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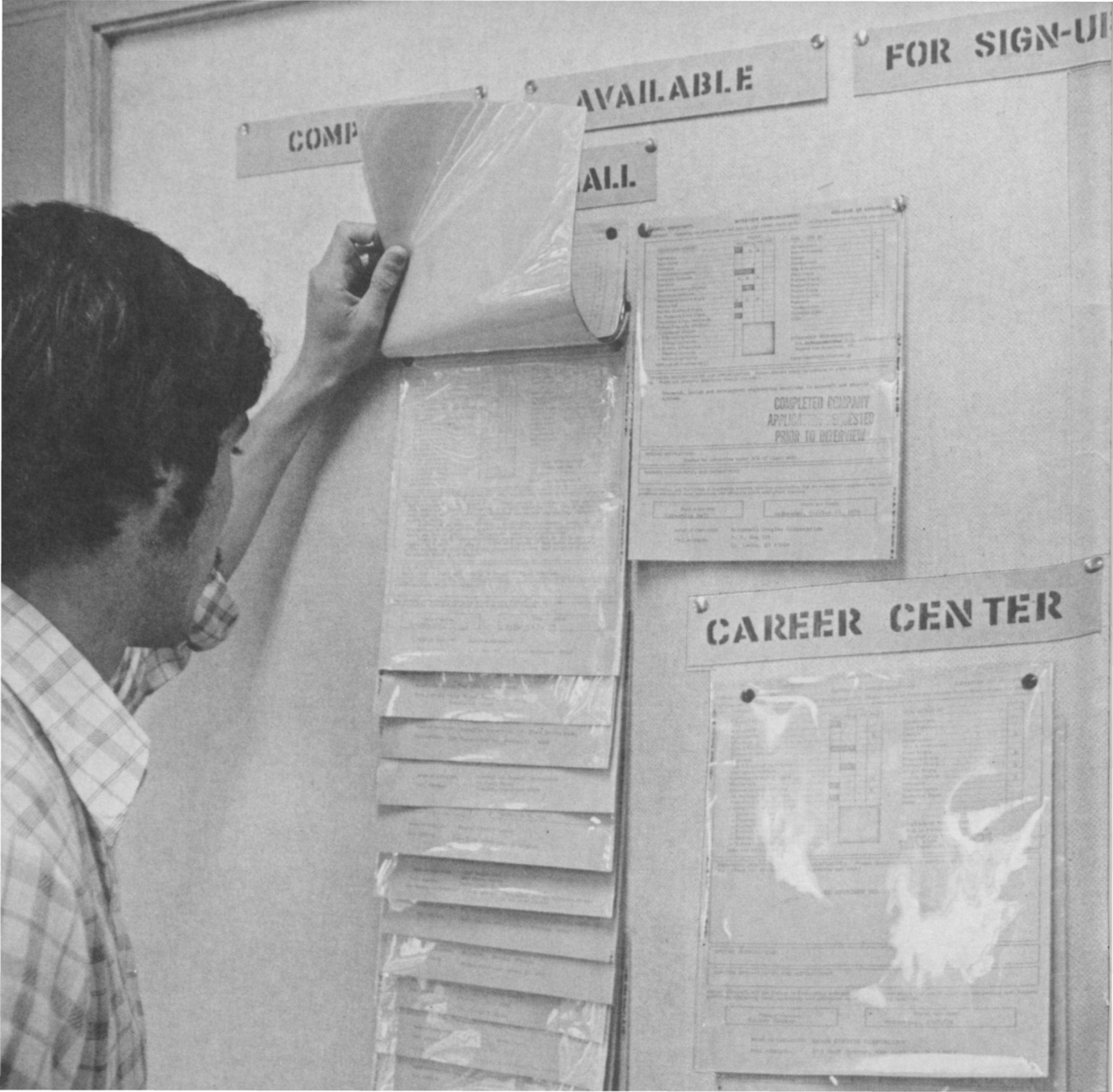
FINDING
THE RIGHT
JOB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IN THIS ISSUE

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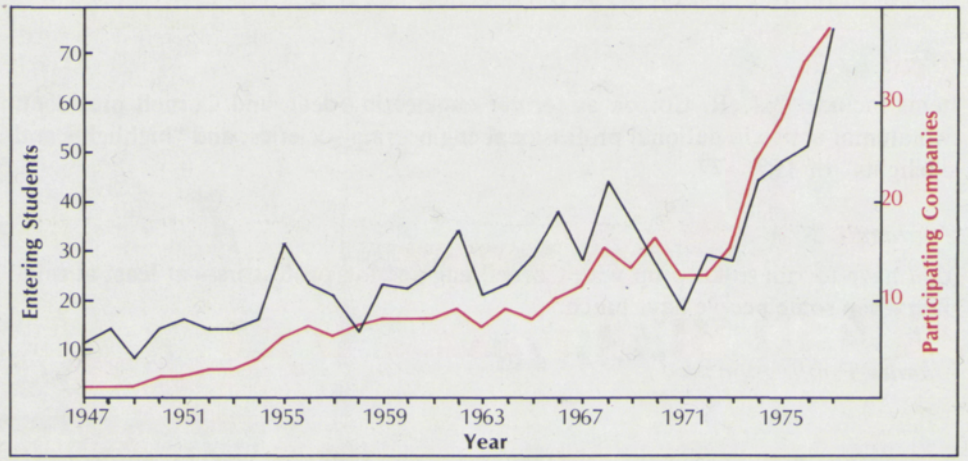
GETTING OUT WHERE THE ACTION IS

Through Cornell's Engineering Coop Program

This fall seventy-five Cornell engineering juniors will leave the campus for the term to learn about their future profession in engineering offices, laboratories, and plants around the country. They are the incoming "coop" students, participants in an expanding program that provides an engineering internship for undergraduates.

The idea of employment as a complement to an academic program is certainly not new to higher education. The Engineering Cooperative Program at Cornell has been going strong for thirty years, and others have been in existence for as long as twice that time. But there has been a marked impetus in the Cornell program in the last two or three years. More students are looking into the possibilities, more companies are participating, more kinds of jobs are opening up.

Why this rise in interest in the venerable cooperative idea? An underlying reason is certainly the tightened job situation in the United States over the past few years, and the accompanying swing toward careerism on the part of contemporary college students. At Cornell's College of Engineering, the impetus toward practical experience has been helped along by an extra shove from the coop program directors, who have worked to expand the available opportunities. *Their* reason, though, is not primarily to respond to current economic pressures. They know from experience that regardless of the times, everyone—students, employers, faculty members, the College—benefits from the interaction of engineers in training and professionals in practice, and they know how and why.



Fluctuations in the number of Cornell students in the Engineering Cooperative Program may reflect changing attitudes, economic conditions, or employment opportunities over the past thirty years. Whatever the underlying factors, the statistics on numbers of students enrolled indicate a marked rise in Program activity in recent years. The number of participating companies has increased in a roughly similar manner from about a dozen in the early 1970's to this year's total of thirty-seven. (These figures refer to the number of companies sponsoring incoming students during a given year.)

"More students are looking into the possibilities, more companies are participating, more kinds of jobs are opening up."

THE SPECIAL CHARACTER OF THE CORNELL PROGRAM

There is a special reason for the importance of the cooperative program in engineering at Cornell, and a special quality to the cooperative experience. Most engineering schools are located in or near large centers of engineering activity, but Cornell is a small-town university, and its setting in the pastoral Finger Lakes Region of New York State does not provide significant exposure to engineering practice. The College therefore seeks to augment the advantages of studying in Ithaca with opportunity for off-campus participation in "real" engineering. The work experience is integrated into the academic program and becomes part of the student's education.

It is this educational emphasis that gives the Cornell Engineering Cooperative Program its unique character. A cooperative job is not just a means of financial help—though the pay may be an important consideration and is usually more than the student could earn from jobs found independently. Rather, the opportunities for students to learn on the job in a selected environment, to develop confidence and perspective, to get a "feel" for engineering as it is practiced, and to contribute to an engineering activity are the main thrusts of the Program. These are the principal reasons students enroll, and the aspects that most graduates appreciate in later years. As one alumnus commented in a recent survey, "I learned what it meant to work as an engineer. I learned to work with supervisors, colleagues, technicians, draftsmen, stockroom workers. Most of all, I gained confidence from having actually gotten some things done."

The educational value of the work experience is enhanced by the fact that the students are well along in their undergraduate education by the time they begin their employment, and therefore can be placed in relatively challenging technical assignments. Another advantage of the Cornell plan is that there is continuity in each student's job experience because the work periods—at least two and often three—are all with the same employer. There is a chance for the student to progress toward advanced engineering activity or to acquire a broad view of an organization's operations through a planned sequence of assignments.

A hallmark of the Cornell program is the individualized way in which it is managed. Admission, for instance, is by mutual selection of student workers and employers on the basis of individual interviews. At the place of employment, the "coop" is given specific assignments chosen with regard to his or her background, needs, and interests. And although the student becomes a real employee, College representatives continue their educational supervision through careful monitoring of the student's progress.

From the undergraduates' point of view, an attractive feature of the Program is that participation does not delay graduation. In many cooperative programs, an extra year is required to accommodate alternating periods of work and study; the Cornell plan manages to avoid this by providing a special academic session for cooperative students during the summer after the

Students and company representatives meet informally as a first step in getting to know one another. Coop job arrangements are made by mutual selection after individual interviews.

sophomore year. They graduate on time, with the extra advantage of having acquired up to a year of professional experience.

THE MATCHING GAME AND OTHER PROGRAM EXERCISES

The organization and administration of the Engineering Cooperative Program is almost an operations research project in itself. Contacting and interesting participants, both employers and students, is the first step. Getting them together and arriving at suitable matches is the next. Overseeing each actual employment situation, in terms of both the student's performance and the educational effectiveness of the assignment, is a continuing responsibility for College representatives.

The process begins with efforts to introduce the possibility of participating in the cooperative plan to sophomores, who are at the point in their college programs where they must make decisions about what field to enter. Group meetings with the Program officers are held, and informal meetings with students who have already completed one or two cooperative work assignments are arranged. Student reports about their assignments and company literature about job opportunities are made available at the Program office. Individual interviews with company representatives are scheduled. As a result of all this activity, a large proportion of eligible students seeks enrollment in the Program (last year it was 50 percent), and about half of these ultimately receive and accept offers of employment.

The students begin the Program during the summer following their sophomore year. The College provides a specially arranged thirteen-week summer session that offers the courses the students would normally take during the fall term of the junior year. According to the directors, this summer session is essential to the successful operation of the Program—and probably the chief limitation to its expansion: The session must provide the specific fifth-term courses needed for each student's major so that there will be no problem of scheduling when he or she returns to the campus in the spring term to resume the normal curriculum.

The first work period is for four and one-half months, extending from about Labor Day through mid-January. The length of this period and the time of year help ensure that the student employee will be participating in the normal functioning of the organization. There is time for adjustment to a new environment and for the accomplishment of worthwhile projects. Supervisors are not busy with summer employees or recently hired June graduates, and established personnel are

These Engineering Cooperative Program students were among the nearly one hundred who held industrial jobs this past year.

1. Albert Peterson, at Eastman Kodak, was assigned to a trouble-shooting program on Ektasound projectors. He helped develop a computer program to check the functional accuracy of circuit board control elements.

2. Charles Chuang worked on the analysis and measurement of the temperature dependence of semiconductor devices at General Electric's Electronics Laboratory.

3. At Hewlett Packard, John Gammel worked with digital circuits and with interfaces between digital and analog circuits.

4. Richard Williams' assignment for Joseph S. Ward & Associates involved inspection and testing of fill material for a shopping center site in New Jersey.

Bocchino

Robert Bocchino *received his undergraduate degree in June and is completing his third coop assignment this summer with Bovay Engineers, a consulting firm in Houston. In the fall he will return to Cornell to begin a combined two-year graduate program leading to the degrees of Master of Engineering (Civil) and Master of Business Administration. The things Bocchino has appreciated most about his coop experience are the opportunity to see what engineering is like outside the university, to meet a variety of people, and to have the experience of living and working in a location new to him. The transition to Houston was easy and pleasant because he has stayed with a Cornell engineer (Chris Stockey, who completed his M.Eng. degree in 1975) whom he met through John McGeary, personnel manager at Bovay. Bocchino's specialty is civil engineering, especially highway and soils engineering, and at Bovay his assignments have been in that department. The work involved field experience as well as design. He may accept the company's offer of a regular job when he completes his graduate work; the career he envisions is several years' work in design followed by a management position. "I like working with people," he said, "and in a company with a diverse consulting business."*

Dahms, Chiang

Two Engineering Cooperative Program students assigned to different companies in Rochester have become friends as a result of their employment; they shared an apartment during the summer work period last year and are living together again this summer. Guy Dahms, *who received his undergraduate degree this spring, is a coop employee at Eastman Kodak;* Clement Chiang, *who will be returning to the campus in the fall for his senior year, is employed by Xerox. Both are specializing in mechanical engineering.*

"The Coop Program has enabled me to get out and see just what goes on in industry without making the multi-year commitment that a regular position usually entails," Dahms said. "Kodak did a great job in placing me in engineering situations I wanted. First I worked in R&D, which gave me an overall view, and then I moved into a design group, an experience at the other end of the engineering spectrum." For this summer's assignment, he was hoping to become involved in simulation studies, the field in which he plans to do graduate work.

