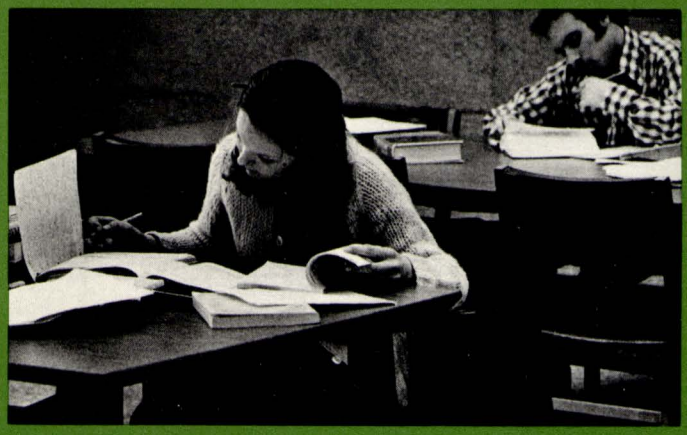
FEBRUARY/APRIL 1976

WPI journal



"It is clear that the Plan is a process, a living and not a mechanical thing, and depends heavily on the particular constellation of people and events at WPI."

—Bruce Mazlish, M.I.T.

Dedication

To the faculty of WPI . . . and their dedication, which made the WPI Plan possible

"Our foresight with respect to the nature of the problems was, I believe, quite good. What we—or at least I—failed to foresee accurately was the determination, perseverence, and resourcefulness that the entire WPI community has brought to bear on those problems."—*George Pake, Vice President, Research, Xerox Corporation*

"WPI embarked on the Plan with an already lean faculty: a student-faculty ratio of 14 to 1. Every essential feature of the Plan has added to the faculty load; none has reduced it. . . .

"So why is the Plan working so well?. . .The answer lies in the faculty's willingness to put in extraordinary effort, dedication, and long hours way beyond the call of duty."
—*Eugene D. Reed, Exenutive Director, Bell Laboratories*

"To create an honors college, like Plan II at the University of Texas, or the subcolleges of Michigan State, or the E^3 program at IIT, is no great trick, even though I think it a valuable accomplishment. But to reform a whole institution and an entire set of fields is, in contrast, unprecedented, and in my judgment could only have been undertaken with a certain innocence, and by people with a dedication to the institution rather than to their specific disciplines.

"I have visited classes taught by those I have referred to as the 'home guard loyalists' of WPI, who have been there a long time, teacher-scholars who are not looking for their next chance somewhere else. At other engineering schools I have visited, people in that position would be resentful. At WPI I have been impressed with their indomitable energy and dedication, their genuine interest in students and their development, and their lack of evangelical desire to convert students to supposedly more noble callings. They do not feel that their own status depends on sending students to graduate school in their own specialties."—*David Riesman, Henry Ford II Professor of Social Sciences, Harvard University*

"A major effect of the Plan has been to substantially increase the level of workload and stress experienced by a large majority of the faculty. When compared to other schools, WPI faculty reported significantly greater increases in time devoted to school-related activities and significantly greater feelings of stress and fatigue. Similarly, WPI faculty reported significantly less time available for research and consulting as a result of implementing the Plan. . . However, archival data do not show that research productivity has declined markedly at WPI since implementation of the Plan. The general trend suggests that research activity declined slightly in the first two years of the Plan but increased to record levels in the third year.

"In comparison to other schools, WPI faculty spend significantly greater amounts of time interacting with students, planning and monitoring project work, interacting with colleagues in other departments, and dealing with outside organizations (especially organizations of a non-industrial nature); and significantly more time reading outside of their special field.

"WPI faculty view their own school as being a substantially more fluid, complex, and flexible environment than do their counterparts.

"The changes implemented by the Plan have been the source of major frustrations and uncertainty for many faculty, as well as sources of satisfaction. These changes have also resulted in considerable self-questioning, learning, and self-initiated adaptation. WPI faculty members have stretched their competencies beyond the areas of expertise normally expected by their disciplines."—*from a report on the effects of the WPI Plan implementation on faculty and administration, by Frank Baker, State University of New York at Buffalo, and John J. Gabarro, Harvard University*

"Our observation of the ingenuity, resiliency, and dedication of faculty and administration in meeting the tremendous pressures to date give us a great deal of confidence in the amount to be achieved by this experiment."—*John R. Whinnery, Professor of Electrical Engineering, University of California at Berkeley*

"The Plan is a process, a living and not a mechanical thing, and depends heavily on the particular people and events at WPI. . . . It is clear that the surmounting of problem after problem was only possible by a rather unique constellation of key people and efforts. . . .

"As one student remarked, you can change the students in the course of four years, but you can't change the faculty in that time. It is remarkable, nevertheless, how much the faculty *has* changed in the course of our three year visits, in the sense of rising to the challenge of the Plan. I have been impressed by the dedication of many long-time members of the WPI faculty to the Plan and to the way in which new faculty are fostering the aims of the Plan."—*Bruce Mazlish, head of the humanities department, M.I.T.*

Those are remarkable tributes to a remarkable group of teachers and scholars, the WPI faculty. The process of bringing the WPI Plan into being, making it a reality instead of a theoretical model, has fallen largely on their shoulders, and they made it happen. They did it at tremendous cost in time and energy, in loss of income through reduced opportunity for consulting, in 12 and 15 hour days spent breaking new ground in teaching methods and interactions across the traditional boundaries of academic specialization.

The kinds of sacrifices they have made cannot go on forever, and as the Plan becomes fully operational, becomes a more familiar and less revolutionary enterprise, the faculty and the Institute will have to find new and better ways of dealing with the overload.

That is the major problem facing WPI in the next few years: How to adequately reward a faculty that has given more of itself than perhaps any faculty at any institution of higher education.

It may not be much to offer, but I'd like, here in this *Journal*, to say "Thank You" to all of them. This issue is dedicated to the WPI faculty, for it is they, against tremendous odds, who conceived, designed, and created the WPI Plan. All of us at WPI—whether we are students, administration, alumni, parents, and just interested bystanders—owe them a tremendous debt.

R.K.

wpi journal

Vol. 79, Nos. 5 & 6 February-April 1976

3 **THE WPI PLAN—WHAT, WHERE, WHY, AND HOW**

4 **IN THE BEGINNING**
The tradition of innovation at WPI

5 **The Four Degree Requirements**

6 *Jon Anderson—"Every engineer he'd ever known who'd gone on into law made a darn good lawyer"*

8 **THE BASIC ELEMENTS OF THE WPI PLAN**

9 **Planning how to make it through the Plan**
The importance of advising—freedom and responsibility

10 *Elaine Sanderson—What to do when a textile mill becomes a jigsaw puzzle*

12 **Projects: the heart of the Plan**

15 *Clifford Ashton—"We took a different approach than the company engineers, and ours turned out a lot closer to what really happens"*

17 **The major project**

19 *Michael Kallet—"I never did get a look at liquid helium"*

20 **The interactive project: bridging the gap between technology and people**

24 *David Lyons—"Classwork is fine, but . . ."*

25 **Laying it on the line: the competency exam**

27 *David Demers—Answering the siren call*

31 *Jay Gainsboro—Millionaire in the making?*

33 **HOW WELL IS THE PLAN GOING**

36 **What outsiders see in the WPI Plan**

41 **THE WPI PLAN . . . WHAT IT ISN'T**

44 **GENESIS—THE BIRTH OF THE WPI PLAN**
Andreas de Rhoda's account of how the faculty, with the help of President Storke, conceived and designed the WPI Plan. You might call it a blueprint of how to turn an institution upside down . . . or maybe right side up?

51 **A FRESHPERSON GUIDE TO WPI**
Excerpts from a student-produced publication introducing new students to life under the WPI Plan.

ALUMNI SECTION (following page 28)

A1 **On the Hill**

A2 **8 oars and 1 flying saucer; to Canada, please**
The story of five WPI athletes who are trying for berths on the U.S. Olympic team.

A10 **Your Class and Others**

Address all correspondence regarding editorial content or advertising to the Editor, *WPI JOURNAL,* Worcester Polytechnic Institute, Worcester, Massachusetts 01609 (phone 617-753-1411).

The *WPI JOURNAL* is published six times a year in August, September, October, December, February, and April. Second Class postage paid at Worcester, Massachusetts. *Postmaster-* Please send Form 3579 to Alumni Association, Worcester Polytechnic Institute, Worcester, Massachusetts 01609.

The WPI Plan— What, where, why, and how

WORCESTER POLYTECHNIC INSTITUTE has been the center of a unique transformation over the last decade. Completely changing its educational goals, methods, and measurements, WPI brought forth a system called "The WPI Plan." It did away, in one step, with requiring specific courses be taken; the Plan put major emphasis on project-oriented experience, on self-motivation, and above all on a bachelor's degree based on the student's demonstrating his professional competence in his field of specialization.

The WPI Plan. The phrase is familiar to all WPI alumni, parents, and students. But what *is* the WPI Plan? What does it mean—to the student, to the faculty, to the Institute itself, to past graduates, to engineering education? What does it mean? Is it significant, and if so, why is it significant? And most basic of all: Does it work? And how well?

For five years the WPI Plan has been in a state of becoming. It was difficult for us on campus to know, at times, just what to make of it all. There were enormous problems involved in trying to make a theoretical educational model into a smoothly functioning system.

And when we tried to explain to people who were not involved just what was this WPI Plan, we found that no two people had quite the same idea of what it was going to become. The WPI Plan had so many different aspects that needed explanation, it was difficult for those of us on campus, much less outsiders, to describe what was going on. Sometimes we didn't know for sure ourselves just what were the trees and where was the forest.

But now things are clearer. For two years, every student entering WPI has been studying under the Plan. By this June more than 550 students will have earned Bachelor of Science degrees under the Plan. Thousands of projects have been undertaken by WPI students. We now know just what the WPI Plan is, and what it can be.

And in this issue of the *WPI Journal,* we'd like to try and share some of the excitement of what the WPI Plan is—as people who are interested and involved with WPI, you want to know just what is happening at the school. So here is the WPI Plan—what, where, why, and how.

As I sit here and write material for this issue, I am fair game for charges of bias—after all, WPI pays my salary. But throughout I have tried to substitute the thoughts of others whenever a judgment or evaluation seems called for. Most of all I have drawn upon the reports made to the National Science Foundation by an outside panel of educators, engineers, and scientists who visited WPI twice a year for two days at a time during the three crucial years when the WPI plan was being put into operation. In a later section of the magazine, I discuss the panel at some length. But their views of the WPI Plan were too wide-ranging, too thoughtful, too close to the nerve, merely to be set off by themselves. In fact, their perceptions of WPI pervade this issue and provide a unique insight into the WPI Plan.

One final word. In writing this issue, it became clear that 64 pages of impersonal and educational rhetoric would find no audience still awake by the end. So we've tried to make these stories as human and as interesting as possible. Because the WPI Plan, in action, really ends up being more than simply the sum of its parts, we've included profiles of seven students—1974 and 1975 WPI graduates—and their academic careers at WPI. And we've scattered them throughout the issue. We feel that it is in these profiles that you can see just how the Plan operates, how students choose the elements of their programs, and how one aspect of the WPI Plan relates in practice to another.

In the beginning

"This Institute has a claim to public favor and indulgent consideration because it is the first attempt in our country to combine theoretic knowledge and practical training." —Stephen Salisbury II, 1871

"This school was not framed on the model of any existing elsewhere." —Seth Sweetser

"The whole scheme must be regarded as an experiment in American education, which, at the present stage, is sufficiently promising to warrant its further prosecution." —Catalog, 1871

Right from the beginning, Worcester Polytechnic Institute was an innovator, an institution in the forefront of educational practice. But somewhere along the way, that thread of innovation and experimentation got put aside. And so it was in the late 1960s that a group of concerned faculty drafted a new statement of purpose for WPI and developed a radical new approach to the education of scientists and engineers.

