

corporate functions were cut to allow the research program to continue with minimum disturbance.

Personnel. "A company that is even holding the line as far as personnel is concerned is going to have to put in quite a few more dollars—inflation is the important element," Hannay said. Almost half of the companies surveyed (eleven) have not changed the size of their technical staffs; another seven note small decreases in the last year, accomplished mainly through attrition. Two companies showed major increases in staff and one a major decrease.

Several techniques employed by industry to hold layoffs to a minimum include a "people-saving policy," as one corporate spokesman put it, where major cuts in capital expenditures and in services enable the company to retain most of its people. Another company's representative told us of a system that allows basic researchers to work on applied or even engineering problems when basic-research funds decrease. If a full R&D program returns, the basic-science workers will still be available within the company.

Research priorities. We asked company spokesmen, first, if there was a notable shift in the balance between basic and applied research. Most of them responded that the basic/applied ratio has not changed much during 1974-75; only three of them noted an increase in applied work in that period. For many, any shift in priorities is part of a longer-term trend started a number of years ago. The last year and a half, many told us, was not particularly unusual.

We were also interested in learning whether there was an increased emphasis on near-term research goals. Five companies said there was indeed a shift in this direction during the last 18 months. Others noted that the move toward more near-term research was part of a changing pattern in corporate research extending over the last several years. Hannay's impressions concurred with our findings—that more near-term work has been done recently by industry, a trend that worries him. "As short-term research takes more and

more of a laboratory's R&D efforts," he said, "something has to give unless you're growing, and what has tended to give is the long-range work. Who will create transistors, lasers, xerographies, digital computers, nylons and antibiotics of the future—the big things that really transform our whole society? I question whether enough is going into grand searches of this kind."

Company problems, of course, should not be underestimated. Although top management must be made aware that the company's long-term health depends on R&D, Hannay told us, external economic effects such as inflation cannot be ignored. Another difficulty arises from governmental funding of more and more research in areas traditionally reserved for industry. As Hannay noted, "Some may be asking, why should industry bother to get into long-range work? Let the government do it." A further problem is that there is fear in some industries that the company conducting long-term R&D will not realize the full benefit, as the results become available to its competitors, Hannay added.

Because of these problems, management often finds it difficult to justify long-range R&D and this becomes especially difficult during a general economic recession. The picture that we per-

More private participation urged in laser fusion

The need for broader industry and university participation in laser-fusion research, especially with an eye toward commercial-power applications, is among the seven findings and recommendations of a special advisory panel that has reviewed the role of universities and industry in the US laser-fusion program. The panel, convened on 15 September and headed by Lawrence R. Hafstad (retired vice-president of General Motors), submitted its views in a report to Robert C. Seamans Jr, administrator of ERDA.

In assessing the possibility of fusion power from laser-imploded pellets, the panel states that "while there is serious question that economic laser-fusion power can be realized, there is, as yet, nothing definitely identified that will prevent it." It goes on to say that a pellet gain (the ratio of thermonuclear yield from the pellet to input laser energy) of 75 is required for a practical power plant. This may not be attainable under "practicable conditions . . . but the possibility is important enough to warrant aggressive development." The panel also notes that "adequate laser technology is the most important engineering problem facing laser-fusion power-system development."

Other parts of the report state that

ceive, however, is quite good—certainly better than what occurred in the early 1970's for many industries and better than general economic indicators would have led us to believe. —RAS

NRC manpower survey covers sampling of PhD's

The National Research Council is conducting a survey of doctoral scientists and engineers and urges those who have received questionnaires to respond. A stratified sampling of 62 000 is involved, including approximately 15% of all physicists and astronomers; this is in contrast to the 100% survey (the 1973 Register) conducted by AIP and APS (PHYSICS TODAY, April 1974, page 23). The NRC survey will serve as an important update to the AIP-APS Register and enable manpower watchers to compare conditions and problems among the various sciences.

According to the AIP Manpower Division, the 1975 NRC survey will provide good information for broad manpower questions in physics and astronomy. The division will participate in the analysis of the detailed NRC data for the two fields. Information from the survey is expected to be available early in 1976.

laser fusion is a potential alternative to magnetic confinement; although extra expense is involved in following two paths of development, the possible rewards (applications) are great; so the investment, panel members feel, is justified. There should be broad industry and university participation in this research effort, which is not the case at present. Nearly all federally funded work (in FY 1975, for example, \$38.4 million out of \$41.4 million) has been conducted at federal laboratories—Los Alamos, Lawrence Livermore and Sandia Laboratories. The panel suggests that initially a minimum of 10% of the federal allocation go to projects outside of the national laboratories to stimulate "external" research. A small staff at ERDA (within the Division of Military Application) is a proposed avenue for unbiased review for both government and external proposals.

A recent declassification action by the Atomic Energy Commission, ERDA's predecessor, has helped in the flow of laser-fusion research information (PHYSICS TODAY, February, page 78). The panel notes that university centers could act as liaisons between unclassified work for commercial power generation and the classified national-security applications. Another barrier can be lowered, the panel says, if ERDA liberalizes its handling of patents to the advantage of industry and universities.

Companies surveyed

The companies we contacted for this survey of industrial research and development were Bell Telephone, Boeing, du Pont, Ford, General Electric, General Motors, General Telephone and Electronics, Hughes Aircraft, International Business Machines, Itek, Kennecott Copper, Lockheed, McDonnell Douglas, Martin Marietta, Perkin-Elmer, Raytheon, RCA, Rockwell International, Texas Instruments, Union Carbide, United Technologies (formerly United Aircraft), Westinghouse and Xerox.