Chiang's first assignment, in manufacturing, served to convince him that he would prefer doing research; he will be working with a research group at Xerox this summer. His main career ambition, he said, is to work toward some beneficial goal in terms of product usefulness. He may pursue graduate study in alternate energy development or geophysics.

not apt to be on vacation. The fall work period provides a solid base for the second period of employment, during the following summer, and for an additional period that may be arranged for the summer after the student has received the B.S. degree. This *second* summer work period is intended for those who plan to continue their engineering studies at Cornell in the professional Master of Engineering degree program or for an M.S. or Ph.D.

During at least two of the student's work periods, one of the Program offi-

cers visits each place of employment to assess the situation. Is the assignment suitable and educationally effective? Is the student performing well? Is there a beneficial relationship between the student and his or her associates? The Cornell representatives counsel the students, frequently make suggestions to the employers, and often gain some insight themselves into how the company organizes and conducts its engineering activity.

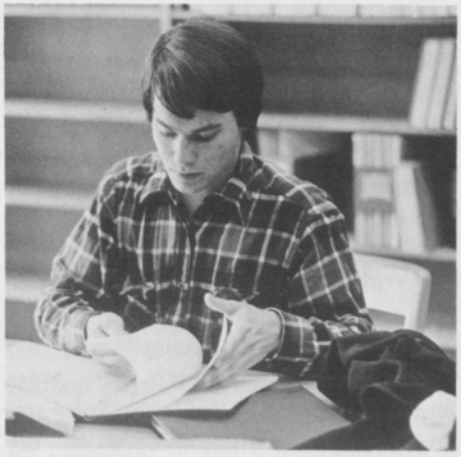
THE EMPLOYER AS EDUCATOR OF FUTURE ENGINEERS

Assuming that an effective matching of employer and student has been made, the key to a successful cooperative experience is the coop student's supervisor, usually a practicing engineer. In addition to providing day-to-day guidance, the supervisor prepares a written evaluation of the coop's performance and makes recommendations for subsequent academic work or job assignments. Frequently other engineers who have contact with the coop employee also take an interest in his or her development. The value of this kind of interaction is evident in comments of alumni surveyed by the Program office. One electrical engineering graduate, for example, wrote that "I greatly valued the opportunity to discuss educational decisions with company engineers, who regarded me primarily as a student with serious professional interests."

Employing a cooperative student is obviously a demanding commitment when it is well done. But it also offers rewards to employers. It gives them the opportunity to participate in the education of engineers, directly in the case of their student employees, and more generally through contact with

One of the unexpected opportunities that electrical engineering senior Roger Strauch *gained from his coop job with Raytheon is the chance to apply for a position as scientist for the space shuttle mission. Through his employer, he met some of the astronauts and learned about the program, which will enable companies to send scientists on the missions to direct experiments. Of course, Strauch admits, there are only fifteen potential openings and a thousand times that many applicants, but he feels he is well qualified, particularly after his coop job experience. During his initial assignment with Raytheon's submarine signal division last fall, he worked on the design of a memory controller using microprocessors; he is back this summer working in the same department on a different project. "For me, living and working in Rhode Island was an introduction to the 'real world' socially and professionally," he said. "It gave me the experience of working in a small engineering group, learning how to effectively utilize support facilities, learning how to deal with pressure personally and professionally, and getting a solid introduction to the phenomenally expanding field of microcomputers."*

Strauch



Work on a magnetohydrodynamics project to generate electricity from coal was the assignment Wayne Kennan *received from his coop employer, Avco Everett Research Laboratory, during his first work period last fall. Kennan, an applied and engineering physics major, worked mainly on computer simulation of impurity effects. This summer he was to have his choice of six other job assignments with the same company, and he feels he is acquiring not only a "real life" perspective in the area of engineering in which he is most interested, but also a broadened view of engineering research and its relation to other activities. Kennan's tentative plans are to continue his studies for a master's degree in some area of applied physics.*

Kennan

The direction of Cornell's Engineering Cooperative Program has been in the hands of these four men over the thirty-year history of the program. Seated are Everett M. Strong (left), director from 1947 to 1967, and Robert N. Allen, director until this year. Standing behind them are the current administrators: Donald F. Berth (left) and Richard H. Lance.

the educational institution. Another potential advantage is that the Program gives an employer early access to promising young engineers who may eventually be candidates for regular jobs. Although permanent job placement is not the primary aim of the Program, it is a fact that about a third of the student participants have gone to work for their cooperative employers after graduation.

As a matter of fact, Cornell engineering students constitute an unusually good pool of potential employees. They are a talented group, since the College is among the most highly selective engineering schools in the nation. They are also a diverse group, since they come from all over the United States and many foreign countries and from many racial and economic backgrounds (more than two-thirds receive some amount of financial aid).

EVOLUTION OF THE PROGRAM OVER ITS THREE DECADES

Change in the cross-sectional character of engineering classes—such as recent influxes of women and members of racial minorities—is only one of the many new situations to which the Cooperative Program has had to adjust. Its thirty-year history has been a period of remarkably rapid and fundamental change in all aspects of national, social, and industrial life.

The Program was begun in 1947, as World War II veterans returned to the campuses and university programs responded to new circumstances and needs. That first year, there were eleven students enrolled in the Program, and they were all employed by the same company, Philco. General Electric joined in 1950 and IBM in 1955, and they have been participants ever since. Over the years, these latter two companies have sponsored the largest number of students—114 for General Electric and 113 for IBM. In the early years, the entire Program was geared to the burgeoning field of electrical engineering.

The founder of the Program, and its director for twenty years, was Everett M. Strong, who retired in 1967 as emeritus professor of electrical engi-

neering. During his term as director, more than four hundred engineering students took part. For the past nine years, the director has been Professor Robert N. Allen of the School of Operations Research and Industrial Engineering, who retired this summer after thirty years on the College faculty. During his directorship, the number of students entering the Program doubled to a level of more than fifty a year and the number of participating companies tripled. Since early spring, the Program has been administered by Donald F. Berth, director of special projects at the College (who served as acting director in the spring of 1976 while Professor Allen was on sabbatic leave), and Richard H. Lance, associate dean and associate professor of theoretical and applied mechanics. In their initial season with the Program, seventy-five sophomores—an all-time high, representing a 50-percent increase over the preceding record year—were enrolled. This summer, the total number of students engaged in various stages of the Program was one hundred seventy, and the number of participating organizations was a record forty-two.

ORGANIZATIONS PARTICIPATING IN THE CORNELL ENGINEERING COOPERATIVE PROGRAM (1977)

American Electric Power Service Corporation
Avco Everett Research Laboratory, Inc.
The Badger Company, Inc.
Bovay Engineers, Inc.
Carrier Corporation
Chevron Research Company
Chicago Pneumatic Tool Company
Cornell Laboratory of Nuclear Studies
Corning Glass Works
Digital Equipment Corporation
Dow Chemical Company
DuPont Company
Eastman Kodak Company
Eaton Corporation
Emerson Electric Company
Exxon Corporation
General Electric Compony: Aircraft Equipment Division, Electronics Laboratory, and Gas Turbine Division
General Motors Corporation: Harrison Radiator Division
Greeley & Hansen
Dept. of Health, Education & Welfare: Social Security Administration
Hewlett-Packard Company: Medical Electronics and New Jersey Divisions
Howard, Needles, Tammen & Bergendoff
International Business Machines Corporation
Lester B. Knight Associates
Massachusetts Bay Transportation Authority
Monsanto Company
The Nestle Company
Nordson Corporation
Olin Corporation: Chemicals Group
Pittsburgh-DesMoines Steel Company
The Procter & Gamble Company: Engineering Division
Raytheon Company
Sanders Associates, Inc.
Scott Paper Company
Smith-Corona Laboratory
Stauffer Chemical Company
Stearns & Wheler
Structural Dynamics Research Corporation
Supermarkets General Corporation
Turner Construction Company
Union Carbide Corporation: Chemicals & Plastics and Linde Divisions
Joseph S. Ward, Inc.
Xerox Corporation
Lev Zetlin Associates

The chief reason for the expansion of the Program in recent years is that it has been opened up to students from more engineering fields. Originally only students who planned to specialize in electrical engineering were eligible. Later, mechanical engineering, engineering physics, and operations research and industrial engineering were added to the disciplines in which participants could specialize. More recently, students majoring in chemical engineering and in civil and environmental engineering became eligible. This growth has diversified the mix of employing organizations and has required an expansion of the special sophomore summer session to include the junior-year courses needed by students specializing in the six different fields of engineering.

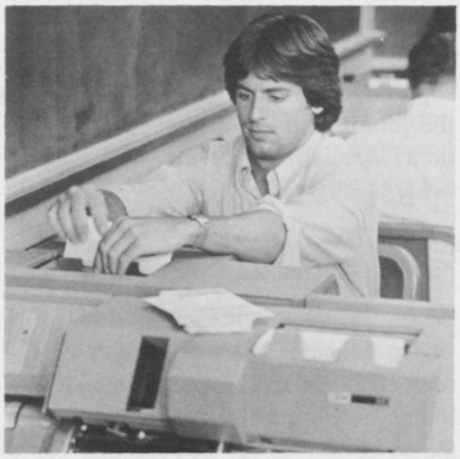
LOOKING AHEAD TO NEW PROGRAM POSSIBILITIES

Other development plans are now under consideration, according to directors Berth and Lance. One of the things they would like to implement is an extension of the opportunity for a cooperative type of program to all students, regardless of their class standing. Participation has always been restricted to those in the upper half of the class, on the theory that these students are most likely to be sought and placed by employers. But as many alumni have pointed out (in the 1974 survey and elsewhere), students in the lower half of the class are also qualified and will be making their careers, often with outstanding success, as professional engineers, and they have at least as great a need for early exposure

Cutcher (left) and lab partner

On Mindy Cutcher's *first day on the job at Lester B. Knight and Associates, her supervisor "plopped a five-inch-thick book of office standards on my desk and told me to read and know it all," she recalled from the vantage of her junior year after the initial coop work period. "I was about ready to turn around and go home," she said, "but then people started coming up to speak to me, my supervisor got me started on some basic drafting, and soon I had begun work on a set of prints for a job presentation." She not only learned drafting ("I am now adept at reading blueprints") but learned a lot about steel design ("I found I could apply theories from my structures courses and also bring back short cuts learned on the job"). The most exciting thing about the job was the opportunity to actually see a structure she had done some designing for—perhaps a building for which she had designed beams or girders—but she also enjoyed working with both architects and engineers and observing how everyone "fit together." And she appreciated being treated as an equal; "I was never talked down to," she commented. Cutcher, now a senior, plans to continue her studies in structures to earn a Master of Engineering degree in civil and environmental engineering.*

Ercole



Donald J. Ercole, *a senior in operations research and industrial engineering, credits his Engineering Cooperative Program experience with helping him decide that a career in business management is what he wants. He feels that his undergraduate engineering background, combined with graduate work in business, will be the best preparation he can get. The projects Ercole worked on for his coop employer, the Scott Paper Company, involved production and stock-market analysis. He was encouraged to work on his own with help from supervisors, and feels he developed his working skills and learned to coordinate his time and effort.*

and experience. Optional extension of the four-year program might be a feasible adaptation for students who feel they would function at a disadvantage under the intensive work-study mode of the Program as it now operates.

The utility of the third work period, during the summer after receipt of the B.S. degree, is also under review. "Employment with the sponsoring organization during the summer after graduation makes educational sense only if the student is continuing in an integrated academic program," Berth pointed out. "Students who plan to seek immediate regular employment should do so right after graduation; if the plan is to go into another academic field—business, law, medicine, or research-oriented science, for example —the summer work period would probably not contribute much except salary." A new Program arrangement, therefore, is that neither student nor company has an obligation to extend the program through the summer *after* graduation unless the student plans to enroll in a Cornell master's or doctoral program in engineering.