"By means of coordinated programs tailored to the needs of the individual student, it is the fundamental purpose of WPI to impart to students an understanding of a sector of science and technology and a mature understanding of themselves and the needs of the people around them. WPI students, from the beginning of their undergraduate education, should demonstrate that they can learn on their own, that they can translate their learning into worthwhile action, and that they are thoroughly aware of the interrelationships among basic knowledge, technological advance, and human need. A WPI education should develop in students a strong degree of self-confidence, an awareness of the community beyond themselves, and an intellectual restlessness that spurs them to continued learning." —endorsed by the WPI faculty, 1969

From that statement of goals, let us first describe the basics of the WPI Plan, the four degree requirements: two projects, a minor in humanities, and a competency examination. It is these four items that mark the cornerstones of WPI's educational edifice.

The four degree requirements

1. The Major Qualifying Project

Each student must investigate a problem in his major field of interest. This project is expected to occupy the student's time for the equivalent of seven weeks full-time (which at WPI is reckoned at around 50 hours a week). The student may work alone or in conjunction with other students, on campus or at an off-campus internship center. A faculty advisor will guide the student, but it is the student's own motivation, independent action, and ability to learn on his own that will determine his progress.

Major projects typically deal with real problems. They are not made-up, hypothetical, or imaginary situations to be dealt with. Often the projects are supplied by, and done in conjunction with, businesses, industries, and social and governmental agencies who can call on the resources of WPI students and faculty in dealing with their particular problems.

Each student working on a major degree project must submit a final report on the project, though sometimes these are done as identified sections of a joint report. The project is evaluated by faculty and by outside people who have been involved.

2. The Interactive Qualifying Project

A second project is also required. It may be a second major project, but students are strongly encouraged to get involved in a project which will relate technology and their major field of interest to the very real needs of society. These Interactive Qualifying Projects force students to become aware of the consequences of technology and its impact on our lives, to consider moral and ethical values as they relate to their professional fields.

3. The Competency Examination

A student's competence is tested through a complex problem, or series of problems, much like what the student can expect to encounter as he or she begins a career. The student is assigned one or more problems and has access to reference materials, computer facilities, library, laboratories, and so forth. At the end of a designated period, usually two days, the student submits a written report back to his examination committee. An oral examination follows, and here the student's method of attack, the soundness of fundamental principles and alternate approaches are discussed and questioned. The exam is designed to test for understanding of methods, ability to use available resources, grasp of fundamental principles and theories, and ability to apply current techniques. All this is done under fairly tight deadlines, so it also measures the student's performance under pressure.

4. The Sufficiency

Students majoring in science or engineering are required to develop a specific minor in the humanities. Students must select five thematically related courses in the humanities, and then, in a sixth activity (usually independent study) the student must write a paper that develops his particular area. This sufficiency involves the same amount of work and academic credit as the two degree-qualifying projects combined.

Students who are majoring in a humanities or social science area are required to develop a sufficiency in science or engineering.

4+. A Few Miscellaneous Requirements

Although the previous four degree requirements are the whole of the WPI Plan, the college does have a few smaller requirements for graduation.

Each student must complete 12 units (the equivalent of three years) of work before taking the competency exam. For transfer students, there is a minimum residence requirement of 8 units of work.

Four physical education courses must be completed.

PLEASE NOTE: The photographs that illustrate this issue have been chosen for their depiction of activities involving WPI students and faculty. In most cases, however, individuals who are specifically referred to in accompanying articles are **not** *shown in photographs because none were available.*

Jon Anderson—

"Every engineer he'd ever known who'd gone on into law made a darn good lawyer"

Jon Anderson wants to go into politics. So of course he started off by majoring in chemical engineering at WPI. "I talked with a lawyer in my hometown in Vermont who went on to become lieutenant governor. He said that engineering was a real good background for law, and that every engineer that he'd ever known who'd gone on into law made a darn good lawyer."

Jon looked at three engineering schools in New England. "I went down to WPI and had an interview about the Plan. After that I didn't even bother to interview the other two schools because they seemed to be caught up in more traditional education. The idea of going to WPI where people were discussing what was the best education—rather than having settled on one thing and you just have to fit the mold—that, I think, was what really attracted me."

Jon chose chemical engineering because he felt it really combined both science and engineering. He feels this background will be helpful to him in the future by enabling him to communicate with scientists and understand the process of scientific research as well as engineering and problem-solving.

One of the most exciting parts of Jon's program was his interactive qualifying project. He videotaped the Senate Watergate Committee hearings and edited them down to a 6½ hour presentation. "We thought the Watergate hearings would go on for two weeks, certainly no longer than three. Then I would sit down and prepare an hour-long tape reviewing the hearings and tying them into American history. We didn't think it would be that big a job.

"After the hearings had gone on for several months, we began to change the focus of the project. And we ran into some money problems. We had originally hoped to save good sections of tape and erase the rest. And after a while that just became impossible. So we started to run over our budget, but Dean Bolz stretched a point and committed some more money to buy tape. For the school, it really only amounted to buying the tape before they would normally, because after the whole project was over the tapes would be available to be erased and reused.

"So around Christmas time, 1973, I edited the tapes into a four hour and twenty minute story of what happened at the Watergate. We juxtaposed Nixon's account and Haldeman's and Erlichmann's accounts with those of John Dean and some of the others. I tried to be very fair about it, because I was managing editor of the WPI Newspeak, and because I was very conscious of Nixon's attacks on the press. Then I put together a half-hour segment on wiretapping—how society tried to control wiretapping and its technology, and failed in this case. Finally, there is an hour-and-a-half exploration of the reasonings that different people used in justifying their breaking the law, doing things they knew to be illegal.

"From this project, I really knew that I wanted to be a lawyer. And I became much more careful about my own behavior and feelings. I thought about honesty and became much more aware of the way we all have our little Watergates, as someone put it.

"All in all, it was quite a project. The result is six hours and twenty minutes of videotape; it represents well over 500 hours of work by me. I got a tremendous amount of confidence in being able to do all that."

Jon's major project in chemical engineering was concerned with molecular sieve zeolites—compounds which are able to separate out parts of other fluids. Oil companies use them in refining; they make possible lower temperatures and pressures, and they save money. Another use is to separate pollutants from smokestack gases. To use them in this way, one needs to know how fast gases diffuse through the packed beds of the small zeolite crystals. Anderson attempted to compare two different methods of determining the rates at which different gases diffuse—one very simple and one much more complicated. His results did not seem to indicate any reasonable method of comparison. "I worked harder on that than anything else I did at WPI. It was fairly frustrating. I guess I know how rugged scientific work is now, and I have a deep appreciation for how hard and how frustrating it can be."

To meet the sufficiency requirement, Jon did three courses worth of independent study on foreign policy and presidential elections, together with other course work. For his final paper, Jon studied the politics of Royall Tyler, the first American comedy playwright to be professionally produced, and a man who later became chief justice of the Vermont Supreme Court. Jon happened to pick Tyler because they shared the same hometown, Brattleboro. Jon discovered that Tyler had been adamantly opposed to slavery until 1801, when he switched parties from the New England-based Federalist Party to the southern Democratic/Republican Party. And after 1801 he never said another word about slavery or the South. Jon's paper was published by the Vermont Historical Society.

At competency exam time, Jon was "shocked and horrified. They made it sound like just months and months of work in the assignment, and we only had five days. But what they really intended was for me to take that assignment, figure out what was most important, and do five good days of work on it."

Jon graduated two terms early, by taking overloads (mostly independent study) for much of his time. He was happy to be able to do this, because he spent the time until the next September working to earn money for his first year at Yale Law School. Washing dishes. "Dish washing was the first thing I found, and the job situation up here in Vermont was pretty bad. But by living at home I saved nearly everything I earned."

WPI

The basic elements of the WPI Plan

Planning how to make it through the Plan

Two of the most important aspects of life under the Plan are the design and planning of each student's individual program, and the part that the faculty advisor plays in this process.

Freed from the traditional structure of required courses, the WPI student has the entire course catalog open to him or her. A major field of interest need not conform to a previously established standard sequence; the student is able to design his own major program, so long as it is one in which the faculty can assess his competence.

Roy Seaberg, associate director of admissions and a 1956 WPI graduate in civil engineering, recalls the rigidity of the curriculum when he was a student: "In the last semester of my senior year, I had one elective course. Everything else was prescribed in the catalog."

By contrast, Plan students have the freedom to explore other areas, to combine course offerings from different departments to meet their specific interests. For example, the last Commencement program listed the following fields (in addition to the traditional departments) in which students received bachelor's degrees:

Urban and environmental planning
Urban development planning
Applied mathematics
Digital systems
Electrical instrumentation
Power systems
Sanitary and water resources engineering
Experimental nuclear science
Chemistry: bioinorganic emphasis
Interdisciplinary: chemistry-life science
Dramatic literature
Chemistry: organic emphasis
American History
Chemistry: mineral chemistry emphasis
Systems software engineering
Life sciences and engineering
Structural engineering
Mathematical physics
Transportation
Interactive operating systems
Mechanics and design
Electronic systems
Applied nuclear physics
Environmental studies
Transportation engineering
Environmental science
Urban planning
Chemistry: chemical education emphasis

The price the student pays for this freedom is the responsibility for designing a program—courses and project work—that hangs together and accomplishes the student's goals. If the student arrives ill-prepared for his competency exam, the fault should lie squarely on his own shoulders. To help prevent such last-minute disasters, the faculty advising system has been set up.

To be sure, there were advisors before the Plan, but their role has taken on significant new meaning under the WPI Plan. Because of the individualized approaches that can be taken, each student generally needs more advising than under a more traditional program: more frequent contact with his advisors, and more time spent with them.

A student begins designing his or her program even before arriving at WPI. Correspondence during the summer before that first term between incoming students and the Dean of Academic Advising begins the process of exploring alternatives. During the first year in particular, students are encouraged to "shop around" and sample courses from different areas—mindful, to be sure, of the basic need for beginning math and science course work.

As the student's experience grows, as he finds out about the possibilities open, discovers the directions in which his interests lie, his plans typically grow more specific: he begins to have a picture of the kind of program he wants to develop, perhaps becoming interested or involved in a project to help test out those interests.

In his first year or two, the WPI student can rely heavily on the counsel of his advisor; but he soon learns his way around, begins getting informal advising from other faculty members, particularly if his interests are changing. And of course, the student learns from other students just what the score is regarding the value (as well as the difficulty) of certain courses and instructors, and the strengths, weaknesses, and idiosyncrasies of given departments.

Some faculty members are better at teaching that at research, and vice versa. Just so, some faculty members are better at advising students than are others. This has presented problems for many students and faculty, problems that have attracted a lot of attention. Putting them in perspective, however, one outside observer, Bruce Mazlish of M.I.T., has said: "Advisors are obviously an important part of any college experience. . . . In my own view, the situation [at WPI] is no different from that of any other college or university. Advisors will vary greatly in quality, and the students equally so in their need to have advisors with whom they do or do not work closely."

Elaine Sanderson—

What to do when a textile mill becomes a jigsaw puzzle!

"My father had gone to WPI, and when I was little I asked him if I could go to this school. He said, "Well, by the time you're old enough, there might be girls there.' And sure enough there are. So here I am."

In high school, Elaine Sanderson was especially interested in math, although before she graduated she had changed her sights. She started off her first two years at WPI with courses in chemistry, math, physics, and basic engineering. By the middle of her second year, Elaine had settled on civil engineering as her major. "I was in environmental engineering, but I didn't see any future in it for the direction I wanted to go in. But I had taken a physics course with mechanics, and I really liked mechanics. Civil engineering is pretty close to that, and I finally decided that's what I really wanted."

