editorial

Instruments: the base for high-tech growth

This issue contains the first annual PHYSICS TODAY Buyers' Guide for instruments and other products used in physics research. Instruments are such a vital need for experimental physics and, indeed, for science generally that we tend to take them for granted. Perhaps this occasion of the launching of the new buyers' guide is a good opportunity to salute the great scientific instrument industry of the US. Just in terms of size, the instrument industry has become an important segment of our national economy. A recent estimate placed 1984 sales of "precision instruments" at about $21 billion, or just over one-half percent of US GNP. About half of these instruments end up in production facilities, so probably in the neighborhood of $10 billion of instruments are designated for research and development laboratories. This seems to be consistent with the total US expenditures for R&D, which will amount to about $98 billion in 1984.

The manufacture of US scientific instruments has become a huge industry which not only provides employment and economic growth in its own right, but constitutes a vital technological base for other high-technology growth industries. Perhaps the most prominent example of this phenomenon is provided by the microcircuit industry, which would hardly have been possible without a plethora of advanced instruments, ranging from crystal pullers and zone refiners through high-vacuum systems, precision furnaces, evaporators and optical registration systems. More advanced molecular-beam systems, x-ray, ion-beam and electron-beam equipment are now being used as this industry enters the submicron range of microcircuit development.

As one examines the US industries likely to grow in the future, a repeat of the microcircuit scenario seems likely, in the sense that advanced instruments will be needed in both the R&D and production phases of these industries. For example, in factory automation, the growing use of robots will be accompanied by built-in advanced instruments, which not only duplicate but greatly improve upon human sensing, data-processing and control functions. Similarly the new biochemical industry based upon genetic engineering will be built upon an array of advanced analytical, microscopical and materials-handling laboratory instruments.

R&D spending within the "precision instrument industry" group mentioned earlier is about $3 billion, or an average of about 15% of sales. In other words, the industry itself is "R&D intensive." It is extremely dynamic in the introduction of new products, perhaps excelled only by the computer industry—which, in fact, has recently become strongly integrated with many advanced instruments. Successful instrument companies work quite closely with their customers. Much of their marketing intelligence comes from working scientists who have strong ideas on what instrument improvements they need.

The instrument industry is also "entrepreneur intensive." Every experimental scientist is a potential entrepreneur. Advancement of experimental techniques in each field of research leads to prototypes of new instruments. Many of them can be the basis for the launching of small instrument companies, in basements or garages. Several contemporaries of mine have been successful in such endeavors, and have created fine instrument companies in the $10- to $100-million class, which provide economic growth and employment in their home regions. This is the high-tech growth that politicians dream about, but mostly don't know how to accomplish. I can point out Dave Coffey (American Magnetics, Oak Ridge), Carl Rosner (Intermagnetics General, Guilderland, New York), and Wade Fite (Extra-Nuclear, Pittsburgh), as good examples of the thousands of outstanding entrepreneurs in instruments. These men have demonstrated that California and Massachusetts have no monopoly on this great industry. Such successful startups take place near most of our universities, industrial and national labs; they refute the idea that scientists and professors can't succeed in business.

Finally, instruments are no respecter of the boundaries that we often erect between disciplines. Instruments developed for a particular field often turn out to be even more valuable when applied to a totally different discipline. In this connection, I will be slightly heretical and suggest that every experimental physicist should be aware of the greatest instrument show on earth, the Pittsburgh Conference on analytical chemistry and applied spectroscopy. In the March 1984 meeting in Atlantic City, 600 companies exhibited their wares, and there were many acres of every conceivable laboratory instrument on display. While this exhibition is primarily directed at chemical research, the overlap with many fields of physics is so extensive that I urge experimental physicists to consider spending a day or two at the March 1985 Conference in New Orleans. I also suggest that every experimental physicist will want to have the annual PHYSICS TODAY Buyers' Guide close at hand in the office or in the laboratory; it should prove to be a useful starting point in the acquisition of new experimental equipment. The editorial staff would welcome comments from users on their general reaction to the guide and possible improvements in it. Give them some feedback, please.

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