When there is such an intention, however, the second summer work period offers the possibility of a particularly effective arrangement. The student could spend the summer working on a design project, as required for the Master of Engineering degree, that would be assigned by the sponsoring organization. One obvious advantage is that the work would be on an engineering project actually being implemented by a professional group, and would be supervised by the professionals assigned to the project. A less apparent advantage, Berth and Lance

suggest, is that such a project assignment would promote the interaction of practicing engineers and the Cornell professors responsible for supervising the graduate students. "This kind of mutually beneficial interaction is one of the reasons for the Coop Program," Lance commented. "The College is interested in exposing its faculty as well as its students to the realities of engineering practice."

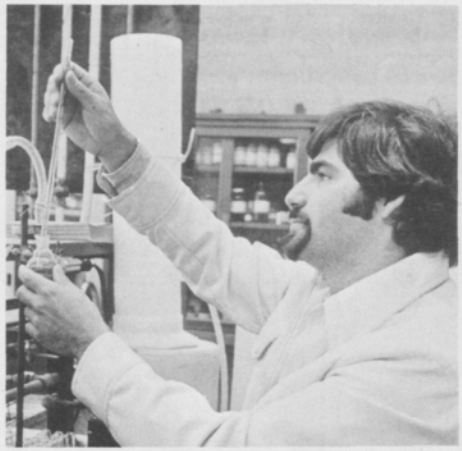
In keeping with this general aim, Berth and Lance plan to include a broader mix of companies, representing small enterprises as well as the newer high technologies.

ALUMNI VIEWS: THE COOP EXPERIENCE IN PERSPECTIVE

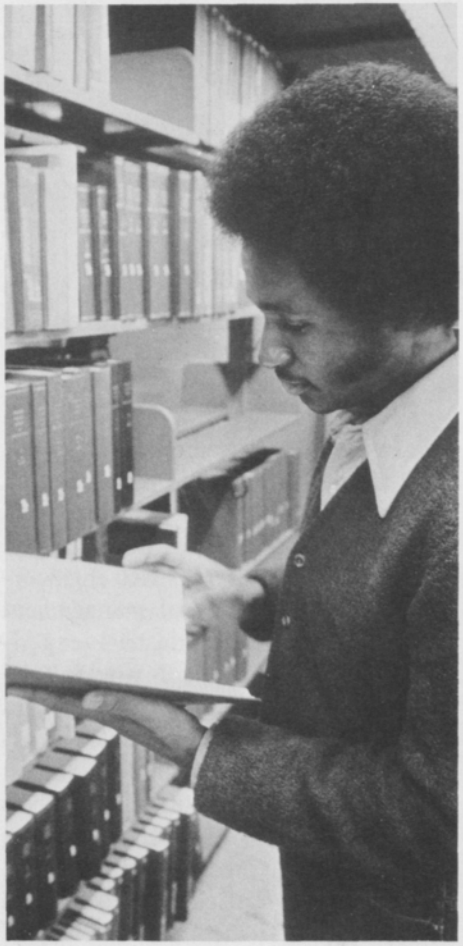
The best assessment of a plan like Cornell's Engineering Cooperative Program is probably made by graduates who participated as students and went on to careers in engineering or other fields. Cornell's engineering graduates who were in the Coop Program were surveyed in 1974 to find out what they did after graduation, why they participated in the Program, and whether and how the experience was a help to them.

Replies (representing a return of more than 60 percent) came from 284 former students all over the country. Most of them were working in firms with engineering activities—some in research, development, or design, and some in management. A few were self-employed,. or worked for government agencies or businesses not primarily engineering-related. Some had become professionals in other fields, such as law and medicine. Many (about 40 percent) obtained full-time employment immediately after graduation,

Mazzamaro



Carmon



Glenn Mazzamaro, *a chemical engineering major, accepted a permanent job with his coop employer, Exxon Chemical, after graduation in June. He is working in the same department—Chemicals Technical —in which he was employed as a coop student. "I had a pretty good idea of the kind of work I wanted to do, and my coop experience confirmed it," he said. His first coop assignment was in process engineering and included trouble-shooting, optimization efforts, and the supervision of daily production in the solvents manufacturing division. In his second assignment, he was more concerned with the business end of the plant's operations. He enjoyed this aspect of the chemical engineering industry and after several years on the job, when he becomes eligible for an Exxon scholarship, he may go to graduate school for a master's degree in business administration. One of the pleasant things about his experience at Exxon, Mazzamaro remarked, was the number of Cornell engineers he met: his first boss, Doug Walker, and the head of his department, John Stanet, are both chemical engineering graduates.*

Wilbur Carmon, *an electrical engineering senior last year, found that his experience in working as a coop student for IBM was helpful in interviewing for a permanent job as well as in providing him with insight into the operations of a big company. During his first assignment, Carmon worked as part of a technology group in the development of semiconductor logic circuits. Last summer, for his second work period, he requested and received assignment with an IBM group working on hybrid memory instrumentation; eventually he would like to design digital systems. This summer he is working at Bell Laboratories, which will be sponsoring him at Cornell as a Master of Engineering degree candidate this coming academic year, and he is hoping to get some ideas for or perhaps even begin work on the design project required for the degree.*

"...the key to a successful cooperative experience is the coop student's supervisor, usually a practicing engineer."

often with their coop firms, and some went into military service. Eventually about two-thirds of the respondents went on to graduate school, more than half of them in engineering or applied science, but also in business, science, medicine, law, or other professions.

Comments from many of the respondents demonstrated the effectiveness of the Program in the primary objective of giving students a better picture of the profession. Some typical comments were: "It gave me a down-to-earth view of engineering; I got to see some of the state-of-the-art in various disciplines." "It gave me an insight into the type of company to work for—in my case, a smaller, less structured one." "It gave me a sense of how to handle myself in an engineering situation—like having card sense when playing bridge." "I learned how to work in an engineering group as a team member." "I learned corporate makeup and divisional activities through the experience; I knew where I wanted to go and what I wanted to do."

The survey of alumni also showed that the coop experience was helpful to them as students in shaping their academic programs. "It was invaluable to me in keeping my courses in perspective, gave me some direction in my studies, and helped me choose electives," an electrical engineering graduate wrote. "I believe the coop program saved me two years in discovering a better match between my interests and possible careers," an industrial engineer concluded.

Some noted that the experience helped them identify areas of engineering they did not want to enter, as well as those they found attractive. Comments included the following: "It steered me away from strict engineering and into a technical management career path." "My industrial experience made me realize I wouldn't be happy as an engineer in industry, and thus I chose a research-oriented graduate program in biophysics."

Many of the graduates felt that their coop experience was, indeed, a major factor in their professional lives. "I found a career that challenged me and the confidence to meet that challenge," one of them wrote. "The confidence I gained from my success in the industrial environment helped me to raise my aspirations and my grades, to go on for a Ph.D., to get employment in a leading research organization, and to reach my present position," wrote a manager of research, development, and pilot production in a high-technology industry.

The idea behind the Engineering Cooperative Program is summed up well by the observation of a former student with twenty years of experience in the profession. "I think the most valuable insight that the coop student can gain," he wrote, "is recognition that the real world of engineering is not a dreamland of creative designing. It is noise, stray capacitance, product cost budgets, schedules, cost overruns, drafting delays, union problems, and a host of comparable irritants to counterbalance the financial rewards and the creative satisfaction. The earlier a fledgling engineer is tempered by or exposed to this reality, the easier it will be for him to make an effective start in his career."

Former Program Director Retires

For the past nine years, Robert N. Allen and Cornell's Engineering Cooperative Program have been closely associated. During his tenure as director, cooperative students have come to know Allen better than most students get to know their professors, and have benefitted from his interest in and concern for their individual progress. For his part, Allen has devoted much of his time to running the Program, with all that entails: getting to know each student and his or her goals and abilities, being available for conference in the Coop Office, traveling to industrial plants, arranging campus visits and interviews for company representatives. A major achievement during his directorship was an expansion of the Program to include all the major engineering fields in the College.

This summer, after more than thirty years on the Cornell faculty, Allen retired and was named professor, emeritus of operations research and industrial engineering. Colleagues have pointed out that Allen's success as a member of that faculty, mainly as a teacher of accounting, is apparent in the responses of alumni who were contacted recently by the School: Allen is unusually well remembered for his warm relations with students and for his effectiveness as a teacher.

Left: At a farewell party given this spring for the Allens by Cooperative Program students, a rocking chair with Cornell insignia and an inscribed plaque were presented by the students. Other gifts were an inscribed silver tray from students in Allen's accounting class and a book, World Atlas of Golf, *presented by a group of assorted deans and directors whom Allen referred to as his "mixed bag of bosses." The general consensus was that in the Allens' future, golf will prevail over the rocking chair.*

A native of nearby Cortland, Allen first came to Cornell as a freshman in 1936. He earned a degree in administrative engineering, then an option in mechanical engineering, and after a brief period as an assistant in that program, he served in the Navy during World War II. In 1946 he returned to Cornell as a member of the faculty. His specialty field developed into the discipline of industrial engineering and is now represented at Cornell in the School of Operations Research and Industrial Engineering.

Throughout his years at Cornell, Allen has been active in affairs that directly concern students. In addition to directing the Cooperative Program, he has served on College and University committees on admissions, academic standards, financial aid, and physical education and athletics. He is a member of the American Society for Engineering Education, the National Association of Accountants, and Pi Tau Sigma.

Allen and his wife, Pat, left Ithaca this summer to establish a new home in Venice, Florida. But he took with him the appreciation and affectionate good wishes of many associates, particularly the colleagues, students, alumni, and industrial representatives who worked with him in the Engineering Cooperative Program.

An Album of Coop Program Alumni

When this article about the Engineering Cooperative Program was being prepared, a group of alumni who had once been participants was selected at random and asked to tell us about their careers and how they feel about the Program in retrospect. Even in this small sampling, there are represented practicing engineers, executives, research scientists, college professors, and members of non-engineering professions—a reflection of the diverse aspirations and achievements of Cornell engineering graduates. It may be noted that not all the fields are represented; some were included in the Program too recently to have alumni in this group.

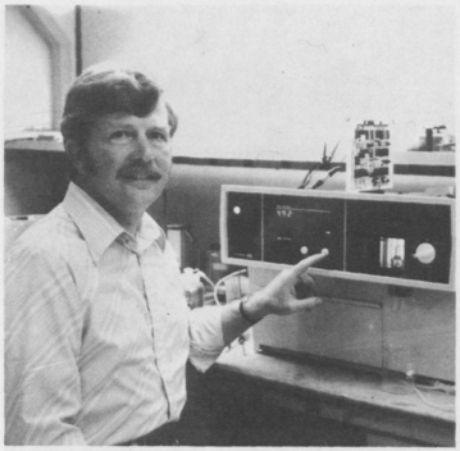
■ Two Cornell engineers working at Oak Ridge in the field of nuclear reactor technology are Engineering Cooperative Program alumni. *George H. Clare,* an engineering physics major who received his M.Eng. (Nuclear) degree in 1973, is now a senior engineer in the advanced reactors division of Westinghouse. *Michael Roberts,* a 1962 electrical engineering graduate who earned the Cornell Ph.D. in 1966, is a technical program manager for Union Carbide in the fusion energy division at Oak Ridge National Laboratory.

Clare is engaged in the licensing procedures required for nuclear reactors, and finds "the challenge of working on critical problems in an area that promises to give real benefits to our society" the most satisfying aspect of his work. His job entails exposure to a broad spectrum of technical concepts, and he has come to appreciate the value of effective communication of ideas. "I've seen many instances in which excellent work was overlooked because an individual was unable to communicate the appropriate concepts," he said. He believes, therefore, that in addition to acquiring a solid scientific and technical background, engineering students need to develop written and verbal communication skills, an often overlooked aspect of their education. Clare's coop employer was Sanders Associates.

Roberts is manager of a program aimed at developing conceptual design for the next major step in the national fusion energy program. He believes that effective program management requires a technical background with three components: (1) a broad but solid knowledge of the fundamentals of the field; (2) a detailed working experience in at least a few areas (the coop experience is invaluable for this, he says; his was with Raytheon); and (3) a wide and continuing acquaintance with other relevant fields. "What is common to all these is exposure to high-quality people doing and believing in productive work," he said. "The principal thought that remains with me after seventeen years is that the use-oriented view I came to appreciate as a coop student made my subsequent course work seem less *academic* and more *needed.* I also developed confidence and a feeling of independence in building a particular college career unlike anyone else's." In recent years, Roberts has visited Cornell as a job interviewer for Oak Ridge National Laboratory.