During her second year, Elaine finished her interactive project. She was part of a group working with the Worcester Juvenile Court, investigating the feasibility of a centralized computer information system covering the police, probation officers, the court itself, and all the different agencies that work with juveniles. The group discovered that there was an enormous amount of duplicated information the different agencies were collecting separately. Elaine's group proposed a central data bank which everyone could draw on, but which would not contain "sensitive" information that shouldn't be available to many of the users. The plan was never implemented because state legislation was changed in such a way as to forbid the concept.

One of the real values of this project, according to Elaine, was the experience in learning how to deal with people in public life—how not to step on their toes, how not to offend them so they won't talk to you. "And then you get back on campus and you have to present your report, so you get a lot of practice getting up in front of groups and talking about it. We presented our results to at least ten other students working with the juvenile court, plus probation officers, representatives of other agencies related to the court, and some professors." Was it an unnerving experience? "I thought it was fun."

During her senior year, Elaine served as chairman of the Worcester branch of the Society of Women Engineers. In fact, she was instrumental in the organization's formation, knocking on dorm doors to drum up interest among women students. She was also a member of the women's crew team—which meant getting up at 5:30 every morning in the fall to go out and row, running three miles a day during the winter months, as well as working out with weights, and rowing once or twice a day during spring . . . including spring vacation. But the outdoors has a strong appeal for Elaine, and she was also a member of the Outing Club and the Canoe/Kayak Club. And maybe that's a part of the reason she chose civil engineering.

Elaine's major project got its start while she was taking an Intersession course at nearby Old Sturbridge Village. One of their problems was to move a cotton mill, dating from 1823, from its present location in Phoenixville, Connecticut, to Sturbridge. In order to do this, the building had to be completely dismantled and then reassembled. Elaine had to do a complete engineering study of the building, to determine how sound were the original materials, particularly wooden beams and stonework, and how well they would withstand the moving process. She had to figure out what had to be replaced and what could be preserved. Finally, Elaine had to investigate what additional supporting structures had to be built to make the building safe for the millions of visitors who will troop through it. This was a particularly difficult phase of the problem because she also had to preserve, as much as possible, the original appearance of the structure. This meant hiding the required electrical wiring and sprinkler systems by designing false floors and ceilings, to use one example.

Elaine's work has given Old Sturbridge Village a careful and detailed estimate of the amount of work that will be needed—and the money it will take—to relocate and reconstruct the old mill.

Elaine's sufficiency was closely related to her project work: she did a paper on New England industrial mills, after having taken courses in the history of technology, urban history, and a number of related Intersession courses involving historical concerns and field trips around New England.

During the fall of her senior year, Elaine took her competency exam. And flunked it. "I wasn't ready for it then. I had only one year of civil engineering courses, which wasn't enough. Now, later, I can see how much more material I have gained, how much I didn't have before. Civil has five or six distinct areas, and since I'm going into general civil engineering I should have some knowledge of several of these different areas. I'm basically a structural engineer, but I do have to know about wastewater treatment, construction management, planning, soil mechanics. You have to get a very well-rounded background to be a general civil engineer. And the competency makes you do that." In March, Elaine retook the competency exam and passed.

WPI

Projects: the heart of the Plan

Projects are the central educational experience under the WPI Plan. And there's a good reason for that.

"Bright kids used to come here with pet projects they wanted to work on," says Dean William R. Grogan. "We would tell them, 'No, you put that aside until you have taken math and chemistry and physics, and so on.' If they wouldn't do it our way, we'd flunk them.

"That was short-sighted. Now we encourage students to pursue their pet projects, let them work on them until they discover for themselves just what kind of theoretical background they really need to continue. Then the students have a genuine interest in that basic course we want them to take, and we don't have to force it down their throats."

There are other important benefits to project work. It involves students in groups and teams, and they can learn how to work together to solve a problem. Most of the projects at WPI, whether they originate with students, faculty, or outside WPI, are real problems that need solving; they're not makework, and they're not trivial. Many are directed at solving real and immediate problems faced by business and industry, government and social agencies that have working arrangements with WPI.

There are four basic elements to every project. First is the idea or problem itself. Second is the student or student team to work on it. Third is the faculty advisor. And fourth are the resources that the project team can call upon, which often include extensive facilities and/or cooperation from a participating outside sponsoring organization.

Each project has one or more faculty advisors who will act as counselors, resources, prodders, overseers, and ultimately as evaluators and graders. Generally a faculty advisor will be involved because the project is in his special area of interest (or maybe it's not, but he happens to be interested in the problem anyway). For many projects, there are several advisors from different fields.

While two projects are required for graduation, students are expected to work on other projects too—as preparation for the degree-qualifying projects, and as projects in their own right. The Plan originally envisioned students spending 25 percent of their time on projects and independent study. In practice, it has worked out to slightly less than that.

Because the nature of project work is so basically different from classroom work, many students have found difficulty in adapting. To help ease the transition, a new course, "Project Initiation," is offered to introduce students to some of the things that will be expected of them, and to give them some practical working and organizational tools for projects.

The outside participating organizations are an important part of the project structure. They provide real and urgent problems for students to work on, they offer a wide variety of resources and working environments for students to sample, and they keep a fresh and steady flow of new ideas coming in to WPI, which helps keep students and faculty aware of the current technical problems of business and industry.

There are several levels of participation by outside organizations. The most extensive is when WPI and the organization agree to establish an off-campus Project Center inside that organization, where a number of projects will be going on at all times. A faculty member will be assigned as site director, who will be in general charge of the projects and the students. Right now there are Project Centers at

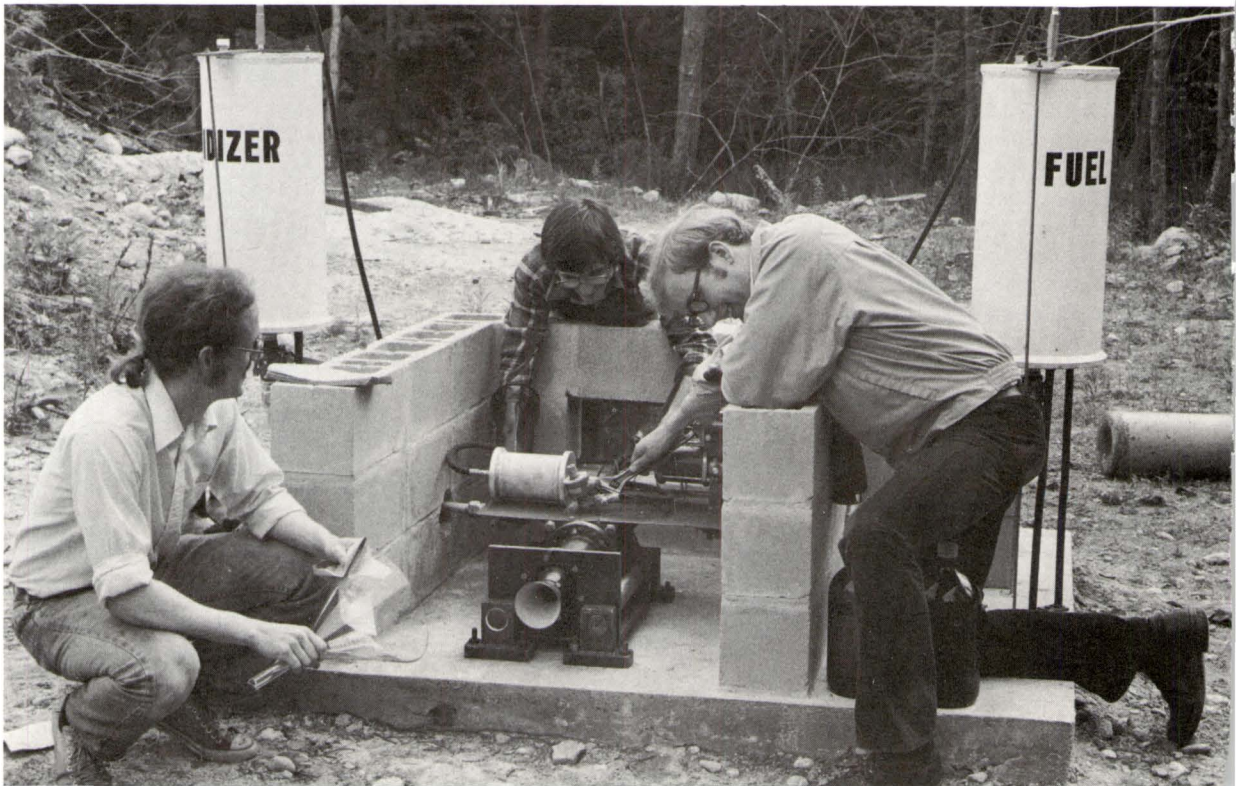
Digital Equipment Corporation, Maynard, Mass.
Norton Company, Worcester, Mass.
Small Business Administration, Boston, Mass.
St. Vincent Hospital, Worcester, Mass.
U.S. Army Laboratories, Natick, Mass.
WPI Project Center, Washington, D.C.

In addition to these project centers, there are many organizations which have sustained project activity over an extended period of time—as much as four years in some cases. These project locations include:

Central Massachusetts Regional Planning Commission
Data General Corporation
General Electric Company
Pratt & Whitney Aircraft Corporation
Sprague Electric Company
New England Electric Systems
Worcester Foundation for Experimental Biology
Worcester Science Center

Finally, several hundred other organizations have sponsored WPI student projects, including:

American Optical Company
American Telephone & Telegraph
Army Materials & Mechanics Research Center
Cape Cod Planning Commission
Department of Commerce, Washington, D.C.
Department of Health, Education, and Welfare, Washington, D.C.
Department of Transportation, Washington, D.C.
Department of Housing and Urban Development, Washington, D.C.
Environmental Protection Agency, Washington, D.C.
Hewlett-Packard, Inc.
Honeywell Corporation
New Haven (Conn.) School System
Society of Plastics Engineers
State Mutual Life Assurance Company
Thermo Electron Corporation
Thom McAn, Incorporated
Uniroyal, Incorporated
Western Electric Company
Weyerhaeuser Paper Corporation
Worcester Airport
Yankee Atomic Electric Company


DIZER
FUEL

Clifford Ashton—

"We took a different approach than the company engineers, and ours turned out a lot closer to what really happens"

When we talk about the WPI Plan, we often stress some of the more "exotic" programs which have been done, such as Dave Demers' fire protection major. But what about the more common type of engineering program?

