The 1979 Pittsburgh Conference: A Special Instrument Report

The United States economy may, in fact, be going into a recession, as many economic experts predict, but there was certainly no evidence of it at the 30th annual Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, held at the beginning of March in Cleveland. Exhibitors and visitors were out in larger numbers, booths were plusher, and exhibits were flashier than ever before. Attendance rose nearly 10 percent to 15,800. The number of companies exhibiting rose only slightly to 369, but the number of booths rose sharply to 942; since each booth is a little more than 3 meters wide, that means there were nearly 3 kilometers of aisles. Conference participants were not only prolific, they were also prosperous. Exhibitor after exhibitor noted that the people who visited their booths had funds available and were ready to buy. The only people who were doing better than the instrument companies, it seemed, were the straining-at-the-seams hotels and the proprietors of a stand selling 25-cent hot dogs. The only note of pessimism was about future sites for the conference. Cleveland went out of its way to accommodate the group: for the first time, receptionists met meeting participants at the airport and helped with transportation arrangements to the city; some hotels placed signs in their rooms asking other business travelers to reschedule their visits around the conference in order to make more hotel rooms available; and Mayor Dennis J. Kucinich corrected his gaffe of last year by appearing for the opening ceremonies. Nonetheless, the conference board of directors will not decide on the site for next year's meeting until May—a very late date and a very unusual policy for such a large meeting. Because of that late date, the group may have no choice but to go to Cleveland next year, but there was much speculation that the 1981 meeting would be held in either Pittsburgh or Atlanta.

Instrument Industry, Users in State of Flux

Subjective impressions can be misleading, but the impression of vigor given by the instrument industry at the Pittsburgh Conference is supported by some glowing statistics. World sales of analytical instruments have been growing at a rate of 12 percent per year recently and in 1978 reached an estimated $1.4 billion, according to Dataquest Inc. of Cupertino, California, a marketing research company. Dataquest further predicts that sales will grow at a rate of at least 14 percent per year for the next 3 years, and will reach $2.4 billion by 1982. Those rosy figures, however, conceal some potentially pessimistic notes about the future of sales growth and about the effects of these increases on users.

There is no question in anyone's mind that a major part of the recent growth reflects increasing governmental regulation of consumer products and industrial discharges into the environment. The Federal Water Pollution Control Act, the Resource Conservation and Recovery Act, the Clean Water Act, the Toxic Substances Control Act, and others mandate both that industry prove the safety of the products it sells and that it identify and eliminate toxic materials from its discharges. All of these activities require sophisticated analytical instrumentation. For the time being, at least, the market produced by these needs is rather inflexible: companies have to perform the analyses, so they have to have the instruments. After the first round of purchases to fill this need, some analysts predict, the instrument industry will hit a slump until those new instruments wear out. That could be as long as 10 years.

Another factor in the sales growth is the increased cost of instruments. Part of that increased cost is accounted for by inflation, but an even greater part is the result of increased sophistication and capabilities of the instruments. This trend has been exemplified during the last few years by the incorporation of microprocessors into instruments in all price ranges. Today, it is represented by the increased use of software and peripheral accessories, such as floppy disk memory systems—so-called because the small disk of magnetic media on which data are stored is very flexible. Indeed, the 1979 Pittsburgh Conference may well be remembered as the "Year of the Floppy Disk."

Such peripheral accessories are increasingly used, says Gaynor N. Kelley, a senior vice-president of Perkin-Elmer Corporation, because an instrument company can no longer succeed as only a manufacturer of hardware. In many areas of the industry—particularly in long-established areas such as infrared and ultraviolet spectroscopy—instrument capabilities have reached a plateau, and the basic instruments do not differ much from one company to another. A competitive advantage can thus be obtained only by providing a software package that will enable the customer to make better use of the instrument. The ability to provide such software packages has been abetted by ever-decreasing electronics prices, first in microprocessors and other silicon chips, and now in memory systems.

Sophisticated software packages have been available in the most expensive instrument systems for some time, of course, but their appearance in low-priced instruments is new this year. Perhaps the best examples of the trend are two new infrared spectrometer systems introduced at Cleveland, the SEARCH package from Perkin-Elmer and the Microlab 620 MX from Beckman Instruments. The SEARCH system is a software package combined with a floppy disk-based data station that attaches to existing spectrophotometers. The Microlab 620 MX is an integrated system in which spectrophotometer, microprocessor, and memory are all in one unit.

In both cases, though, the objective is the same. Spectral data from a sample are processed to identify the characteristic constituent peaks. This profile is then compared to a library of 2000

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spectra in the Perkin-Elmer system, or 4800 in the Beckman instrument, to provide either a precise or a tentative identification of the compound. Other spectral manipulations can also be performed, and accuracy of identification can be improved by using a larger library on more disks. In a sense, what the companies have done is taken a degree of experience and training in spectral interpretation that might exist in only a dozen scientists throughout the world, distilled it into a software package, and made it available to every laboratory in the country. This could have been done before, of course; but even as recently as 5 years ago, according to one Beckman spokesman, it would have required a computer the size of an IBM 370 and would probably have cost at least $200,000. The Microlab 620 MX and software, in contrast, sell for $23,000.