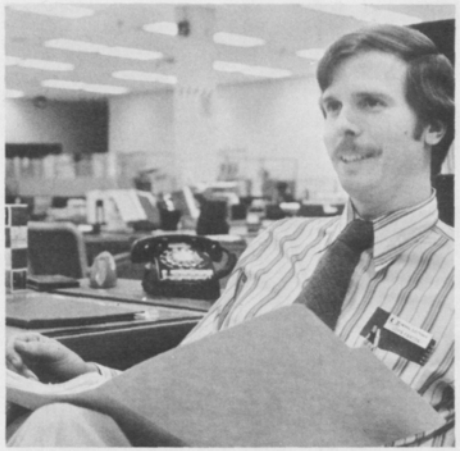
Clare

Haynes



Roberts

Fanton

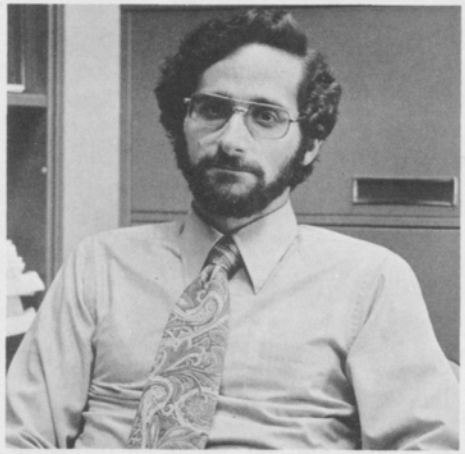


■ It worked for me," says *John Haynes,* designer of medical instruments, about his Engineering Cooperative Program experience at Cornell, which provided "an early appreciation of what tasks form an engineer's working world." Haynes majored in electrical engineering as an undergraduate, worked as a coop for the former Cornell Aeronautical Laboratory, and studied at Stanford for a master's degree in semiconductor electronics. His work as a senior scientist with Becton, Dickinson, California manufacturers of hospital supplies, offers the challenge of multidisciplinary problems that involve not only electronics, but also optics, fluid flow, light scattering, immunochemistry, and statistical theory. The most important thing for students, he says, is to learn how to learn: "how to attack a problem or a new discipline, breaking it down into manageable pieces and then assembing them into a structure." Work experience, seminars with speakers from industry, plant visits, and more work experience is what he prescribes.

■ Planning and developing new health-care products is the specialty of *John L. Fanton,* product manager for respiratory care in the Waltham division of Hewlett-Packard, who completed his electrical engineering education at Cornell with receipt of the M.Eng. degree in 1968. His coop employer was IBM. As a practicing engineer, Fanton is particularly concerned with improving both the quality and the cost effectiveness of health care; and because most engineers work in an industrial context, he feels that the nontechnical areas of engineering practice —economic considerations of design, personnel management, production constraints, and scheduling, for example—should have a place in engineering education. "A continuing interface with representatives of the commercial sector is invaluable," he said. "Offering the Coop Program is perhaps the most useful single way the College can provide such interaction; coupling this with a faculty that includes members with commercial experience should provide the best overall preparation."

Goell

Zolotar

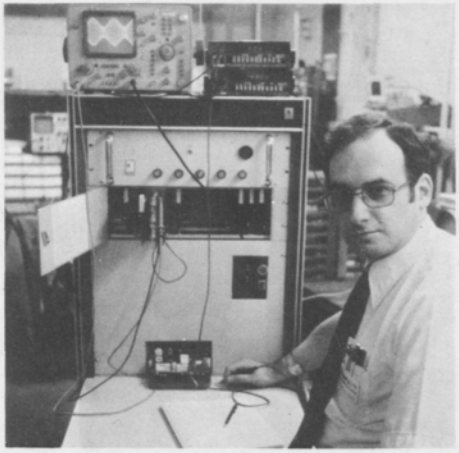


■ The director of the Fiber Optics Laboratory at International Telephone and Telegraph, *James E. Goell,* believes that his success as an Engineering Cooperative Program student at Cornell gave him the confidence needed to pursue an ambitious academic program and professional career. Goell earned all three of his degrees in electrical engineering at Cornell, the baccalaureate in 1962, the master's in 1963, and the doctorate in 1965. His coop employer was Philco. Goell considers participation in the implementation of state-of-the-art technology the most satisfying aspect of his work, which comprises management of research, development, and pilot production in the ITT laboratory in Roanoke, Virginia. The education of engineers in the expanding field of electro-optics, he says, should include training in communications technology, glass and semiconductor materials, and electronics, and also courses in practical skills such as machining.

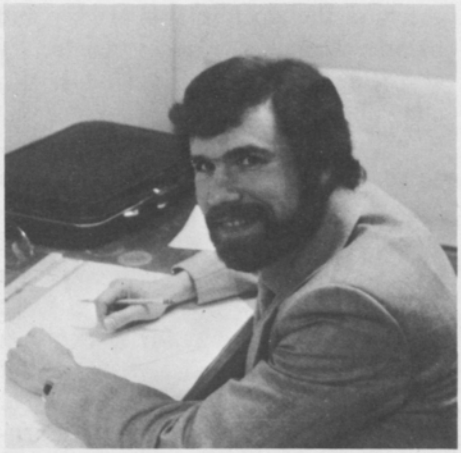
■ To *Burt A. Zolotar,* the chance to work in the forefront of new explorations for alternative energy sources is the most rewarding aspect of his position with the Electric Power Research Institute (EPRI) in California. As an undergraduate, Zolotar specialized in engineering physics, and after graduating in 1964, he continued his Cornell studies in nuclear science and engineering. At EPRI his work is in nuclear engineering, computer methodology, and research project administration. He valued his coop experience with IBM as a chance to "really participate in research" and as a help in choosing a field for specialization.

■ *Donald W. Spencer,* a process and equipment development engineer at the General Electric television business department in Portsmouth, Virginia, had his first exposure to the manufacture of TV equipment on his coop job with Philco back in the late 1950s. "Industrial experience via the Coop Program is great because it gives practical experience in actual engineering situations—in working as part of a team, with specific responsibilities and deadlines to meet," he commented. Spencer specialized in electrical engineering at Cornell, graduating in 1959 after completion of the five-year baccalaureate program then in effect, and went to work for General Electric in Syracuse. He completed a master's degree in part-time study at Syracuse University. His transfer to the television business department came twelve years after his coop assignment, and he found it interesting to note the differences and similarities. "Features that were unthought of or were not practical are now commonplace, yet some of the improvements sought then are the same ones we are still trying to make," he remarked. He works in a small group on the production of one-of-a-kind computer-controlled units, and as the market for automated equipment expands, he works frequently with mechanical engineers on the control aspects of automated process equipment. He feels his education was good basic preparation for the kind of work he is doing, but that in today's curricula there should be (as there is at Cornell) greater emphasis on semiconductors, integrated circuits, digital circuitry, and computer hardware and software. The photograph shows him with a system for testing home TV receiver modules.

Spencer



Zebuhr



■ A former coop student who has founded two companies to manufacture products of his invention is *William Zebuhr,* mechanical engineering graduate who completed his M.Eng. degree work in 1966. He is now president and major stockholder of Sunhouse, Inc., which this summer will be placing on the market a cost-effective solar system, incorporating many new features, that will provide for home heating, cooling, ventilating, and hot-water supply. He lives in Nashua, New Hampshire, in a passively solar heated house he designed and built himself. To Zebuhr, invention—the creative side of engineering—and the development, production, and marketing of a useful device or system is the most satisfying kind of accomplishment. He should know. He began his career with Emerson Electric, his coop employer, in the design of hydraulic components and electronic controls for machine tools. In 1971, after several years with Sanders Associates, he joined the associated Sanders Nuclear Corporation to work on the design of radioisotopic thermal electricity generators. (One of the products developed was a survival heating and electrical power system to be used by downed airmen.) While he was at Sanders Nuclear, Zebuhr invented a rotary heat exchanger and this led to an association with a development corporation in the field of heat exchanger technology. In 1974 he founded and became vice president of a company that produces Z-Duct, a commercial heat exchanger of his invention. Sunhouse, Inc. was established last year. Zebuhr credits the Engineering Cooperative Program with keeping him interested in engineering studies (he especially notes the influence of L. K. Stringham, then vice president of R&D at Emerson Electric Company and currently vice president for consumer affairs). For students with creative potential, Zebuhr advocates a curriculum concentrated on the basics of mathematics and physics or chemistry in order to "maximize the ability to solve new problems and minimize the tendency to gain preconceived notions about how a given problem should be solved."

Below: William Zebuhr estimates that this passively solar-heated New Hampshire house, which he designed and built, requires about 20 percent less fuel than a conventional house. His company is now planning a demonstration home with a cost-effective building core, to be used in conjunction with a solar collector system, that will provide about 90 percent of the space and water heating even in the New England climate. The core, about 7.5 x 7.5 feet square and the height of the house, contains a large cylinder of stored water that is heated by the solar energy. Additional energy is derived from a solar-assisted heat pump that may also be used to provide air cooling, humidification, dehumidification, and ventilation.

■ Two Cornell engineering faculty members are among the College's Coop Program alumni: *William L. Maxwell,* professor, and *Lee W. Schruben,* assistant professor, both of the School of Operations Research and Industrial Engineering.

Maxwell, a mechanical engineering major who received the B.S. degree in 1957, worked for Philco on his coop job. This experience, he says, helped him to realize he needed more education, and he undertook graduate work in operations research at Cornell. He received the doctorate in 1961, and became a member of the regular faculty at that time. He is a specialist in scheduling and simulation.

Schruben, a 1968 industrial engineering graduate, worked for Emerson Electric as a coop student. The Program had a lot to do with the course of his career by helping him choose a major field early on. "Course work gives a student a basis for work as an engineer, but it doesn't give an idea of what it's like to *be* one," he commented. After graduating from Cornell, Schruben worked for a year for his coop company, served in the Navy, took a job in Washington, and then began graduate school. He has a master's degree in statistics from North Carolina and a doctorate from Yale in operations research. He joined the Cornell faculty last year.

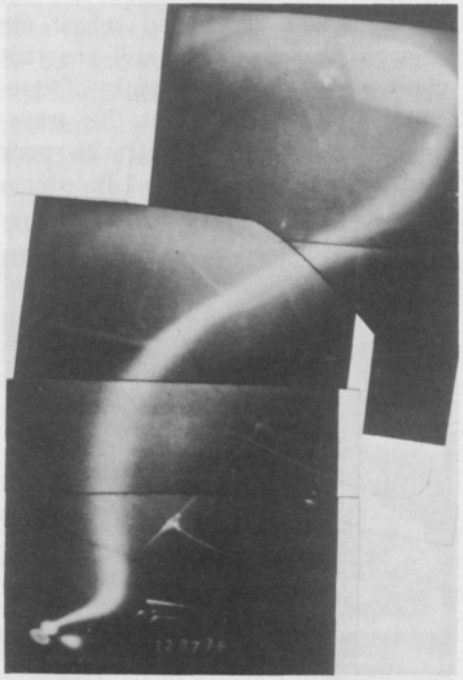
■ A coop assignment with IBM in Zürich, Switzerland influenced *David Kessler,* a 1962 mechanical engineering graduate, to "broaden his horizons" and seek a career that would combine engineering and public affairs. Since earning master's degrees in both these fields at Princeton, he has been employed mainly in technical–analytical management activities in state and city government. In his present position as deputy director for planning in the New York City Department of Probation (he is pictured here with the director, Gerald Hecht), Kessler is responsible for all planning, research, and information systems related to the agency's functions. These include the probation supervision of 2,300 children and 26,000 adults, in addition to dealing with many more cases involving juvenile delinquency, family support problems, and various offenses. Kessler finds his work in the criminal justice area challenging because of the opportunity to help protect the community and also to serve the needs of clients and influence their behavior. "It is no secret that urban communities are in need of talent to solve complex problems, many of which are technical or technological," he commented. Kessler thinks the best preparation for his kind of work is education in operations research, public administration, and computer science.

Maxwell, Schruben

Kessler (at left)

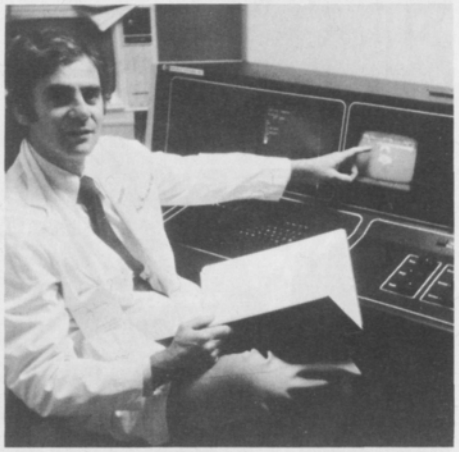
■ A career in geophysics research for *Thomas J. Hallinan* had its roots in a fifth-year project that grew out of his coop job at General Electric. At GE, Hallinan was introduced to the then-infant field of low-light-level television, and he also met the late Carl Gartlein of Cornell's astronomy department, a pioneer in auroral research who was interested in constructing a television camera for photographing the northern lights. With the encouragement of his GE supervisors and of Professor Strong, then the Cooperative Program director, Hallinan worked on the camera for his fifth-year project. After his graduation in 1964, he applied for a job with Aero-Geo-Astro ("the first name under Electronics in the Washington phone book"); by lucky coincidence, the company received a request from NASA's Goddard Space Flight Center to recommend an engineer who could work on a system for recording the aurora using low-light-level television. This became Hallinan's first full-time position. Later he continued his work on aurora at the Geophysical Institute of the University of Alaska, and undertook graduate study there. He received the Ph.D. last year and is now an assistant professor of geophysics at that university. He reports that his continuing research on natural and artificial auroras and high-altitude chemical releases takes him to many parts of the world. He has operated his special cameras on aircraft and has launched one aboard a sounding rocket (in the accompanying photograph he is performing final tests prior to launch). In a recent experiment, artificial auroras were photographed inside a large vacuum chamber.