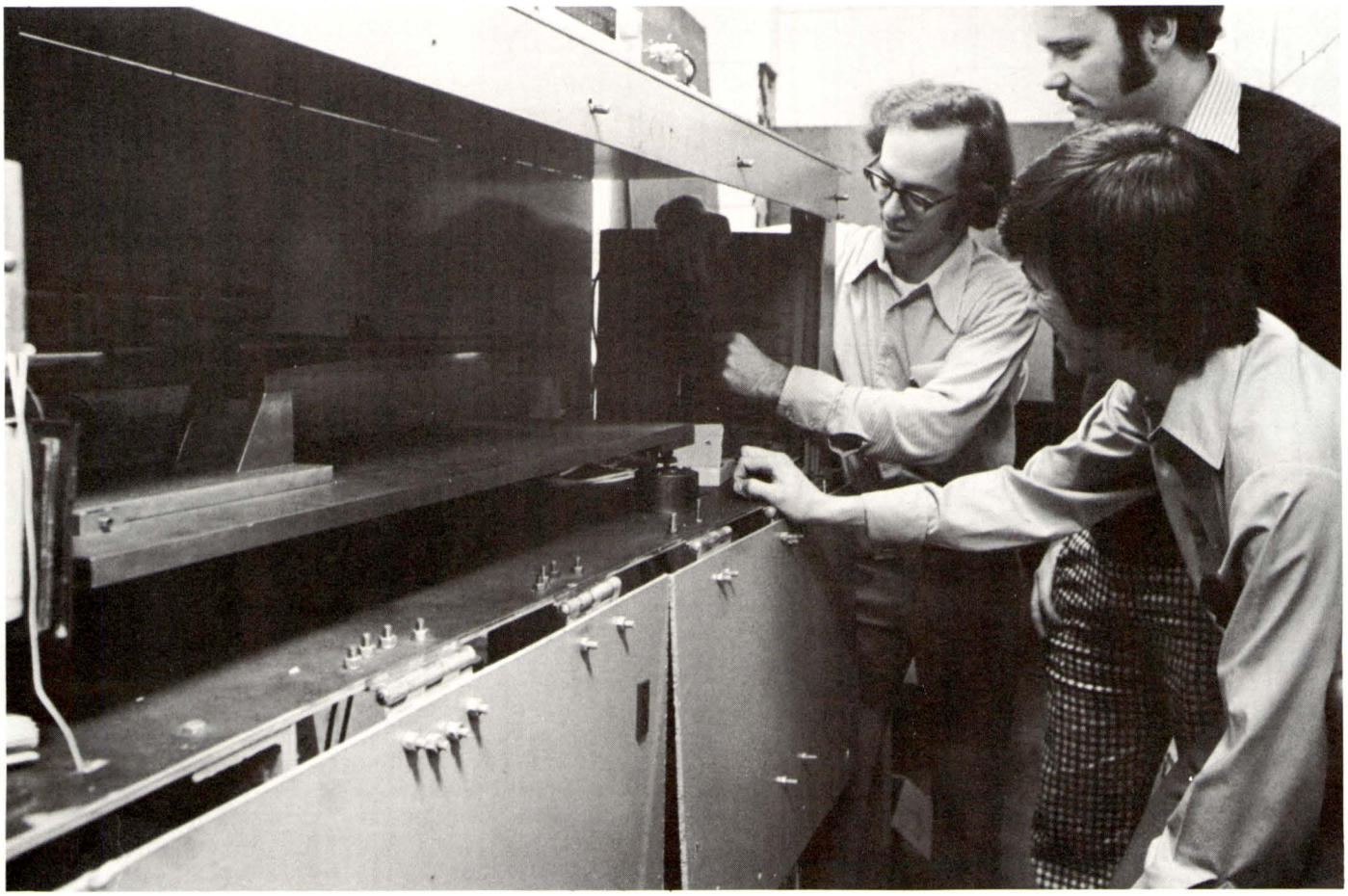
Cliff Ashton is a mechanical engineer. He chose WPI, after looking over a number of schools (including some in England), because of the individual responsibility placed on a student by the WPI Plan and the ability to plan his own program.

"In planning my program, I got a lot of help from my folks. My father is associated with engineering, although he's not an engineer himself. I got inputs from my advisor and from friends who had already been through the mill. And I decided I wanted to get an undergraduate degree in mechanical engineering—not to specialize in any one field but to get a firm background in all the engineering sciences, a good grasp of the fundamentals, and then go on from there. I've found that the more I learn about engineering, the more I think it's best for an engineer to have a grasp of all the different areas. In ME this might include machine design, heat transfer, fluids. In the future I expect to be able to talk with other engineers, so I tried to pick up courses in electrical, civil, and chemical engineering as well."

As Cliff sees it, the main intent of the WPI Plan is to give an engineer or scientist an understanding of other areas. "If an engineering student isn't careful, he can be immersed in just his own discipline. But he also has to be able to work with people, understand their feelings, understand what drives people to do what they do, even if only in a basic sense."

Cliff's major qualifying project involved some very sophisticated research. In conjunction with Pratt & Whitney Aircraft, he and a group of students studied the problem of containing failed turbine parts within a jet engine. If a jet engine is operating and one of its turbine blades breaks, for example, you don't want the blade to go flying right through the outer casing and into the passenger cabin or the fuel tank. It's a serious problem, keeping the parts within the engine or at least shooting them out the back end where no injury or damage will result. Pratt & Whitney approached WPI with this problem, and Cliff and the group took it on. They began with a literature search to find out what other people had done. They came up with an idea, a method of analysis, which they thought would help move toward a solution. "Obviously we couldn't expect to solve it. These guys had been working on it for fifteen years, and we weren't about to knock it off in three terms."

The students proposed a ballistic testing program, got it approved by the company, then built the testing apparatus and tried to model what actually happens when a turbine blade hits a containment case. After four



terms of work, they came up with a set of results they considered meaningful. They went down to Pratt & Whitney and presented their results to the project engineer and some twenty other engineers. "What was so personally gratifying," Cliff recalls, "was that they were really interested and thought we had done a really fine job. They wanted to see this thing continued because we got significant results. We had taken a different approach in our ballistic tests than they had, and ours turned out to model more closely what really happens. The company wants to have the project continue."

Pratt & Whitney was happy with the student group. Cliff remembers the project engineer saying, "You know, you guys are better than some of the engineers we have down here. They can't communicate to people what their thoughts are. They can put it down on paper, maybe. You can get the best results or the best data, but if you can't interpret it and explain it to people in a meaningful way, then it's worthless."

For his interactive project, Cliff worked on another aspect of the same Worcester Juvenile Court project that Elaine Sanderson was involved in. He and two others began a program of "micro-experiences." "We saw that the court system obviously lacked manpower. They always need people. And the probationers needed more one-to-one contact with people. We tried to fill that need, a one-to-one relationship along with a learning experience that might be fun for the kid. That's where the term micro-experience comes from. In my case, I tried to understand why this one individual had got in trouble. He was a normal kid, kind of looking for things to do, and he got messed up in stealing cars. I worked with him in auto mechanics. He loved it and I did too."

Cliff feels that he attacked this problem from an engineering point of view. He tried to follow a logical sequence in setting up this test program, and in evaluating its success. But he didn't approach it in the way a sociologist might, for instance. Since Cliff's work on this project, the micro-experience program has been continued and expanded, with many other students doing project work in this area.

Cliff's competency exam involved an analysis of the home fireplace: if you operate it between October and March in addition to your home heating system, does it really help your heating situation? That was about the entire problem statement. Cliff had to pick a house and also an approach. After some back-and-forth contact with the faculty member who had written the problem, Cliff set to work. He determined that using the fireplace was not beneficial, that it actually required more heat from the furnace (and therefore more cost) to heat the house. Cliff presented a few possible approaches to improve the situation. "It was grueling, working on one problem for two days with a deadline coming up, but definitely a valuable experience. It showed me that I could solve an engineering problem.

"It was an important part of the whole experience at WPI, in knowing where to go and how to approach a problem. I think the Plan teaches you how to learn."

WPI

The major project

The first of the two required projects is in the student's major field of study. This project requirement gets students deeply involved in their major field in working, problem-solving situations. It develops, stretches, and tests students' competence and ability to put their knowledge and skills to use. The project occupies at least the equivalent of three courses—seven weeks work at about 50 hours a week—although it is usually spread over several terms, and carried out at the same time as other work.

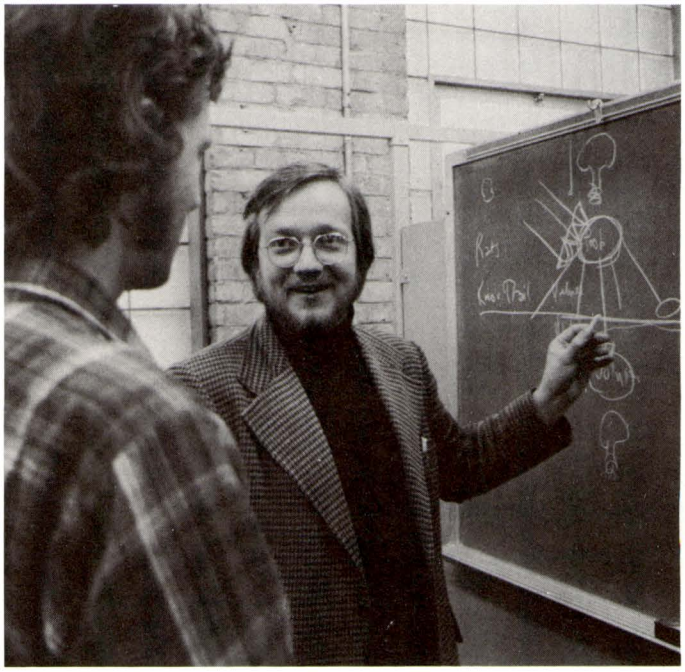
As a part of the WPI Plan, the major project gives students a real taste of what *work* in their fields will be like, and so it helps confirm or deny students' real interest in their majors. One of the problems with traditional classroom and laboratory teaching is that it has always been very different from life in the working world. Traditional engineering instruction, for example, has had very little to do with what an engineer actually does after graduation.

Projects have proved to be important to students in getting jobs, too. The fact that a student has had some "real" experience in his field is often a significant factor in job interviews. Bruce Mazlish of M.I.T., one of the NSF visiting committee members, commented that "students see the (major project) as a help in getting a job, and indeed are spreading the word that the choice of a difficult project is desirable in that regard."

The best way of assessing the results of Plan projects is to look at a selection of recent projects.

Air Cushion Vehicle Test Bed: John Barnes designed and fabricated an air cushion vehicle to test the effects on performance and stability of changes in the construction of the skirt (rigid or flexible), and the configuration of the interior air chamber.

Electronic Piano Tuner: John Chipman and Warren Spence, after studying past methods of tuning pianos, concluded that there were serious defects, and they developed a new electronic method. First John designed a special transducer to measure the piano wire's frequency (without the background pickup a microphone would hear), then hooked it up with a frequency counter and multiplier. Warren then designed a direct-reading electronic instrument for the actual tuning procedure. A reference oscillator can be switched to any note of the piano, and is compared with the actual measured frequency. Differences appear on a meter, calibrated in beats per second, while panel lights indicate whether the string is sharp or flat. The final instrumented procedure is accurate to 0.008 percent, and it is simple to operate. It needs no technical expertise, musical knowledge, or special hearing ability.



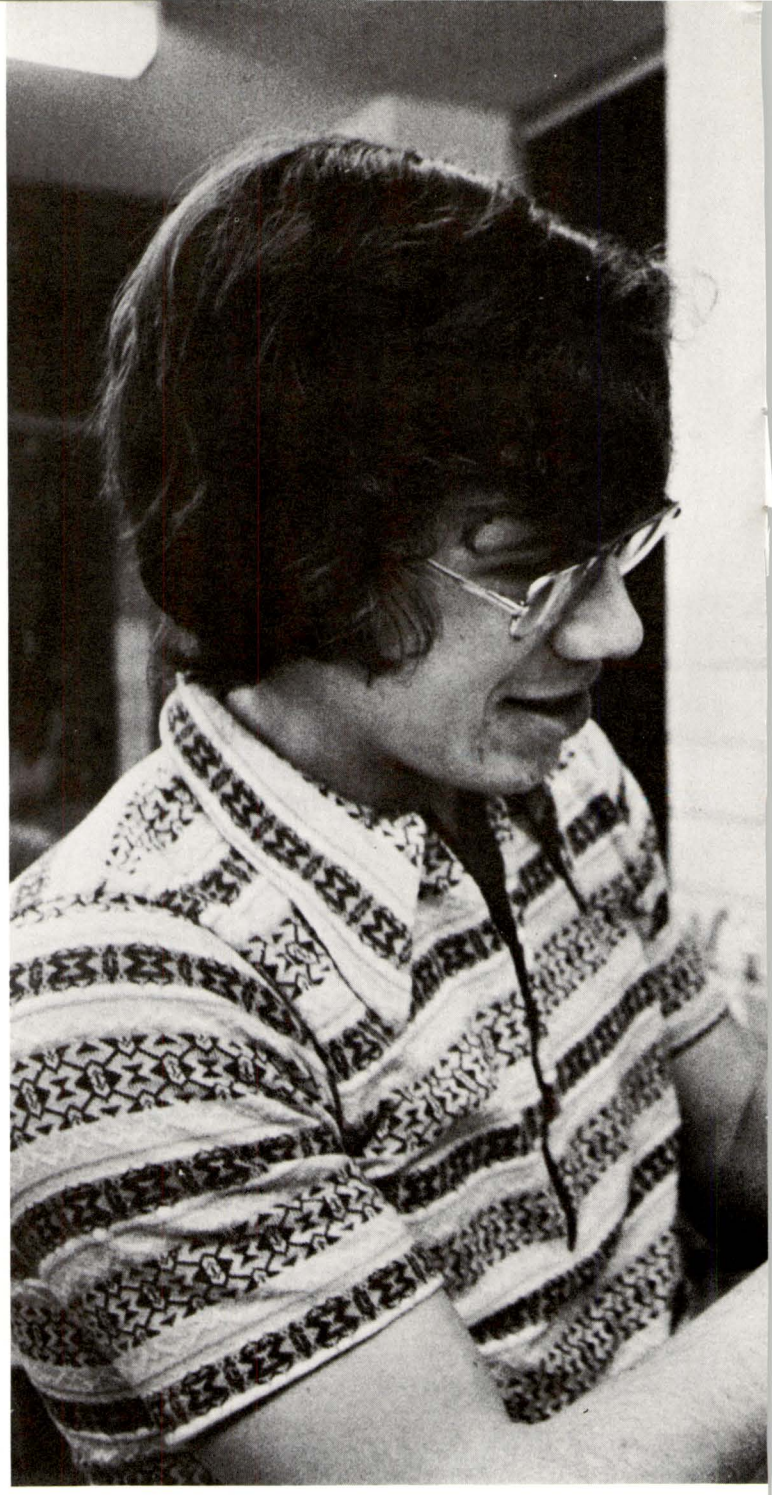
Superconductivity of Niobium: Linder Gettner studied the basic properties and theoretical explanations of superconductivity, using a niobium core and a liquid helium bath. Although she ran into some trouble with producing liquid helium, she was able to obtain data on niobium's superconductive properties—and she learned about the problems that face working physicists.

