of science, pointing out that in countries where this approach had been dropped, the results had usually been unfortunate. Bromley is pleased that the Defense Department, NASA, Department of Transportation, and the Department of Housing and Urban Development are maintaining at least small programs in basic physics research. The report had argued that NSF should be responsible for maintaining a balanced physics program in the US; this is made difficult, Bromley notes, because NSF also attempts to maintain a balanced internal program. Maintaining the national balance is especially important now that NSF is being urged to move into more applied research.

The response of the physics community to the report is difficult to assess. Conversations with industrial research managers suggest that the report has provided an effective overview of all of physics, a preview of the future in scientific manpower, and in many cases, specific ideas for using physicists, Bromley said.

By talking to people in a number of universities, Bromley learned that many of the physics departments have profited from the recommendations in deciding on expansions or contractions in different areas. Further, the report has helped to make it "socially acceptable not to cover the waterfront in physics," Bromley told us. During the 1960's physics departments that aspired to national stature felt that they had to have some activity in all the major subfields. But the report argued that it was not possible to spread resources that widely and still achieve excellence. Bromley does not claim, however, that the report was the only damper on such thinking. Some universities are using parts of the report as textbooks or auxiliary reading for physics majors in their junior and senior years.

Another impact of the report is that it appears to have stimulated similar studies in other sciences, for example geophysics and materials science. Bromley questions whether or not it will be worthwhile in the future to do quite as complete a study as the Physics Survey Committee did. He feels that future committees may concentrate on quicker, more specific reports. As yet there is no move towards a new physics survey.

Bromley is proud of the completeness of the scientific data base developed by his committee. He urges that the committee's recommendations on maintaining this data base be followed. When NSF discontinued support of the National Register, we lost the ability to get periodic snapshots and to do longitudinal studies—to learn about interfield migration and changing employment patterns, he says. One cannot correlate the surveys being conducted by the American Physical Society, the American Chemical Society, and the biological societies because of difference in definition, he notes.

The committee had been concerned that by the late 1970's the US would have a deficit in trained physicists because of declining undergraduate enrollments. This trend has now been reversed, at least in part, Bromley believes, because of the data base developed by the committee and because the report has demonstrated some of the potential roles of physics in society. These things have helped lure students back, he says.

Another concern of the committee was that in the 1960's the number of institutions awarding PhD's in physics had roughly doubled while the number awarding bachelor's degrees had remained almost constant. As a result, the committee maintained, many of these new PhD institutions had marginal facilities and faculty. To satisfy the desire of the faculty in these places to remain active in research, the committee had advocated postdoctoral programs for these faculty that did not involve the training of graduate students. Such a program was recently inaugurated by NSF, Bromley remarked.

The committee was concerned about interdisciplinary programs for undergraduates, feeling that such programs were better left for graduate study. Initially the leaders of such programs have a firm ground in some discipline, Bromley explained. In an undergraduate program the student tends to get a little bit of all the disciplines, which leads to a dilettante attitude in the first generation. Then when that generation attempts to teach a second generation, you're in trouble, Bromley says. Many universities are now tending to emphasize disciplinary studies for undergraduates, and then bring them together in graduate school for interdisciplinary work.

The Bromley report also made some recommendations for the scientific societies, particularly for the American Physical Society. These were studied by the Committee on the future of APS, whose report has now been published. Bromley feels it is too soon to know what, in fact, APS will do about these recommendations.

"A report such as ours," Bromley concludes, "hopefully fulfills many different functions for many different audiences. Whether or not individual physicists may agree or disagree with any specific conclusions or recommendations, this sort of report is particularly useful in stimulating many members of the corresponding scientific community to back off from their more parochial problems and consider the opportunities, challenges and problems of their field as a whole." —GBL

Illinois experiments with technology-liaison plan

A Department of Commerce experiment, underway for a year, to transfer federally developed technology to private industry is being carried out by a group of engineers and physicists for the State of Illinois. They are staff members of the Division of Science and Technology, a section of the Illi-