Hallinan



Left: Composite picture, supplied by Thomas J. Hallinan, of the artificial aurora produced in a large vacuum chamber by an electron beam 20 meters long. The images were made at the Johnson Spaceflight Center in Houston by photographing the TV monitor at several of the camera's "look angles." Hallinan explained that when the electron gun (at lower left) is aimed parallel to the earth's magnetic field, the beam is straight; otherwise (as in the image shown), it corkscrews around the magnetic field.

Freedman



■ *Gerald S. Freedman,* associate professor of radiology and nuclear medicine at the Yale University School of Medicine and Cornell mechanical engineering graduate of 1959, believes that the movement into medicine of talented people with backgrounds in engineering and physics has greatly enriched medical technology. Engineering graduates who enter medicine, he says, have the asset of "the creative thinking process, which is taught to you as an engineer. Medical education de-emphasizes creative thinking and places a high premium on seeking solutions from existing information." As for the Coop Program, which he believes gives an excellent opportunity to students to develop greater awareness of potential careers, Freedman would like to see more diversification so that students could have work–learning experiences in fields peripherally allied to their courses of study. Diversity in general educational experience is one of the aspects he appreciated most about Cornell. He recalls, for example, a course in the physiology and function of the human body that he took in the home economics college after returning from his first coop job (at IBM), and a senior research project he carried out at the veterinary college. "The problem was to develop a system to spray medication into a chicken's mouth," he recalled. "We hit upon the idea of using capsules shaped like kernels of corn, which would break up when the chicken pecked. I can still see that chicken surrounded by banks of electronics, pecking away at this transducer-loaded corn kernel with peck recorded on the polygraph." Freedman notes the recent development of biomedical engineering as a discipline, and the need for people knowledgeable in both clinical and technological areas. "As a radiologist," he said, "I deal with extremely complex technology, exemplified by the computerized axial tomographic scanners which make the headlines so often now." (In the accompanying photograph, Freedman is shown at the console of the unit at the Yale School of Medicine.) Freedman received his medical training at Columbia.

Weinberg

■ Another graduate of the College who used his engineering education as a basis for work in another profession is *Steven K. Weinberg,* an associate in the New York City law firm of Kronish, Lieb, Shainswit, Weiner & Hellman, specialists in corporate law. His coop experience with IBM reinforced his plan to go into business—though as a lawyer rather than an engineer—and gave him "an insight into the structure and workings of a large corporation." Though no one course of study is clearly the best for prelaw, Weinberg says, the "rigorous analytical training found in all of the engineering disciplines is very helpful." Weinberg was graduated with a baccalaureate degree in industrial engineering in 1968 and then continued at Cornell for an M.B.A. at the business school and for the J.D., granted in 1971, at the law school.

THE BIG TRANSITION: FROM CORNELL TO INDUSTRY

by David C. Johnson

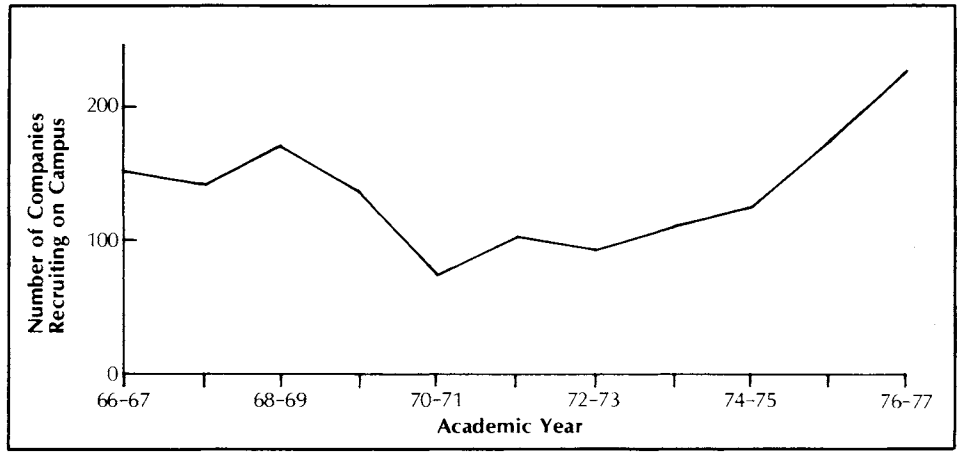
This year is the best in the engineering job market since the boom days of the 1960s. At Cornell, during the height of the corporate recruiting season this spring, the Engineering Placement Office arranged some two hundred interviews a day between graduating seniors and representatives of industrial firms and government agencies. During the 1976–77 academic year, recruiters from 223 organizations visited the College of Engineering; this compares with the 1972–73 "slump" year in engineering placement, when only ninety companies sent representatives.

This heightened activity reflects not only the increased interest of employers in finding new engineers, but also a vigorous effort by the Cornell Engineering Placement Office. The diminished job market of the early 1970s stimulated a renewed awareness at the College of the importance of helping graduates find suitable employment, and the result was a more comprehensive placement program. We on the staff believe that our office provides one of the most important services available to undergraduate and graduate students, since it functions as an often critical link between the educational and the professional worlds.

ENGINEERING EMPLOYMENT AND THE NATIONAL CLIMATE

Historically, employment opportunities for engineers have followed a cyclical pattern that corresponds closely to the general state of the economy and to the acknowledgment of national problems or goals requiring technical solutions. During the 1960s, the growth of defense-related industries and those associated with the national space program created an unparalleled demand for engineers. By 1970, however, a noticeable slump occurred, largely as a result of the nation's disengagement from military involvement in Southeast Asia and coincidentally because of severe cuts in the national space program after the success of the Apollo missions. The plight of engineers seeking jobs at that time was well documented and publicized, and it was no surprise when undergraduate engineering enrollments began a precipitous slide. Freshman engineering classes decreased by nearly 35 percent on a national basis (though not at Cornell). Many authorities, such as the Engineering Manpower Commission and the National Society of Professional Engineers, expressed great concern about the dropping enrollments and predicted a severe shortage of engineers beginning with the graduating classes of 1974. Only the economic recession, caused in large part by the severe inflationary pressure resulting from rising energy costs, prevented the engineering manpower shortage forecast from becoming reality.

A few years later, the urgent need for greater attention to energy conservation and technology development once again encouraged students to pursue engineering degrees: the number of freshmen entering the nation's engineering schools in 1976 far exceeded any first-year class during the expansive 1960s. It is a paradox, indeed, that the very problem (energy) that has created a favorable job climate for newly graduated engineers may be responsible also for the tremendous growth of undergraduate enrollments



The employment situation in engineering over the past decade, as indicated by industrial recruitment activity at Cornell. These data reflect the "slump" of the early 1970s and the recovery.

that three or four years hence may produce another "glut" of engineers on the job market. For the time being, though, the new engineering graduate can afford a genuine sense of optimism.

The big shift took place during the winter months of 1975-76. Cautious optimism seemed to pervade industry as the economy showed rather consistent signs of an upward swing. Plans for capital spending and new product development, which had been shelved for several years, received renewed attention. In addition, the emergence of whole new technologies—such as the microprocessor industry, whose phenomenal growth was made possible by the development of miniaturized integrated circuits—created a demand for a whole new array of technical expertise. It is not surprising that 1976-77 has turned out to be the best in many years for those seeking jobs in engineering.

THE JOB MARKET IN THE NEAR FUTURE

The obvious question is whether the current growth in demand for engineering graduates will continue. The answer, to the extent that the future can be foreseen, is yes. According to the College Placement Council (CPC), a clearinghouse that monitors the demand for college graduates in all fields on a national basis, engineers are likely to be the most recruited and highest paid baccalaureate degree recipients for the remainder of the 1970s. At the master's degree level, only those with Master of Business Administration degrees are likely to command higher starting salaries than engineering graduates. (A particularly advantageous combination is an undergraduate engineering degree followed by an MBA.)

While the overall job prospects for engineers appear bright, it is important to remember that the demand for engineering graduates varies widely by field or discipline. Currently, employment opportunities seem to be most favorable in those technical specialties most strongly associated with energy production and development, consumer products, and manufacturing. Demand is still sluggish in fields more closely associated with building materials and heavy construction, although activity in these areas is expected to surge in the next twelve months.

Relative demand levels for graduates are commonly inferred from average monthly starting salaries, such as those listed in Table I for baccalaureate degree graduates in engineering. According to starting-salary data reported by CPC, engineering graduates are in greater demand than those in any nontechnical field. Yet within engineering, there are marked differences among the various disciplines (the top position on the salary scale has gone to chemical engineers for many years, according to both Cornell and CPC data). The value of a master's degree in engineering, according to CPC starting-salary statistics, has increased only modestly over the last ten years: in 1966 it added an average of $125 a month to starting salaries and in 1976 it added $145.

But although starting salary is the most frequently used indicator of the comparative demands for different kinds of employees, it does not accurately reflect the degree of competi-

tion for jobs. A high starting salary is no guarantee of plentiful job opportunities. We have found that a more meaningful indicator is a company/student ratio relating the number of on-campus recruiters who express interest in students in a particular technical field to the number of potential applicants (students participating in the recruiting program) in that field. While such ratios do not indicate the absolute number of jobs available, they do imply the degree of competition among students that can be expected. Cornell data for the 1976-77 academic year are shown in Table II.

When the demand ratios in Table II are compared with the CPC monthly-salary data in Table I, it becomes evident that some specialists are in much higher demand than others in spite of what might be only marginal or insignificant differences in starting salaries. Compare, for example, the monthly average starting salaries and interview-request ratios for civil engineers and industrial engineers. According to the salary data, industrial engineers on the average receive only $31 a month more than their colleagues in civil engineering, but according to the interview-request data, employment opportunity for graduates in operations research and industrial engineering (indicated by the ratio of 1.1 in Table II) is at least double that for graduates in civil and environmental engineering (indicated by the ratio of 0.5).

Inspection of the Table II data for the traditional undergraduate disciplines (this excludes nuclear science and engineering, computer science, and materials science and engineering) reveals that mechanical engineering has a distinct edge over the other fields in terms of corporate interest and, presumably, job opportunities. Chemical engineering runs a close second (and still holds the number one position in terms of starting salaries, perhaps because of the relative scarcity of chemical engineers in the past and the consistent and often exclusive demand for them by the petrochemical industry). This kind of information may be useful to students in choosing their specialty fields. Certainly, no one would advocate the choice of a college major on the basis of its perceived job value alone, but students should be aware of the consequences of their educational choices in terms of the ease of entry into professional employment. An all-too-common problem of placement offices is an overwhelming demand for graduates in one field while students in other fields face frustration in their job searches.

It is important to remember, however, that although the "demand ratio" concept is useful in assessing the current job market, such information is not necessarily a reliable indicator for

Table I. **MONTHLY SALARY OFFERS: B.S. CANDIDATES***

Engineering Field	Academic Year 66–67	71–72	75–76
Aeronautical	$724	$884	$1153
Chemical	733	928	1279
Civil	706	869	1108
Electrical	728	888	1155
Industrial	707	871	1139
Mechanical	720	894	1197
Metallurgical	710	881	1212

*College Placement Council, *Final Reports of Beginning Salary Offers*

Table II. **RATIOS OF INTERESTED COMPANIES TO AVAILABLE GRADUATES***

Field	Companies per Student
Nuclear Science and Engineering	5.7
Computer Science	5.4
Materials Science and Engineering	2.5
Mechanical & Aerospace Engineering	1.4
Chemical Engineering	1.3
Agricultural Engineering	1.1
Operations Research & Industrial Engineering	1.1
Electrical Engineering	1.0
Civil & Environmental Engineering	0.5

*Based on interview-request data from Cornell's Engineering Placement Office

"... an effective on-campus recruitment program ... provides the best chance a student is ever likely to have to encounter a variety of employment possibilities."

future planning. The demand ratios are functions of student enrollments, and these are subject to tremendous changes over even short periods of time. Substantial shifts in undergraduate enrollment—such as the 200 percent increase in chemical engineering majors at Cornell over the past two years—will certainly affect the placement prospects for graduates if these changes occur on a national scale.