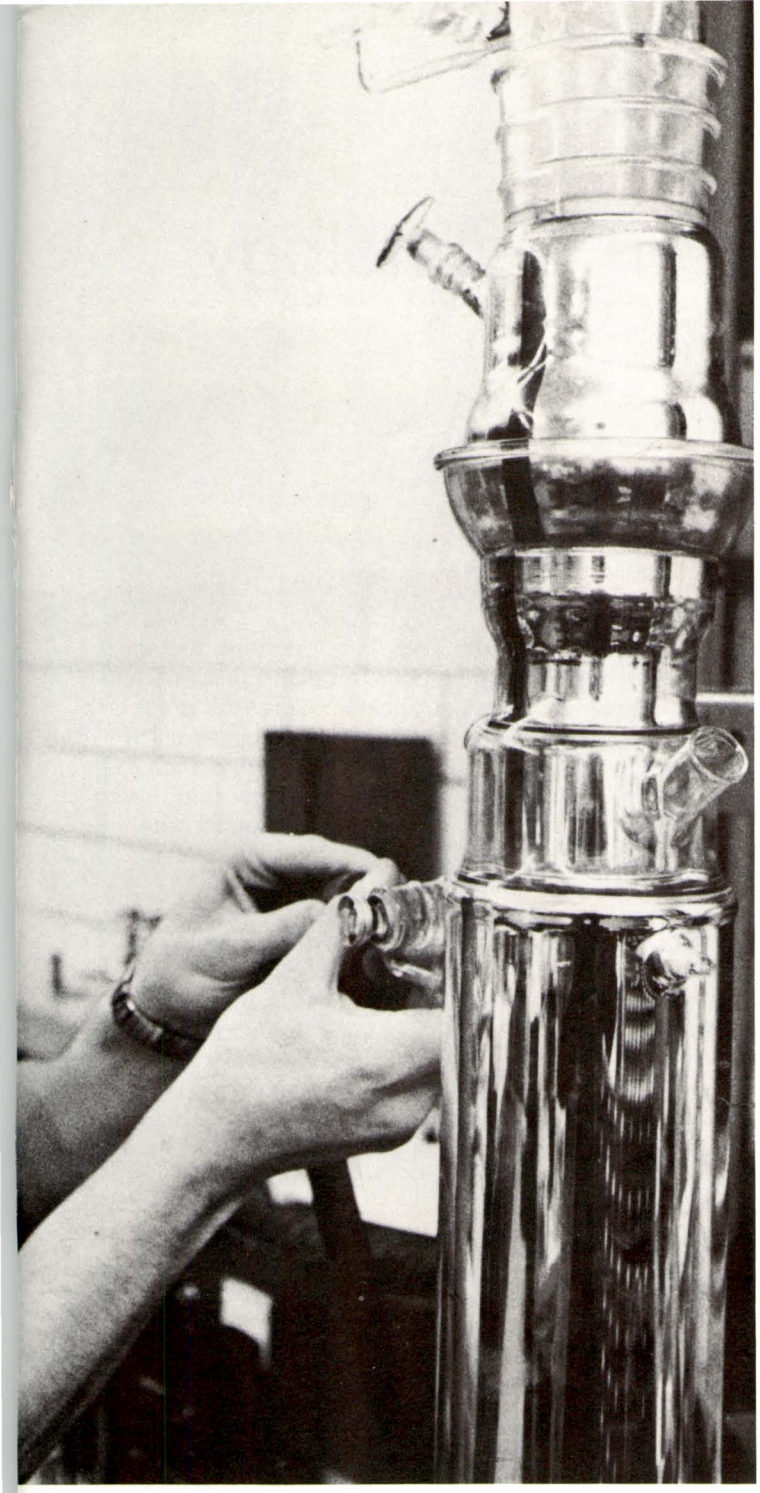
Security in Computer Systems: With the increasing presence of computers in our lives, both in terms of personal data banks and money transfers, there is a stronger need than ever to make computer systems safe from unauthorized access. The students in this project devised a secure operating system for the DEC-10, featuring levels of password protection and an audit trail of file access. Armed with a knowledge of security procedures, an understanding of operating systems, and a review of current and projected computer security systems, the students concluded that a computer can be as secure, within human limits, as any manual system, and as safe as a bank vault.

Mark Twain and Religion: After a year spent reading Twain's complete writings and other materials, Stephen Page produced a comprehensive study of Mark Twain's religious attitudes. "I never did find out whether the real Mark Twain was an optimist or a pessimist . . . he was, however, a man torn between writing seriously or humorously regarding religion."

Design and Construction of Experimental Apparatus to Study Oxidation of Nuclear Reactor Fuel Rods: Students interested in nuclear reactor accidents involving loss of coolant found that there was insufficient data available on what happens to the zircalloy coating on fuel rods in the critical temperature range of 1600-2800°F. Therefore they designed and built their own research apparatus to develop the necessary data, studying both the inside and the outside of the tubing. This project was funded by New England Electric, Yankee Atomic Electric, and the Electric Power Research Institute.

Motion in Mammals: In cooperation with a local pharmaceutical manufacturer, Kurt Lutgens did a study of motion in mammals in his junior year. He dissected a dog skeleton and studied the muscle patterns and the directions of motion by applying the laws of mechanics. He studied reflexes in relation to short-term anesthesia in dogs and sheep, and he constructed an apparatus for obtaining electroencephalograms from dogs and sheep. In making his final report, he made use of videotape. The results of this project were presented at a scientific meeting in Sweden and have been published in this country.





Michael Kallet—

"I never did get a look at liquid helium"

For Michael Kallet, the WPI Plan offered the freedom to pursue his interests in science—first chemistry, then theoretical physics—without having to follow a rigid predetermined curriculum. Beginning with his first year, he began to study the history of science, and later worked up his sufficiency requirement in the area. He examined why science develops, particularly the interaction between experiment and theory. How does a theorist come up with a theory? Does he take it from experiment, or does he pull it out of the blue? Mike concluded that some observation and experiment was necessary.

Although two projects are required for graduation, most students participate in other, "non-qualifying" projects as a part of their program. Mike has carried this one step further by working for a year and a half on a project without registering for credit. In this investigation of the dispersion of a quantum wave packet, he has made use of WPI's computer center "to solve an equation and graph the results because I couldn't do it myself. It would have taken years." Since Mike had learned BASIC and FORTRAN in high school, and worked two summers programming for an engineering firm, he only took one computer course at WPI—and that to learn a few refinements of a language he was already familiar with.

As a theoretical physicist, Mike Kallet may well end up teaching, and he's had experience here too. For his interactive project, he helped physics professor Van Bluemel redesign the quantum mechanics course and put together videotapes. "I enjoy teaching, but this project showed me that it's not all fun. There's a lot of preparation involved, but you get a lot of satisfaction when you explain to someone how something works and he finally understands it."

Mike spent nearly a year on his major project, dealing with liquid helium and its properties of superfluidity. It seems that liquid helium never really freezes unless it's put under pressure. If it's brought down to about -270°C, it becomes almost a frictionless fluid: it flows with zero viscosity, and heat travels through it very quickly. Mike set out to do a theoretical study, but decided some experimentation was in order.

"My first goal was to see if I could just look at liquid helium. It's so cold that it's difficult to get any accumulation of it . . . like putting water into a pan that's 400° or 500° and trying to find a pool of liquid. We used a helium dewar, a double insulated glass tube into which you pour liquid nitrogen to help keep it cold. But it leaked . . . a very small leak, but we were unable to find it and plug it, and I never did get a look at the stuff."

During Mike's second year at WPI, he spent the two spring terms in Europe. He studied at the City University of London under WPI's exchange program, taking physics courses as well as a history of finance in London. "I'm happy I went. If I hadn't, I probably would have graduated in three years, but going to London was really fantastic, and so was seeing the rest of Europe afterwards. I met a lot of people with different values and different ideas, learned that most people are the same—just a little bit different in little ways."

While applying to graduate school, Mike found that some schools were skeptical of WPI's grading system, which can't be realistically converted to the standard numerical average. Others, including Yale, where he is presently enrolled, liked the system and were enthusiastic about the sort of preparation that the Plan provides.

The interactive project: bridging the gap between technology and people

Two projects are required under the WPI Plan. The second may be of the same sort as the student's major project, but most students choose an altogether different type of project. Known as an IQP (for Interactive Qualifying Project), this project allows students to bring their technical backgrounds and methods to focus on problems of society. In the IQP we find not only the mathematical language of science and engineering, but an active involvement with moral and ethical judgments, social needs, value systems, and cultural considerations.

Before discussing some of the unique aspects of the IQP, let's first look at some actual projects.

Miniparks: Neal Wright and John Aubin collaborated on a proposal for a series of "miniparks" to be located throughout Holden, Massachusetts. The two students interviewed local residents to determine public opinion, then went ahead with the cooperation of the Holden Planning Board and selectmen to produce, in the span of a year, the final design and report on the minipark network.

Problems Faced by New Employees: Richard Turner spent seven weeks on a project at the Ford of Britain engine plant, as a participant in the WPI-City University of London exchange program. He studied the four-to-five week induction period that new employees must go through, and how it affected their attitudes. The Dagenham plant which Turner studied is the largest factory under one roof in all of Europe, producing 6,000 engines a day. Turner determined that workers found their jobs repetitive and boring, while management exerted significant pressure on the assembly line to meet production requirements and cut costs. Turner concluded that an education program for management at a national level was needed, and that a uniform induction period for new employees should be considered.