Several other new instruments also demonstrate this trend. The Beckman Toxsys system and the Baird Fluorocomp total luminescence spectrometer incorporate floppy disk memory systems and sophisticated software packages. So, too, do the DuPont 1090 thermal analysis system, the Cromatix GPC Lab Data System, the Spectra-Physics SP 4000 data system, the Princeton Applied Research model 384 polarographic analyzer, and the Bascom-Turner 8110 Intelligent Recorder. In varying degrees, each of these is designed to provide answers rather than spectra.

Here, too, there may be a one-time effect on sales growth. Some analysts attribute much of the recent growth in sales to the increased prices associated with incorporation of electronics hardware and software. When this round of incorporation is complete, they predict, sales will show a lower, more realistic growth rate.

The combination of rapidly accelerating technology and increasing prices is producing some unusual ripple effects among instrument users. A few laboratory heads, for example, have indicated a desire to lease rather than purchase expensive instruments right now because they fear that much more advanced models will be available in the near future. This attitude is noticed most commonly in those areas where the link between instrument and computer is not complete. Manufacturers, however, contend that they have seen little evidence of such reluctance. One manufacturer's representative, more cynical than the rest, even suggested that new instruments are only good for a couple of years anyway. Instrument leasing has increased somewhat recently, notes a Varian executive, but it still accounts for only a miniscule share of the market—certainly less than 2 percent. Instrument salesmen are attempting to overcome some of this real or perceived reluctance by offering liberal trade-in allowances for used instruments. Unlike the automobile industry, however, the majority of the trade-ins are simply junked.

The accelerating technology creates problems in a competitive academic environment because instruments must be replaced faster to combat obsolescence, whatever the cost. This necessity may alter the competitive balance among university chemistry departments. The National Science Foundation (NSF), which provides the bulk of funding for instruments in such departments, has traditionally restricted its grants to limit each department to one purchase per year. Faculties of the better schools have recently pointed out, though, that this policy and others have resulted in a slow but steady erosion of their research capabilities. NSF officials have reluctantly agreed with their contention and, beginning this year, will allow more than one award to be made to any department when a strong case can be made. Since the amount of funds available has not increased significantly, however, the practical result of this policy may be that chemistry departments in the lower echelon schools must either find new sources of instrument funding or fall by the wayside.

A final trend involves the instruments themselves. The increased simplicity of operation of instruments has frequently been accompanied by an increased difficulty of repair and maintenance. Many scientists within a department, furthermore, are frequently not aware of the capabilities of new instrumentation. Some universities, therefore, are hiring new faculty members to be in charge of all instrumentation and to assist their fellow scientists in using them to their fullest capacities; these specialists are often in charge of shops, also. The new faculty members are often accompanied by highly trained technical personnel responsible for maintenance and repair of the instruments; in many cases, these technicians receive higher salaries than full faculty members. Total budgets for operation of instruments for one department may approach $1 million per year. A few examples of such faculty members and schools where the program is working include John Amy of Purdue University, Charles Wilkins of the University of Nebraska, Frank Anet of the University of California at Los Angeles, and Paul Bender at the University of Wisconsin. As the complexity and sophistication of instruments continues to grow, such faculty may become commonplace, putting further strains on already tight departmental budgets.

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Toxicology: New Laws Mean New Instruments

The primary response of the analytical instrument industry to the increased testing mandated by new environmental regulations has so far been refinement and adaptation of existing instruments. It would be very surprising, however, if there are not a number of new instruments and systems introduced in the future to meet the needs addressed by that legislation. One harbinger of such a development is Beckman Instruments' introduction at the Pittsburgh Conference of two new systems for toxicology testing. Both are designed to simplify testing and to ensure more reliable and reproducible results.

The first system, called Microtox, is designed for monitoring the acute toxicity of waste waters, industrial effluents, and the like. Current federal regulations require that many industrial discharges be tested with fish, daphnia, or other aquatic organisms to determine whether toxic chemicals are being released; this testing is most often performed with fish. In theory, the procedure requires exposing a certain number of fish to the effluent or toxicant for 96 hours. The toxicity is then expressed as an LC_{50}, the concentration that is lethal to 50 percent of the organisms. In practice, the procedure is much more complex because the fish must be acclimatized to the laboratory for 10 to 30 days prior to the testing, trial dilutions of the toxicant or effluent are necessary to determine the best concentration for accurate results, and great care must be taken to ensure that the highly sensitive fish are not affected by external factors. Results obtained in this fashion, furthermore, are somewhat limited, both be-

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