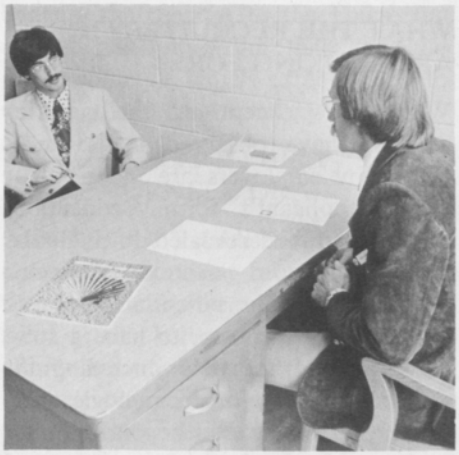
Of course, neither average starting salaries nor demand ratios reveal much about an individual's strength as a job applicant. A graduate's specialty field will tend to identify or limit the available positions, but holding a degree in a high-demand field in no way assures one of a job. Factors such as academic standing, prior work experience gained through summer or cooperative work–study arrangements, and basic communication skills can have a significant influence on a student's placement opportunities. Since a college placement office can do little, if anything, to alter either the corporate demand for graduates by field or the students' specialty choices, its most helpful approach is to concentrate on those ancillary skills that can raise the individual's chances of securing satisfactory professional employment upon graduation. This is the direction that has been taken by the Engineering Placement Office at Cornell.

THE STUDENT'S ODDS IN THE INVERTED CONE

Corporate recruiters sometimes describe college recruiting as an "inverted cone" process in which many candidates are funneled into the top to receive some consideration, but only a few emerge to receive offers of employment. It is not uncommon that for every available position, twenty to twenty-five candidates receive at least a cursory review. (The odds are not as poor as this might make them seem, however, because the companies are also in competition, all seeking to hire the most promising individuals.) As an example of how the placement process works, let us consider what happens when the ABC Company follows a typical recruiting strategy to hire two hundred new engineers:

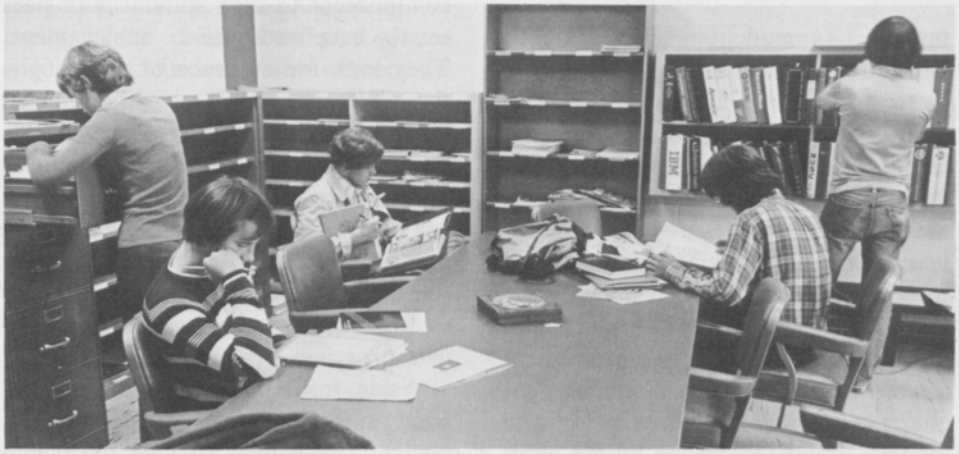
1. College visits are scheduled so as to produce a pool of 4,000 to 5,000 qualified and interested degree candidates. Students at any school are obviously in competition not only with their own classmates, but with candidates in every college visited by the recruiters.
2. Of the interviewed candidates, 800 to 1,000 are invited to the corporate facility for more detailed, second-round interviews, called "plant visits" in recruiting parlance. A candidate's odds of moving from step 1 to step 2: about 5 or 6 to 1.
3. Of those who have plant visits, some 400 receive formal offers of employment. Odds of moving from step 2 to step 3: 2 to 1.
4. Of those offered positions, roughly half accept. Odds of moving from step 3 to step 4: 2 to 1 (but entirely under the student's control).

While perhaps oversimplified, this scheme shows that the greatest attrition occurs between steps 1 and 2; only 15 to 20 percent of those interviewed are given serious consideration. In its work with participating students, therefore,



Left: The important initial job interview is usually held on campus during two-week recruiting periods in the fall and in the spring.

Below: Before signing up for interviews, students are encouraged to investigate companies and define their own goals and priorities. Information is available in this lounge in Carpenter Hall.



the Engineering Placement Office at Cornell has emphasized preparation for step 1 of the placement process—the brief but critically important initial interview.

PREPARATION, PREPARATION, AND MORE PREPARATION

The placement program instituted by the College of Engineering in 1976-77 requires the students to prepare thoroughly for their job interviews and also encourages them to develop a sense of discrimination about employment possibilities, since most students will receive several offers and some will have as many as six or eight.

The process begins during the first week of classes in the fall, when representatives of the Engineering Placement Office meet all the students who expect to receive degrees that academic year. At this initial meeting, each student is provided with a copy of the *Cornell Engineering Placement Manual,* which outlines interviewing policies and procedures, discusses how to prepare for job interviews and how to follow up on them, and gives advice on letter-writing and the preparation of personal resumes. During the following weeks in September, the placement office sponsors a number of workshops designed to acquaint students with the demands of placement participation and the results they may anticipate. One workshop, for example, is on preparation of the personal resume. Others, led by corporate recruiters, cover interviewing techniques. The main purpose of the workshops is to alleviate the apprehension that is often associated with looking for a job.

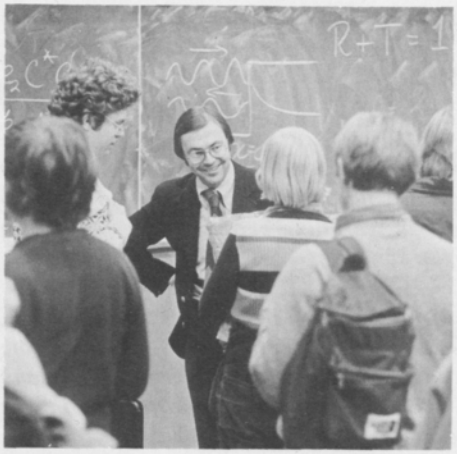
The effort to encourage students to prepare vigorously for placement interviews seems to have paid dividends. In a comprehensive survey taken of corporate recruiters who visited the College of Engineering this past year, the great majority indicated that Cornell students were well above average in their interviewing techniques. It remains to be seen whether this will result in increased job offers.

The next phase of the process, the scheduling of interviews, requires the

Engineering placement activities at Cornell begin in the fall term with a series of workshops for students who expect to apply for jobs.

Below: Last fall Robert Battaglin of Corning Glass Works conducted a seminar on "The Job Interview."

Right: A seminar on "The Plant Visit" was led by C. L. Johnson of Procter & Gamble Paper Products.



students to define their individual priorities and to assess the companies as potential employers. The success of this critical step depends not only on careful investigation of the companies, but on self-knowledge: those students who have clearly identified their technical interests and immediate career goals are in the best position to select companies, as well as to discuss cogently the possibilities for meaningful employment. In the competitive job market, where several thousand applicants are being considered for only a few jobs, a student who appears to lack direction will simply not survive the test.

Interview appointments are secured through a quasi-lottery system. Each student participant draws service cards that permit requests for up to four interviews during each of several two-week blocks of recruiting activity in the fall and in the spring. The placement staff schedules interviews according to a system that honors all first-choice requests before any and all second-choice requests, regardless of the lottery numbers; this past year, virtually all students received appointments with their first-choice companies throughout the year. Although difficult to describe, the lottery system works effectively and has eliminated the frustrating long lines and waiting periods that often characterized interview days in the past. An added benefit of the system is that the schedules for interviews are known four to six weeks in advance, permitting placement staff members to confer with companies about possible expansion of scheduling if there are substantial waiting lists.

WHAT THE RECRUITERS ARE LOOKING FOR

With a few exceptions, the qualities that we have observed to be most valued by employers are independent of an applicant's formal education, except as this is revealed through the academic record or extracurricular achievements. The potential employee is expected, of course, to have a solid knowledge of the field, including familiarity with major technologies and their applicability. But beyond this, recruiters value enthusiasm, energy, and commitment to high standards of personal excellence and achievement. They look for evidence of maturity—the ability to function without close supervision; adaptability—the willingness to undertake work in a variety of industrial environments and as a member of a team; and the ability to communicate well. These are qualities that the College encourages in its students throughout the undergraduate and graduate programs in engineering.

Aside from personal qualifications, what special advantages do Cornell students have in placement interviewing? One is certainly the national reputation of the University and its College of Engineering. Another is the fact that recruiters are attracted to Cornell because of the diversity of the student group, which is drawn from across the United States and around the world and shows little provincialism in job expectations. An additional advantage that Cornell students enjoy derives from the ties that the University and the College have developed over the years with many of America's foremost companies. Traditions of recruiting at Cornell are among the many

benefits that accrue to the University and its students from these associations, some of which extend back to the founding of the firms.

NEW EFFORTS TO HELP PLACE CORNELL GRADUATES

Although the established patterns of corporate recruiting at Cornell continue to be effective, the College placement staff believes that additional efforts are now needed to ensure that Cornell engineers have sufficient opportunities to secure suitable employment. Just as the network of corporate recruiting has expanded to touch virtually every college campus where engineering curricula are offered, so too the activities of the Engineering Placement Office at Cornell have expanded to provide greater assistance to students during what is often the most critical part of their career development: the movement from school to industry.

Within the last two years, the College has assumed an aggressive posture in two complementary efforts. One is to better prepare its students to work effectively in their profession and to find suitable employment. The other is to acquaint corporate employers with the qualifications and potential of Cornell graduates. To meet the first objective, the College is expanding and initiating programs that provide industrial exposure and experience to students while they are still undergraduates; an example is the current expansion of the Engineering Cooperative Program (discussed elsewhere in this issue). The Placement Office's new workshops on job application techniques are intended to supplement the students' substantive education and experience, helping them to market their professional skills. As part of the effort to improve and expand contact with industrial employers, the Engineering Placement Office is now preparing a resume book that presents all the 1978 degree candidates. By the time this article appears, the resume book should be available to interested companies. To our knowledge, it is the first college or university publication that provides information on students' backgrounds and facilitates access to them before a recruiting year actually begins.

Cornell's engineering placement program is administered by Dean David C. Johnson and Carol Walck, administrative aide.

No school can guarantee satisfactory employment for each of its graduates, but it can provide sound preparation and access to suitable job opportunities. This is the commitment that the Cornell College of Engineering makes to its students. It is realized in part through an effective on-campus recruitment program that provides the best chance a student is ever likely to have to encounter a variety of employment possibilities. The first full-time job, frequently obtained as the result of a placement interview, marks the crucial transition from professional education to professional practice and may well determine the course of a career.

David C. Johnson, assistant dean of the College of Engineering and director of engineering student personnel, has been a member of the Cornell staff since 1969. His responsibilities have been in the areas of admissions, student placement, and financial aid. The office that Johnson heads was recently awarded a grant from Pfizer, Inc., in recognition of the high quality of its placement program and in support of its career planning and placement activities.

Johnson is a 1967 graduate of DePauw University, where he majored in English. Before coming to Cornell, he spent two years as assistant director of admissions at Ohio Wesleyan University. He is now completing graduate study at Cornell for a master's degree in guidance and student personnel administration.

REGISTER

Corson Honored as Cornell President and Engineering Dean

Dale R. Corson, who concluded his service as president of the University this summer, is held in special esteem among Cornell engineers: Before he was president, he had been dean of engineering. This connection, in particular, was celebrated at the May dinner of the Engineering College Council, when Corson was presented with the Engineering Medal of the College and tributes from Council members and colleagues.

Corson's long association with Cornell began in 1946, when he joined the faculty as an assistant professor of physics. He became chairman of that department in 1956 and then served as dean of the College of Engineering from 1959 to 1963, when he was appointed University provost. His term as president began in 1969. Now, although he has stepped down as president, Corson is continuing his association with Cornell in his new capacity as chancellor of the University. (He is the second person in Cornell history to be elected to this position by the Board of Trustees; the first was the late Edmund Ezra Day, after his retirement as president.) As chancellor, his responsibilities will include working with the joint administrative board of the New York Hospital–Cornell Medical Center and with the president's advisory committee for the National Astronomy and Ionosphere Center at Arecibo, Puerto Rico, a facility planned and designed by engineers at Cornell during Corson's term as dean.