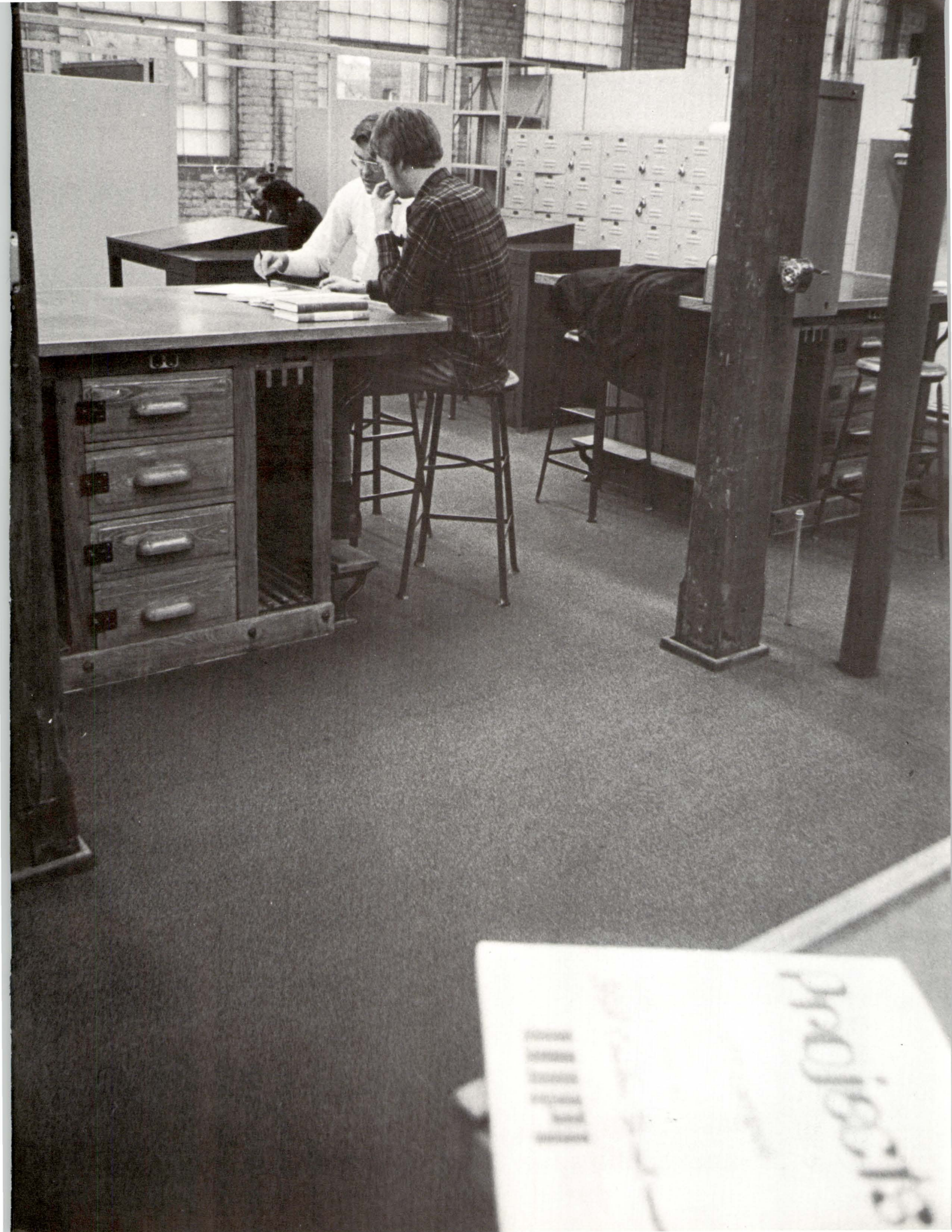
Energy Conversion to Direct Coal Combustion: Students at the Washington Project Center explored the feasibility of conversion to coal for large industrial and utility installations currently using oil or natural gas. The students drew up a number of policy, legislative, and research recommendations. The group recommended investment in new mining methods and modernization of coal transportation systems, particularly eastern railroads.

Regional Systems Modeling: This long-term project tried to formulate a mathematical model to describe and predict urban life in the metropolitan Worcester area. The students tried using the urban dynamics model of Jay Forrester (publicized in recent years by the Club of Rome), but found it difficult to apply to a specific urban system. When they tried to use it with historical data, they found that most of the information they needed was unavailable or very difficult to acquire.

Where Do You Build a Power Plant? To meet growing energy demands, new power plants will have to be built in this country. Four WPI students at the Washington Project Center recently dealt with the factors involved in determining sites for oil refineries and electrical power plants. They studied and evaluated engineering constraints, environmental problems, economic considerations, legal questions, and sociocultural effects—background knowledge necessary for an intelligent analysis of legislation affecting the issue.

The Protection of Wetlands: The Wetlands Protection Act of 1972 gave local conservation commissions the authority and responsibility to impose conditions on the use of wetlands to minimize harmful effects. WPI students discovered, though, that local conservation commissions are generally understaffed, with little money to spend. The group therefore established an ongoing operation, the WPI Wetlands Protection Program, in which interested undergraduates can serve as technical resource people to these local groups, carrying out impact studies and other types of research, giving valuable advice to the commissions.

Occupational Health Hazards: The costs involved in industrial health hazards—accidents and occupational diseases—are currently borne by society in general. Two WPI students studied how to make such costs chargeable to the industry. In this way, the cost of occupational disease becomes a competitive factor in the cost of the final product. The students are hopeful that, if such a system could be instituted, marketplace competition will become a factor in reducing the incidence of such hazards.



Who Gets Treatment? Bruce Croft studied the values involved in deciding what patients should get priority in access to rare therapy equipment, such as kidney dialysis machines. He mailed a questionnaire to 500 individuals to test his hypothesis that people from lower-income brackets will prefer a decision process based on randomization (such as by a lottery) while higher-income people will opt for a system that evaluates the patients "social worth."

Coordination and Support of IQPs

Because of the unique and different nature of interactive projects, a totally different kind of faculty support has been developed. It seems the rule rather than the exception that for IQPs there will be a team of faculty advisors from different disciplines. Much of the work is aided by a new academic nondepartment called the Division of Interdisciplinary Affairs, with a rotating staff representing a variety of departments.

These projects call upon the faculty for a somewhat different outlook, too, and for broader horizons than are often found among engineering professors. To assist WPI faculty in these areas, two separate summer programs have been run, aimed specifically at developing IQP ideas and introducing some of the methodologies and concepts of the social sciences.

WPI Washington Project Center

Some of the most effective IQPs have taken place at the Washington Project Center, in conjunction with the following organizations:

Department of Commerce
Department of Health, Education and Welfare
Department of Housing and Urban Development
Department of Transportation
Environmental Protection Agency
National Science Foundation
Council for Environmental Quality
Consumer Protection Safety Commission
New England Congressional Caucus
National Association of Manufacturers
Institute of Electrical and Electronic Engineers
District of Columbia Civil Defense
Public Technology, Inc.

At the Center, 20 students at a time spend seven weeks living in Washington and working on their projects. Two WPI faculty members direct the Center's work and advise students as they carry out their projects.

"It's a real experience calling up some of these agencies," commented Bryan Young last year while he was working on a Washington project. "Sometimes you find the right person who can help you on the first try. Then again, you can spend half a day getting calls transferred from one office to another."

Washington is accustomed to college student "interns," but the project work of WPI students is not the typical internship in which a student works along with someone in an agency. "We outline our project before we leave Worcester, we know what our objectives are, and when we get here we're ready to do a specific job," said another student. "With only seven weeks here, we have to be organized."

Looking at a couple of projects gives an idea of the challenges that the Washington Center provides. Bryan and John Manning worked at the IEEE office, helping the society get factual information needed to formulate the IEEE energy policy. "We've been looking into strip mining and gasoline taxation problems particularly," said John. "Washington just has to be about the best place in the world to find information. Every agency has a good library. That's part of the problem, though—just learning which library to try!"

In another project, Tom Vaughn and Dan Garfi were at the National Science Foundation. "We're trying to develop a better way to transfer the information contained in the final reports of NSF-sponsored research projects to the agencies which can effectively use this information. It sounds easy, but it's a real problem."

About the Washington Project Center, and the students who work there, social scientist David Riesman (of the NSF committee which visited WPI during the first three years of Plan implementation) has written: "Some of the project reports I have seen are admirable. They establish what I have long believed: namely, that able undergraduates can do as serious work as most graduate students, and as inventive." Riesman also felt the Center had other important lessons for WPI students: "If one considers how provincial are the origins of WPI students, not only in terms of social background but also in geographic terms, the Washington sojourn means as much to them as, for example, the Stanford Year in Tokyo means to Stanford undergraduates—it may be at least as much of a culture shock."

A group of Washington Project Center students were asked what was the single most important thing they had learned in Washington. Their final consensus was that there appears to be no ultimate truth when you are searching for information. Every bit of collected information seems to contain some built-in bias. "I'll probably never again take for granted any collected data, just because it's published," said one student. "I'm going to try to find the same data from another source just to check it."

The IQP Problem

Many people have hailed the IQP as the most important, or most unique, part of the WPI Plan. Yet it has also posed some of the thorniest problems in carrying out the concept. There is the problem of how to maintain academic standards (quality control) when a project ranges far afield of a faculty advisor's professional expertise. There is the problem of how that faculty member can best—or even adequately, sometimes—advise on such a project. How much technology content should there be? How much social reference? How do you compare problem-solving projects with those whose main emphasis is a learning experience, such as teaching? When is an IQP really a major-field project?

This brief article will not suggest answers to these questions, but they are considered every day. In fact, each project has to be treated on an individual basis, and as the WPI faculty gains increasing experience with these projects the problems begin to dissolve.

David Lyons—

"Classwork is fine, but when you have to sit down and do it yourself and make it work. . . when your grade stands or falls on this one program—that's practical experience!"

David Lyons spent most of his fourth year at WPI goofing off. So after that year "majoring in girls," he needed an extra year to complete his degree requirements in computer science. And he graduated with honors.

David entered WPI as an electrical engineering major, switching to computer science partway through his first year. He began work on his major project during the summer after his third year. He ended up spending a year and a half on it, designing a computer program to keep track of all the projects currently going and others available at WPI for students. The periodically printed listings available at the time were so hopelessly out of date by the time they appeared that there was a real need for David's project. The original intent of the project was to have two or three students work on it, but David ended up being the only student involved.

During his fourth year, David worked on his sufficiency in philosophy, particularly the philosophy of religion. At the end, instead of a final paper, David and ten others participated in a term-long seminar on the philosophies of religion. Each week, two students presented a paper and led an hour-and-a-half discussion on different aspects of religion.

David found the flexibility of the WPI Plan very helpful, and very much in accord with the way he works. "I learned that unless I'm pushed I don't do much. I find I can't turn myself on and off to do a job. I can't leave my work at the office, so to speak. I take it home and think about it. It kind of bothers some people at times, because they see me apparently goofing off and think I never do any work, when actually I'm sitting there thinking about a problem."

David learned some lessons about the relationship between classroom work on the one hand, and projects and work experience on the other. "I found how hard it is to get a project started. And once you get it started, it's really hard to stop it. That was a problem with my major project—there was always a little bit more to do to make it a lot better, a little more to add here and there. It just kept going on and on. But at some point you have to draw the line and say that it's done.

"It's really helped in the job market that we have these projects. Companies feel they're getting somebody with practical experience, someone who knows what it's like to do some real work. Classwork programming is fine, but when you have to sit down and design a system and program it yourself and have it work. . . when you're doing that for your grade, and it stands or falls on this one program—that's practical experience!"

Lyons' second project involved writing a user's manual aimed at people who know nothing about computers. His 50-page book was meant to be a sort of textbook to familiarize a person with computers by using a program they would find helpful and which would overcome a layman's fear of using computers because they're so big and complicated. He wrote a special program to produce and store form letters, with the ability to choose paragraphs at will, insert names and other types of information, change wording around, and so forth. The idea was that no matter how well a form letter is written, there will always be occasions when it doesn't fit. David's program allows all the necessary manipulation, and it allows the user to store a copy of the finished letter for future reference.

David found the project very difficult. The problem of communicating with people who don't have the same technical background was, in fact, the central problem in writing the user's manual.