Corson's work in physics and engineering began at the University of California at Berkeley, where he studied for the Ph.D. in physics, granted in 1938. (He received his undergraduate degree from the College of Emporia in his native Kansas in 1934, and his master's degree from the University of Kansas in 1935.) At Berkeley, he was associated with the design and construction of the 60-inch cyclotron at the Radiation Laboratory there, and subsequently—from 1941 to 1943—he was a staff member of the Massachusetts Institute of Technology Radiation Laboratory. Later he served as a radar consultant with the Air Force and, after the war, as a staff member of the Los Alamos Scientific Laboratory; in 1948 he received a Presidential Certificate of Merit for his contributions to national defense. At Cornell, as a member of the physics department, he helped design the synchrotron that was housed in the Newman Laboratory of Nuclear Studies. He is coauthor of a book, *Electromagnetic Fields and Waves,* and has written numerous papers for physics journals. He is a fellow of the American Physical Society, a member of Tau Beta Pi and Sigma Xi, as well as Phi Beta Kappa, and a licensed professional engineer in New York State.

During his years at Cornell, Corson has also been active at the national and state levels in educational, scientific, and technological affairs. He served on the Board of Directors of the American Council on Education, and on the Council's Commission on Plans and Objectives for Higher Education. He was a member of the Panel of International Technical Cooperation and Assistance, a subpanel of President Johnson's Science Advisory Committee. He also served on the Executive Committee of the National Association of State Universities and Land Grant Colleges, the National Science Foundation's Panel on Science Development and International Affairs Programs, the New York State Commission on Industrial Research and Development, the New York State Science Advisory Council, and other advisory groups. In February he was elected chairman of the Council of Presidents of Universities Research Association, Inc.

Corson's years as a Cornell administrator have spanned a period of unprecedented change—educational, social, technological, economic, political. His

Left: At the Engineering College Council dinner, President and Mrs. Corson accept a gift of the College: a print of a drawing of the historic tangent galvonometer built at Cornell in the 1880s by physicists and electrical engineers. The drawing was chosen to represent the long-standing cooperative relationship at Cornell between physics and engineering. Arthur M. Bueche, vice president for research at the General Electric Company and chairman of the Engineering College Council, presented Corson with a camera on behalf of the Council. Edmund T. Cranch, dean of engineering, presented Corson with the Engineering Award, the College's highest honor.

term as engineering dean, during the expansive sixties, was distinguished by the development of graduate research programs, made possible largely by a $4.1 million grant from the Ford Foundation. During his first year in office, he helped organize the Center for Radiophysics and Space Research and the Materials Science Center, and he continued to encourage the development of interdisciplinary efforts. New applied science departments were introduced in the College of Engineering, and underclass studies were integrated in a common curriculum that provided a basic preparation for advanced work in many areas. Challenges of a different kind marked his presidency. He took office during the difficult years of campus unrest and has dealt ever since with continuing and emerging problems of university administration.

Corson was one of only two Cornell faculty members who became president of the University, it was pointed out by Byron W. Saunders, dean of the University faculty and professor of operations research and industrial engineering, at the May faculty meeting. Speaking to Corson on behalf of his colleagues, Saunders said that "we cannot let you leave office without your hearing words of affection moved by your quiet grace, or words of respect for your absolute integrity, or words of gratitude for your long and selfless commitment to our institution. Your presidency has helped us regain our perspective, resume our ancient dialogues, and prepare for new challenges."

At the Engineering College Council dinner, Corson's wide-ranging accomplishments as professor, department chairman, dean, provost, and president were cited with appreciation. There was a prevailing sense of his value as a leader who could be counted on for thoughtful and balanced judgments and effective action. There was a bit of parochial pride in his connection with the engineering college. But above all, there was a feeling of warmth and admiration for a humane man representing the best of Cornell.

Two Cornell Alumni Serve as Heads of Influential Engineering Organizations

Leadership in national organizations of practicing engineers—the key groups in defining engineering as a profession in the United States—has been provided in recent months by two Cornell graduates. *Harry E. Bovay, Jr.,* chairman of the board and chief executive officer of Bovay Engineers, Inc., Houston, Texas, recently served as president of the National Society of Professional Engineers (NSPE), and *Bryce I. MacDonald,* director of engineering at the Kennecott Copper Corporation, New York City, is president of the Engineers Joint Council (EJC). Bovay was graduated from Cornell in 1936 with the degree of Civil Engineer; MacDonald received the B.Ch.E. degree (in chemical engineering) in 1945.

■ NSPE represents some 72,000 professional engineers in all technical disciplines throughout the United States. The society is organized at the local, state, and national levels, and has divisions for members who are employed in industry, construction, government, education, or private practice. It is concerned with the public interest and the public welfare and with the social, ethical, economic, and professional issues that are common to all engineers.

In carrying out his functions as NSPE president-elect, president in 1975–76, and past-president, Bovay traveled more than 200,000 miles to address engineering, civic, and legislative groups across the nation. During his term as president, one of the major efforts of the society was in the area of legislation and governmental affairs; among the activities were two major conferences on the development of a national energy policy. The society also continued a court fight against a federal Department of Justice lawsuit based on an antitrust law interpretation that would require competitive bidding for professional services. A special project during the year was publication of a comprehensive book on the development of professional graduate schools of engineering similar to those now serving the legal and medical professions.

Bovay began his professional engineering career with the Humble Oil & Refining Company, where he spent ten years on a variety of assignments from junior metal inspector to project engineer. For one year during World War II, he worked as a member of the War Production Board's General Industrial Requirements Committee and as executive secretary of the Facilities Review Committee of the Petroleum Administration for War. He entered private practice in 1946 with the establishment of a firm that has developed into Bovay Engineers, Inc., a diversified consulting engineering and planning firm with more than 450 employees, offices in six cities in the South and Southwest, and clients throughout the world. During its three decades of operation, the firm has provided consultation services for construction projects costing a total of more than $2 billion; new projects total some $200 million in construction costs each year.

Bovay has been active for many years in the NSPE and in the state, regional, and local divisions for his geographical area. He served as president of the San Jacinto chapter in 1953–54, as president of the Texas society (TSPE) in 1967–68, and as vice president of the Southwestern region from 1970 to 1972. In 1967 he was named Engineer of the Year by the San Jacinto chapter, and in 1974 he was awarded the first annual TSPE Outstanding Engineer Award.

Throughout his career, Bovay has been involved in Cornell affairs, both on campus and in the Houston area. For example, his firm participates in the Engineering Cooperative Program (see the article beginning on page 1), and he has lectured in a practitioners' series for Master of Engineering (Civil) degree students. He serves on the

Bovay

MacDonald

University's Estate Affairs Committee and participates in alumni affairs as a member of the Class of 1936. He is a member of the Cornell Alumni Council.

Bovay is president of Mid-South Telephone Company, Inc., and the Lamar County Telephone Company, Inc., and is owner of Bovista Farms in Texas and Tennessee, which raise cotton, soybeans, Arabian horses, and Hereford cattle. He is a fellow of the American Society of Civil Engineers, a member of nearly a dozen other engineering and industrial organizations, and a licensed engineer in seventeen states.

■ The Engineers Joint Council (EJC), which MacDonald heads, is a federation of engineering societies that is concerned with public and educational aspects of the profession and with enhancement of the professional climate for engineers. Throughout its more than thirty years of existence, the Council has been active in organizing national and regional conferences on problem areas in which the engineering community could be of service to society as a whole. It maintains a corporate affiliates program which sponsors conferences and projects in areas of concern to engineers, professional societies, and employers. It also directs the Engineering Manpower Commission, which for many years has been a highly regarded source of information on such matters as enrollments in engineering schools, degrees awarded, and compensation of engineers.

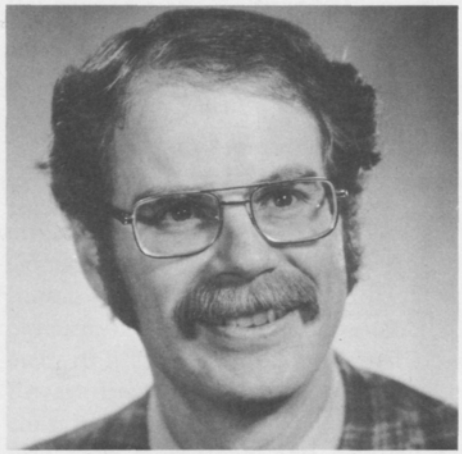
MacDonald's career has included sixteen years at the General Electric Company (1946 to 1962), where he worked in engineering and engineering management, followed by six years with the Glidden-Durkee Division of the SCM Corporation. He has been at Kennecott Copper since 1968. In his present capacity he has responsibility for engineering matters, including environmental, economic, management, and technical problems.

In previous work with the EJC, MacDonald served as a director for a four-year term and as chairman of the Metric Commission. He organized the first Joint Conference on Metric Instruction in Engineering Curricula, which was held in 1974 under the sponsorship of EJC and the American Society for Engineering Education.

He is a member also of the American Institute of Chemical Engineers; he served as chairman of the Environmental Division in 1974 and was elected a director for a three-year term beginning in 1976. He also belongs to the Air Pollution Control Association. For the past few years he has been a member of the advisory board of the Department of Chemical Engineering of the University of California at Berkeley. Since 1959 he has been registered as a professional engineer in New York State.

MacDonald maintains contact with the University through his membership in the Cornell Society of Engineers; he has been a member of the executive committee of that group since 1972. As a chemical engineering alumnus, he has been active also in organizing the fund-raising campaigns to establish endowments for the Fred H. Rhodes Professorship of Chemical Engineering and the Charles C. Winding Scholarship Fund.

Caughey



Highlights and Sidelights of 1976-77

■ Increased participation of minority students in graduate engineering study is the goal of two recently implemented programs in which Cornell is taking an active part.

A project sponsored by Rockwell International Corporation is the establishment of solid-state electronics laboratories at two predominantly minority universities—Howard and North Carolina Agricultural and Technical. Personnel in Cornell's School of Electrical Enginering are serving as consultants, and in return Rockwell is helping to equip Cornell's newly expanded facility. The four-way arrangements involve exchanges of personnel and students, and cooperative research on solar-cell technology and on microwave solid-state devices.

Two Cornell students have already completed master's degrees under a program offered by the National Consortium for Graduate Degrees for Minorities in Engineering, which comprises nineteen engineering schools and nine industrial and government laboratories. The program, which provides financial aid and summer employment in the participating laboratories, is financed in part by the Alfred P. Sloan Foundation and has its administrative center at the University of Notre Dame.

Below: Gary Harris (right) and his Ph.D. adviser, Charles A. Lee, are among Cornell participants in the Rockwell-sponsored program to promote graduate work in engineering for minority students. Other Cornell electrical engineering professors active in the project are Joseph M. Ballantyne, G. Conrad Dalman, and Lester F. Eastman.

■ David A. Caughey, assistant professor of mechanical and aerospace engineering, was selected this spring for the annual $1,000 Award for Excellence in Engineering Teaching. The award is sponsored jointly by the Cornell Society of Engineers and Tau Beta Pi, student honorary society; the recipient is chosen on the basis of student nominations. Caughey, a specialist in aerodynamics, transonic flow, sonic boom, and fluid dynamics, earned his Ph.D. at Princeton in 1969, spent a year at the Soviet Academy of Sciences as an

NSF exchange scientist and four years in aerodynamic research at the McDonnell Douglas Corporation, and then joined the Cornell faculty in 1974. He has taught courses in aeronautical engineering and aerodynamics and has offered an introductory freshman "mini course" in aircraft design.

■ Another award winner this spring was Elaine Zajac, who was chosen for the Outstanding Junior Award of the local chapter of the Society of Women Engineers. A $100 prize provided by

Zajac

the Linde Division of Union Carbide accompanies the award, which is made on the basis of academic achievement, extracurricular activities, and involvement in the society. Zajac is specializing in chemical engineering and is spending the summer on her Engineering Cooperative Program job with the Badger Company in Cambridge, Massachusetts.

■ A Cornell mechanical engineering graduate in the news recently is P. C. (Chris) Euchner, Jr., a section manager at Con Edison, who was awarded a patent for an apparatus to prevent implosion damage to boilers. He is the second of three Euchners who are Cornell engineers: Perry '15, Chris '48, and James '78. The patented device deals with a problem encountered with large boilers that require high-suction fans: Failure of the normal combustion controls can result in implosion. Euchner's invention keeps vacuum and pressure within safe limits by adjusting the maximum opening of fan control dampers.

Euchner

Above: The first recipients of Lester B. Knight Scholarships for M.Eng. students at Cornell were announced this spring. Left to right: Lee R. LaPierre, Donald P. Rhoads, Charles T. Calotta, Knight, Russell Rushmeier, and Peter D'Onofrio.