David's competency exam (he was able to choose from three different problems) involved the design of an operating system for a computer. "An operating system is the programming of the computer that keeps track of all the users and decides which programs are going to be able to be run, takes care of the accounting, makes sure you're authorized to use the computer, and does the neat little programming things for you. I was to design this for a specific computer, which I could choose: it could be imaginary, and it had to be reasonable. It couldn't be a computer that was so vast and complex that it didn't need any programming. It had to be a minicomputer."

The way David handled the exam also illustrated the Plan's relation to real life. "At noon on Wednesday, I picked up the question. By four o'clock that day we had to submit a first draft of the report. Four o'clock came around, I submitted my report, and I said 'To heck with this!' I found myself in a party that night and even got a little sloshed. What a great beginning! Thursday I didn't really do a lot of work on the problem either. I thought about everything, and I kept sorting things out in my mind. Friday morning, though, I got up and figured I knew about how I wanted my solution to be, so I just wrote the whole thing down and handed it right in.

"I was the first one of the four students taking the exam to hand in the report, and I had the chance to pick the time on Monday for my oral exam. I picked the last one. My advisor asked why I did that, why didn't I go first and get it over with? I said I didn't like to get up early in the morning. So I slept late Monday, then reported in the afternoon for the exam. I was amazed. Some of the questions I got were totally theoretical: 'Why did you do it this way?' and so forth. A lot of my answers were that the point they raised wasn't a part of the problem, so I didn't consider it. And that was a totally acceptable answer because it was completely correct." David got the first Distinction the department had ever awarded for a competency examination.

Except for a few small wrinkles in his interactive project, David finished all his work in March of his fifth year. Although he didn't graduate until June, he began work immediately at Data General Corporation, in a small "think tank" research and development section.

Laying it on the line: the competency exam

Three or four years of work, and the question of whether or not you graduate from WPI comes down to one examination, designed to test your "competence" as a scientist or engineer or whatever. Is this fair? Is it workable?

David Riesman: *"Can one indeed measure competence of an engineer over less than a lifetime? One can measure various components: articulateness, ability to use the resources of the institution on one's own. Yet the ability to work under pressure that such an examination requires, and to know how to pace oneself without becoming prematurely exhausted, is not a task to which WPI students, or for that matter most academicians, are accustomed. It is only people in practical life who have to work this way!"*

To many people's way of thinking, the competency exam has been one of the thorniest parts of the Plan to put into practice. Difficulties with other areas—the volume of projects, adapting to 7-week terms, increased workloads—all boiled down ultimately to questions of logistics, support, and available resources. But the competency presented a basic philosophical problem: was it measuring "competence," whatever that was, or was it measuring the comprehensiveness of a student's knowledge of a given field?

This confusion was apparent from the start. The document which served as the model for the Plan, "The Future of Two Towers, Part IV," called the exam a comprehensive, although it talked about measuring competence. The first Plan catalog carried on this nomenclature, though subsequent catalogs changed the term to competency exam.

As a result, different departments interpreted this degree requirement in very different ways. Another NSF observer, Eugene Reed of Bell Labs, put it this way: "There is a lack of consensus between and within departments whether the exam should test competency or comprehensiveness. Should it deal with fundamentals or methodology?" Some departments began to require a "pre-competency" exam which was, in fact, a comprehensive. It gradually became clear to most faculty, though, that this situation could not be allowed to stand. As Bruce Mazlish put it, "If the competency exam can be turned into a measure of the student's professional comprehension of a particular field, it begins to subvert the general intention of the Plan. Students will learn very quickly that they must take specific courses in order to pass."

A general consensus does seem to have been reached among Plan administrators and guiding faculty committees that the competency exam should be problem-oriented, that it should test the student's ability to attack (and perhaps solve) such a problem within his major field of study. Although a student obviously requires a vast reservoir of knowledge and data in his field, what the competency exam tries to assess is the student's ability to use that knowledge, and his understanding of what he is doing.

Once this basic philosophical question was settled, though, there was still the problem of designing and giving the exams. An illuminating insight into these difficulties was recently written by Jo Ann Manfra, Thomas Shannon, and John Zeugner of the humanities department, concerning the development of a competency exam for students majoring in humanities and technology (history):

"There was an antipathy toward operational definitions of the historian. Consequently, the first H/T major faced a kind of competency examination that was offhandedly drawn up and reflected the historians' own professional training—a mini-Ph.D. examination. The student failed, naturally enough, since he had not really been given comprehensive exposure to four fields of history, and since the department discovered competency and comprehensiveness were not equivalent.

"The student's anguish and the department's embarrassment that its first student major would not graduate spurred a rethinking of how to measure competence in the study of history. The science/engineering side of the college was formulating competency measures in terms of problems to be solved within time constraints. That approach was adopted in a rather haphazard fashion by the history department.

"The student was reexamined and this time he was asked to identify a contemporary problem and explain, in Toynbee's phrase, 'How this came out of that,' to discuss how the past shaped the present dilemma. The student had deliberately been given the choice of the problem. The department assumed he would fix on an area of his own strength and avoid the embarrassing question of comprehensiveness. Department experts in black history, urban affairs, and foreign policy were standing by, expecting civil rights or the plight of the inner city, or the war in Viet Nam as logical problems for historical explanation.

"Alas, the student selected as his problem, Marcuse's postulate of sexual desublimation in advanced technological societies. It was a deft selection, for he was able to introduce personal experience as well as historical knowledge. The kinds of sources the student could summon, the kinds of points he made, the terminology he used, the dialectic he employed, the bibliography he cited in his long essay, the department soon discovered it could not adequately evaluate. His competence was different from ours. Naturally, he passed. And the problem of measuring or even identifying historical competency was moved a notch up on the department's priority list."

In practice, the usual competency exam is in two parts. The first is a problem given to (or selected by) the student, who then has a certain period of time, which is typically two to three days, to investigate solutions, approaches, lines of attack, and submit a written report about what has been done. Then, in the second part of the exam, the student faces a panel of faculty members (sometimes including off-campus experts, where their special knowledge is needed) to discuss—and defend—what he did and didn't do. After this oral exam, the examining faculty meet to discuss the student's performance and grade it.

Normally, a student is not allowed to schedule a competency exam before completing at least 12 units of course and project work (the equivalent of three years' study).

David Demers —
Answering the siren call

Like a lot of 8-year-olds, Dave Demers wanted to be a fireman. But for him it wasn't just a passing childhood phase. By the time he was in high school, in Lunenburg, Massachusetts, he was a volunteer firefighter for the town. And he still is.

But Dave wanted to do more. He liked his high school science courses, and he decided to go into an engineering aspect of firefighting. He applied to M.I.T. and WPI and was accepted at both schools. "It was a question of atmosphere, and I liked the atmosphere here at WPI much better . . . a small school rather than a factory. And I also prefer the practical approach rather than the theoretical."

At WPI Dave started to map out a unique program in fire protection engineering. He talked with a practicing fire protection engineer and a nearby insurance company, and they stressed the importance of a general background of engineering basics with slight concentration in one field. Dave decided to study mechanical engineering as his main area, but his program grew to include chemical engineering, civil engineering, and electrical engineering courses as well as some nuclear engineering work with WPI's on-campus nuclear reactor.

Because he was so sure of the direction he was going in, Dave used every opportunity he got to expand his knowledge of fire. In a law course, he did a paper on the legal aspects of arson. For a hydraulics course paper, he wrote about fire pumps. For history, he wrote about the social impact of steam fire engines in the nineteenth century. And for his humanities sufficiency, he did his final paper on the "disaster theory" of gettings things done—a theory which states that to accomplish any major social change a disaster is needed. Using the Boston fire of 1872 as a case study, he showed how this affected fire protection measures afterwards.

Dave's major qualifying project dealt with fire protection in buildings. He developed the basics for an information-retrieval system for fire protection, and then worked on a systems approach to fire safety in buildings, making use of the fault-tree method of analysis, originally developed by Bell Labs for missile safety. He didn't know it at the time, but the General Services Administration of the federal government had an entire staff working on the very same subject. The government results closely paralleled Dave's own—they were more sophisticated, but then they'd spent a lot more time at it, too. The final part of Dave's major project involved working with a fire protection consulting firm.

As his interactive project, Dave studied the Worcester Fire Prevention Bureau. He started with the history of the organization, going back through available records, then began going along on their inspections and on fire investigations. He went to court with the Bureau many times, on prosecutions for arson and on abatement orders. He concluded his project with an analysis of what they were doing and recommendations for improving their procedures. Some of these recommendations have already been put into practice.

Even Dave's summers contributed to his knowledge of fire protection. He spent two summers working as a construction laborer, which gave him some practical insight into how buildings are put up. (This knowledge has certainly come in handy, because as this account is being written Dave is supervising the installation and engineering of the sprinkler system in the John Hancock Tower, the tallest building in Boston.) Another summer, Dave worked for a fire extinguisher service company, and another he was a firefighter with the U.S. Forest Service in California, jumping out of helicopters and chasing forest fires all over the state.

WPI doesn't have a fire-protection department, even though Dave built his program in the field. To measure his competency, a panel of two faculty members and a consulting fire-protection engineer gave Dave the following problem: working from a set of architectural plans, figure out how to improve the fire safety of a proposed high-rise home for the aged, and put the recommendations into a letter to the builder.

After passing his competency exam, Dave was all set to go to work for Mobil Oil in Illinois, working on fire protection for the petroleum industry. And then, out of the blue, the consultant who had been on Dave's competency board, and with whom Dave had worked slightly on one of his projects, offered him a job. Dave is now working for him, "because there's a lot more to fire protection that interests me than just petroleum problems. And I'm glad to be able to stay in New England."

WPI

The sufficiency: an appreciation for human values

In most engineering/science colleges, the humanities are traditionally—if not openly—regarded as orphans or stepchildren. They constitute a small fraction of the courses required for graduation, and they are often self-consciously designed to exert some sort of "civilizing" influence on the future engineer. In their turn, students at such colleges tend to regard the humanities as so much "cultural bull," a necessary if distasteful hurdle to be jumped on the way to a degree and a job in the real world.

But the WPI Plan is an attempt to educate engineers who can see and deal with relationships between their professional activities, the needs of people and society, and the values of our cultural heritage. And that means that study of the humanities is a central part of the Plan.

There were two different approaches that could have been taken in building an appreciation for human values into the WPI Plan design. One would be to offer a traditional humanities minor program—an array of survey courses in different areas of the humanities, backed up with a "cafeteria" selection of more specific courses in the various fields. This approach was rejected, however, as being in some ways too superficial, too diffuse to have real impact. It would have been much the same sort of offering as the non-technical electives WPI had before the Plan, but without the stimulus of even necessarily requiring any specific number.

Instead of this older model, the Plan designers decided it would be more fruitful—and more of an educational experience—if students were to investigate one area of the humanities—their choice—in some depth. This would not only give students a focused and concentrated introduction to the humanities, but it would show them just what in-depth study in the humanities entails. This is in fact different from the sort of study needed in engineering and science and math, and it is every bit as difficult—an aspect of humanities scholarship that few engineering students ever learn to appreciate.

Thus was born the humanities sufficiency for Plan students majoring in science or engineering. The sufficiency involves the equivalent of a full half-year of study (six courses) in one area of the humanities, built around a theme of the student's own choice. Students have several broad areas in which they can develop their sufficiency themes: drama and theatre, history, history of science and technology, foreign languages, literature, music, philosophy, art, and religion and social ethics.