■ A new scholarship program for Master of Engineering degree candidates has been established through a $5,000 grant from Lester B. Knight & Associates, a Chicago-based management and engineering consulting firm that Knight founded and served as president until 1969. He is currently chairman of the board. A 1929 mechanical engineering graduate, Knight is a member of the Cornell University Council and was recently selected as a Presidential Councillor by the University Board of Trustees. He is the first in three generations of Cornell engineers: his son Charles, now chairman and chief executive officer of Emerson Electric Company, is a mechanical engineering graduate of 1958, and his grandson, Lester, is a sophomore.

■ An experimental course in operations research and industrial engineering during the spring term gave M.Eng. students and seniors an opportunity to work in industry. A dozen students participated in the cooperative program with the Brewer Titchner Company, parts manufacturers in nearby Cortland, New York. The course concluded with presentations of project results at the plant, and with a dinner given by the company for the Cornell contingent. Plans are to expand the program next year.

Right: One group, supervised by Professor William L. Maxwell, worked with company personnel on setting up a new process for the manufacture of blocks. Here an assembly worker (right) explains to Maxwell (left) and M.Eng. student Assad Sarkis how the blocks have been assembled.

Below: A new assembly fixture designed and built by Professor Maxwell's group is discussed by (left to right) Marshall Andrews and Jimmy Specht, both seniors; Al Sabroff, technical director for the company; and Bud Rigg, finishing plant manager.

Above: The group supervised by Professor John A. Muckstadt worked on computer control of manufacturing operations and parts inventory. Here a company file clerk explains the record-keeping system to Muckstadt (left) and senior Bob Breitman.

Right: Marketing surveys and sales forecasting were projects for student groups supervised by Professor Lee W. Schruben (at right). Inventory procedures were explained by company personnel.

■ Cornell engineers contributed to the outstanding 1977 season of three Big Red teams—the NCAA national championship lacrosse team; the crew, which took the national championship of the Intercollegiate Rowing Association; and the varsity baseball team, which won the Eastern Intercollegiate Baseball League title and qualified for the NCAA playoffs for the first time in Cornell baseball history.

Left: Coxswain Jim Howe of civil engineering and commodore Steve Dahlem of the engineering College Program jubilantly claim the Varsity Challenge Trophy after the win in the championship regatta on Onondaga Lake at Syracuse. Another engineer on the varsity crew was Doug Nordham of mechanical engineering.

Left: Defenseman Frank Muehleman, mechanical engineering junior, was the engineer on the championship lacrosse team. Muehleman received an honorable mention in the 1977 All-League team selections.

Below: Baseball team members, pictured with Varsity Coach Ted Thoren at the end-of-season banquet are (left to right): centerfield Dave Johnson (who was chosen unanimously for the 1977 all-Eastern Intercollegiate Baseball League Team); co-captain and second baseman Joseph Guarascio; and third baseman Stephen Hensler. All were seniors in mechanical engineering. The varsity team had twenty-nine wins for the season, an all-time record at Cornell. Part of the College's proprietary interest in the baseball team is owing to Coach Thoren's special status as husband of Jeanne, administrative manager in the engineering dean's office.

VANTAGE

You Have to Run to Keep Up With Cornell Engineering Professors

In at least one College of Engineering department, the way they assess a potential colleague is whether he or she intends to spend lunch hours at the Statler Club cafeteria, eating, or out on the road, running. Or so we were told by a faculty member when we proposed to prepare a feature about professors who run or bicycle on a regular basis.

We've spotted a number of them jogging along Fall Creek or biking on back roads around Ithaca, but we hadn't realized how prevalent the roadwork habit is among the Cornell engineering faculty, or how important. Easy access to athletic facilities is one of Cornell's main attractions, ranking right up there with good research facilities and stimulating intellectual and cultural environment, we were told, perhaps facetiously, by one of the runners. This anonymous addict of the daily run claims he turned down the offer of a highly paid position with an important international organization because of inferior opportunities for lunch-hour conditioning. "If I don't run, I feel like a vegetable," he explained.

The runners cover a wide range of ability and dedication, from the top echelon of competitors down to those who jog around the countryside to keep fit and enjoy the surroundings. The cyclists are a rarer breed, unless one counts the legions who bike to and from the campus for healthful, pleasant, energy-conserving transportation, but at least two are serious contenders in local competitions.

Outstanding as both runner and bicyclist is forty-seven-year-old Tob deBoer, a professor in Mechanical and Aerospace Engineering. A high point of his running career was the 1973 National Championship marathon in Rotterdam (he happened to be on vacation in his native Holland at the time), where he placed third in the master's division—for those over forty. He broke the three in that one, with a time of 2:58 for the marathon distance of 26 miles, 385 yards. DeBoer is also a veteran of the Boston Marathon, having completed the course in 1971 and 1973 with times of 3:10 and 3:05.

Currently, his main interest is bicycling, and he has garnered some im-

Tob deBoer and Leigh Phoenix, both of the mechanical and aerospace engineering faculty, are bicycle racers who work out every day starting from Teagle Hall, Cornell's athletic facility.

pressive wins in bike racing too. Last year he placed first in the veterans' division of the Lake Luzerne Cup race, an Eastern Sectional classic that fielded most of the top riders in the eastern United States. In United States Cycling Federation (USCF) district races last year, he placed first in the veterans' 25-mile time trial and first in the veterans' 50-mile road race. Locally, he placed first in the veterans' division and third overall in the annual Cayuga Lake Bike Race, an 87-mile road race around the lake.

DeBoer's first competitive sport was rowing as an undergraduate student in Delft; he began running regularly about eight years ago. "Participating in meets helps keep you fit," he commented, but basically he runs for fun and exercise. "Most of us hold firm ideas about the benefits of exercise for both our personal and our professional lives," he said. "These benefits include relief of stress, maintenance of health and first-rate physical condition, including proper weight, and, consequently the capacity to perform better and get more accomplished. With vigorous exercise like this during part of the day, no physical activities will get you tired."

Stars among the faculty runners include two other professors who compete in the master's class: Frank Moore of Mechanical and Aerospace Engineering, and Don Farley of Electrical Engineering.

Moore, fifty-four years old, competed most recently in this year's Boston Marathon, which he ran in 3:20, a good time for the master's division. Altogether he has finished nine marathons, including three at Boston. In the 1940's, as a Cornell undergraduate, he ran cross country and the two mile, but after that he hadn't been a serious distance runner until eight years ago. Now he runs about forty-five miles a week, usually during the noon hour. He also bicycles, and is a member of the Finger Lakes Cycling Club as well as its sister organization, the older Finger Lakes Runners Club.

Moore notes that running seems to be particularly attractive to people in the physical sciences or technical fields. Why? He suggests a psychological

Mechanical engineering professor Frank Moore is a bicyclist and a competitive distance runner. Another competitor among faculty runners is Will Brutsaert, of the environmental engineering department, who is now on leave.

matching of personality traits—an acceptance of hard work, perhaps, or an introspective nature—with the demands of distance running. "One could easily make a theory," he commented, perhaps illustrating another inclination of scientists. In a recent interview with Jim Myers in the *Ithaca Journal,* Moore said the reasons for running include the camaraderie with other runners and the pride of being fit. Also, he said, "there's something elemental about running in bare legs over ordinary ground that puts other things in proportion."

Farley, who is generally regarded as the best of the faculty runners, started as a Cornell undergraduate; in his junior year he won the two mile in the indoor Heptagonals, an annual winter track competition for teams from ten schools, including those in the Ivy League, that is held at Cornell's Barton Hall. In recent years, Farley has entered the fall marathon between Ithaca and Marathon (New York), which is sponsored by the Finger Lakes Runner's Club; and he participates in the club's monthly meets, which often draw more than one hundred contestants in various categories for men, women, boys, and girls. Farley has placed in the top ten in the Cornell Intramural Cross Country Race for the past three years, and has run the two mile in the excellent time of 9:58. Several years ago he entered the Haptagonals again in the master's class (open to all competitors) and placed second in the mile. He runs forty to sixty miles a week year-round, outdoors or on the Barton Hall track. "It's hard getting started if you are out of condition," he said, "but then it's very pleasant. I don't have any specific reason for running—I'm just addicted to it."

Farley holds two unusual records: the three-times-around and the ten-times-around distances for the approximately one-kilometer road that encircles the "dish" at the radio-telescope facility in Arecibo, Puerto Rico. He was down there this past spring, mainly to participate in research activities (his specialty field is incoherent scattering, including experimental work using the Arecibo radio-radar tele-

Don Farley (left) and Mike Kelley are electrical engineering faculty colleagues who train togther for running competition.

scope, the world's largest, at the facility operated by Cornell for the National Science Foundation). Farley's time of 10:36 for the three-times-around and 39:41 for the ten-times-around set new lows in the cumulative records kept by the Arecibo personnel for all comers, local workers as well as visiting scientists.

This story about the Arecibo events was told to us by Mike Kelley, Farley's colleague in Electrical Engineering and his frequent companion in the daily runs. Kelley, an assistant professor here since 1975, says that the word around the EE school is that to get tenure, a young professor must run a five-minute mile, but should not run better than 4:43, which is full Professor Farley's best time.

Kelley began running in his small-town Ohio high school, where he set a record for the half mile of 2:02. In college he played basketball and kept that up during graduate school, but when he came to Cornell he took up running again, partly to keep Farley company. He prefers running to basketball at this point in his career because it provides an intense amount of exercise in a short time and is "always there," available at the runner's convenience. He participates regularly in the Finger Lakes Runners Club monthly meets, as do his wife and sons, aged six and seven; his best achievement so far is a second place in the half mile. He is best in short distances, he says, but runs as much as ten miles a day with Farley when the latter is getting ready for distance competition.

Cornell's two competitive cyclists are also colleagues: both deBoer and Leigh Phoenix are members of the Mechanical and Aerospace Engineering faculty. Both are also members of the Finger Lakes Cycling Club, which claims them as two of their eight Outstanding Performers of 1976.

Phoenix, a young assistant professor, competes in the senior division. Last year, his first in serious cycling, he made a name for himself locally by taking first place in the Cayuga Lake Bike Race, finishing the 87-mile course six minutes ahead of the next con-

tender. He also placed second in the Onondaga Cycling Club's 24-hour time trial, covering a distance of 431 miles, four more than the previous national record. He placed fourth in the 102-mile district USCF championship race, and ninth overall in the Eastern sectional Lake Luzerne Cup Race. This spring he finished second in the 101-mile Lake Luzerne event, with the time of 2:05:25, one second behind Finger Lakes teammate Jim Black.

Phoenix and deBoer bike daily all year long; last winter they worked out ways of managing clothing and equipment and could usually find roads not too deep in snow. Phoenix owns three bicycles and has on order a tandem that he plans to ride with his wife and also in competition with a team member from the cycling club. In May he and partner Peter Udam won the 30-kilometer tandem race at the Sectional Classic in Syracuse; their time of 40:09:09 set a record for the course.

Professors who bicycle regularly for transportation, exercise, or pleasure include Ralph Bolgiano of Electrical Engineering ("By bicycle you go fast enough to cover considerable ground, but slowly enough to appreciate the countryside") and Geoffrey Ludford of Theoretical and Applied Mechanics ("I've been on a cycle for forty-five years and prefer it to all other modes of transportation").

There is no apparent end to a story about physically fit engineering professors. Our inquiries about runners and cyclists were frequently countered with questions about why we were leaving out other kinds of athletic activities.

Dennis Shepherd, a mechanical engineering professor in his sixties, works out daily at Schoellkopf Field or the vicinity. Other amateur joggers on the engineering faculty include Pete Loucks (when he isn't playing squash or tennis), Arnim Meyburg (when he can't find a tennis partner), Frank Cesario (when his hand hurts from too much handball), Art Nilson, Jim Liggett, Peter Murphy, and John Booker.

There are all those noon-hour squash players, for example; Pete Loucks tells us he plays daily with a group of five or so. One gets the impression that half the Environmental Engineering faculty inhabits the Teagle Hall gym and locker rooms in the middle of the day. (Chris Shoemaker of that department is unusual in being one of the few women on the faculty as yet, but she is in the mainstream athletic tradition, frequently running or playing lunch-hour squash or tennis.) Besides the squash and tennis players, there are swimmers and golfers. And then there is Ed Cranch, the engineering dean, who plays hockey in the wintertime and gardens in the spring—but that's another can of worms.

FACULTY PUBLICATIONS

The following publications and conference papers by faculty and staff members and graduate students of the Cornell College of Engineering were published or presented during the period January through March 1977. Earlier publications inadvertently omitted from previous listings are included here in parentheses. The names of Cornell personnel are in italics.

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