Sample sufficiency topics, to give some flavor of the diversity possible, include the following:

The U.S., the U.S.S.R., and detente
Psychology viewed humanistically
Remaining human in the modern world
Varieties of religious experience
Love and marriage
The U-2 incident as presented in the contemporary press and in later memoirs
Thomas Jefferson's contributions in practical technology
The military performance of General Philip Sheridan during the Civil War
Ordered strengths—the ethical views of Locke, Kant, Darwin, and Biblical Christianity
Islamic philosophy
Creativity in philosophy
Why man seeks religion
A history of American thought before the Civil War
The development of storm theory in the United States
New England Transcendental thought in science and literature
Huckleberry Finn and escape from civilization
Arthur Koestler: his life and political novels
Frank Zappa and his music
An analysis of Wagner's Lohengrin
An analysis of two productions of the American Shakespeare Theatre
A parallel between *Othello* and the passion of Christ
Rural life in novels by Hardy and Twain

Typically a student will be interested in one of the general areas and will take a course or two while deciding just exactly what the theme of his sufficiency will be. A sufficiency program will normally involve five related courses taken as background and preparation, then culminate in an independent study for one term actually writing the final paper or project. In certain areas, students working around the same general topic will partici-

by the editor

50 years since Goddard's rocket

When the Auburn Rotary Club began their plans for a 50th anniversary celebration of the first successful launching of a liquid-fueled rocket by Dr. Robert Goddard, '08, they turned to WPI for help.

They wanted someone to construct a full scale replica of that first rocket as a focal point for the ceremonies. WPI officials immediately thought of Felix Tozeski. His official title is Technical Designer and Instructional Associate in the Mechanical Engineering Department. Unofficially, he's the man people on campus turn to when they need help with a tricky project involving welding or machine shop work.

For the past 20 years, "Phil" has taught students how to weld, how to cast metal and how to operate machine tools. He teaches them only the fundamentals since his students will never earn their living on the machine. Instead, they'll be designing mechanical equipment or supervising production someday. "They have to know the basics," said Tozeski, "so they'll understand how things are actually made in a shop."

He started the rocket project last fall. First he visited the Robert Hutchings Goddard Library at Clark University, where Dr. Goddard's notebooks and papers are carefully preserved in a special vault. Mrs. Robert Goddard herself helped him locate some of the early notes, documents and photographs which provided him a start. Later, he went to the Smithsonian Institution in Washington where officials at the Air and Space Museum still under construction arranged for him to make measurements and sketches from the authentic replica of Goddard's first rocket which will occupy a prominent place there. Their greatest help was a set of drawings used to build their replica.

"Once I had all this information, it was just a case of making all the pieces and putting them together," commented Phil.

His job was easier than Dr. Goddard's was 50 years ago because Phil knew his rocket would never fly. The intricate inner workings of the original rocket which couldn't be seen are missing from his replica. However, he added a special touch for realism. Phil's rocket does "fire" with the aid of piped-in propane gas which shoots a long flame from the nozzle for show purposes.

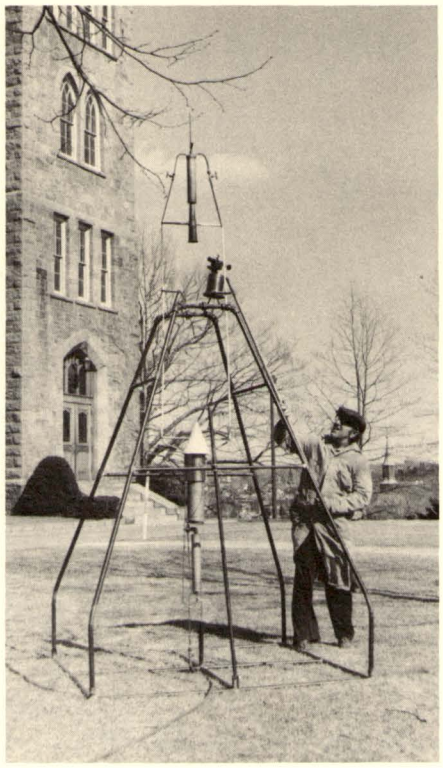
"People have been asking me whatever happened to Goddard's original rocket," said Phil. "It doesn't exist anymore. After his first flight, he rebuilt it completely using a lot of old parts. I understand he did this several times. For historic purposes, it would have been great if he'd kept it intact. But from a practical point of view, he saved himself hours of extra work by reusing the original parts."

A major part of Tozeski's work is teaching courses in basic machine tool operation, welding, forging and metal casting. He and his partner John "Joe" Gale also do maintenance on college equipment between classes. Gale was his principal helper on the rocket project. Several students also worked with him.

"I like working with the students," said Phil. "They really appreciate the help I give them and I find that I'm learning from them all the time, too. It's really a pleasure to get up every morning and come in to the college."

In his spare time, Phil is a bit of an inventor. Faced with splitting a large pile of logs for his fireplace, he built a hydraulic log splitter which he called "Big Squeeze." He built it all from scrap parts. This device was featured in Popular Mechanics and he was deluged with requests for information on how he built it. He has built equipment for use in the college shop such as a metal roller, and a machine for changing truck tires. He loves the challenge of a mechanical problem.

If he'd been born 50 years earlier, he might have been one of Robert Goddard's helpers. It was just this sort of versatile mechanic who could do anything with metal who found a place on those early Goddard teams.



The 50th anniversary celebration was held March 16, with programs at Pakachoag Hill in Auburn, the site of Goddard's rocket's 41-foot flight, and in Harrington Auditorium on campus. The featured guest speaker at both programs was Navy Captain Eugene A. Cernan, the astronaut who in 1972 commanded Apollo 17, the last American manned mission to the moon. Cernan was the last astronaut to leave the moon's surface.

Capt. Cernan's participation in the commemoration was an ironic reminder of a 1929 *Boston Globe* headline referring to Goddard's efforts: "Moon Rocket Misses Target by 238,799½ Miles."

WPI

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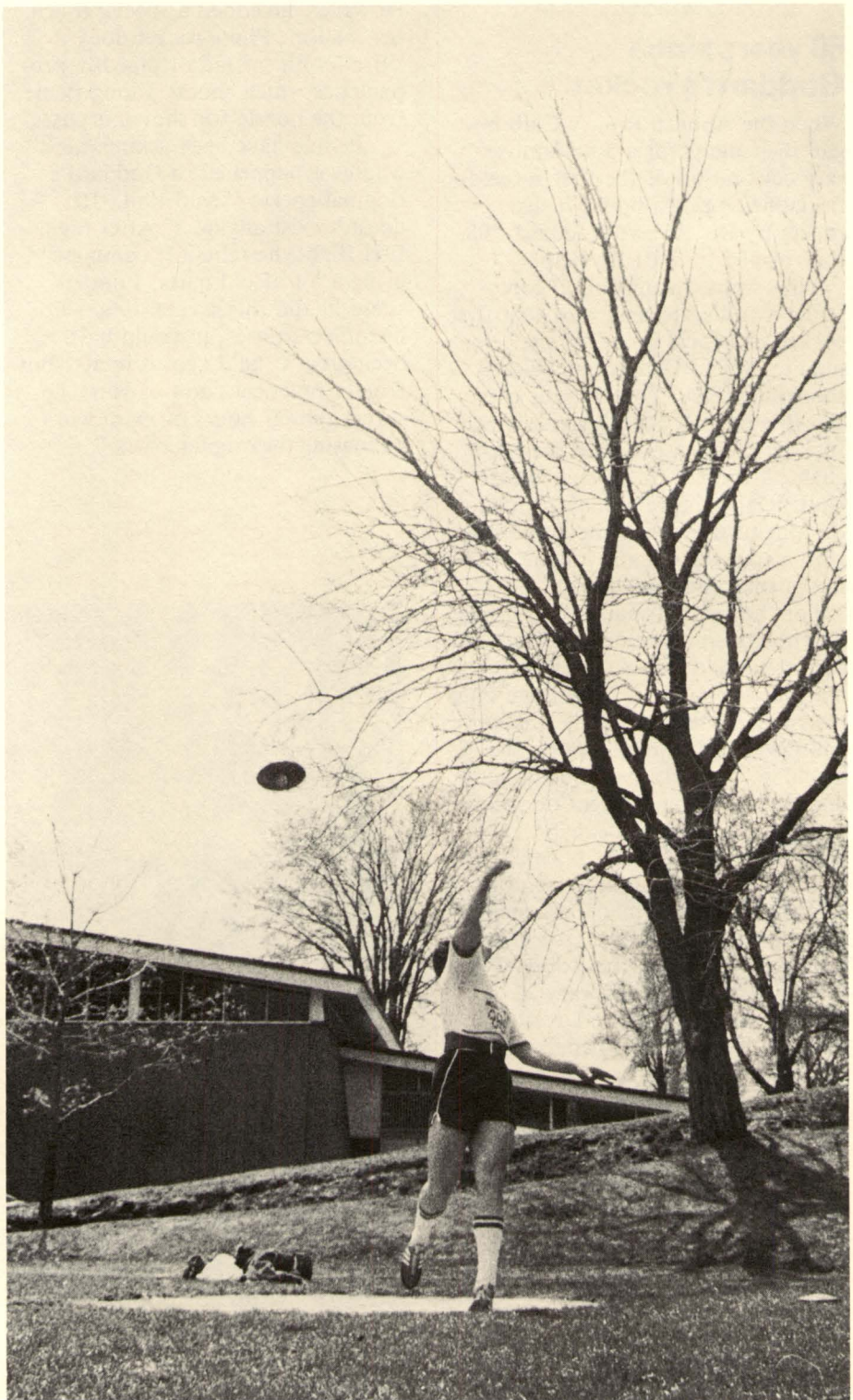


saucer; to Canada, please

by Ruth Trask

YOU GET OUT OF LIFE exactly what you put into it. If there is any truth in that old saying, then four recent WPI graduates and one undergraduate will soon be due for some pretty impressive dividends. Rising as early as 4:30 a.m. each day, they undertake painfully rigorous rounds of weight-lifting (over 250,000 pounds a week!), running, discus-throwing, and rowing, all to one end—to make it to and through the Olympic trials this spring and on to the summer Olympic Games in Canada.

"Montreal is where I hope to be in July," says Mark Dupuis, '72, the current New England discus champion. And that's exactly where Philadelphia-based scullers Jim Raslavsky, '68, Bob Raslavsky, '77, Edward D'Alba, '73, and John Mathews, '74, hope to be, too.

The price of a berth on the U.S. Olympic team is not cheap. Having extraordinary athletic ability is only the beginning. Athletic skills amount to little or nothing without the determination, discipline, and continued dedication necessary to develop them. Continuous training and athletic competition involve so much singleness of purpose that careers, education, and family life, although not entirely abandoned, fall of necessity, into holding patterns. Self-sacrifice becomes an accepted way of life.

MARK DUPUIS has been dreaming of participating in the Olympics since he was 17. Last year he gave up an excellent managerial position with Procter & Gamble to take a job which cut his income by approximately two-thirds.

"I needed more time to build myself up and perfect my skills with the discus," he explains. "P&G wasn't able to give me enough time off for training. I decided to look for a teaching job at a private school where I could take advantage of the long vacations."

Mark Dupuis's training involves scores of practice discus throws each day.

Currently an instructor at the Winchendon (Mass.) School, Dupuis feels that he has found an adequate, if not ideal, solution to his problem. His wife, Karen, agrees. "It's really working out well for us here," she says, "even though some of our friends thought we were crazy to make such a radical change. While our present income can't compare with our former one, the school does provide for our living arrangements and food. Being a close-knit family, one bonus is that we still live near our parents. Another plus is that Bridget (the baby) and I get to see a lot more of Mark. Besides, he is fulfilling his Olympic goal now, and when Mark is happy, so are we."

Home for the Dupuis family now is a cozy apartment in Merrell Hall at the Winchendon School, a far cry from the $40,000 home they had to sell at a loss when he left P&G. But nobody complains about the change.

His schedule at Winchendon leaves him plenty of time for training, although he is responsible around the clock for the welfare of the 16 boys in his section of Merrell. From 11:45 until 3 the students have a sports break, and during this period Mark trains in weight lifting, running, and throwing. He gets in extra workout time on Wednesday and Friday afternoons, which are free time from noon on. And, of course, there are weekends and long vacations, which are almost entirely devoted to training.

Training and competing have become second nature to Dupuis since he was in high school. At WPI Mark broke a school record by hurling the discus 153'9". While at P&G he met coach Carl Wallin of Dartmouth College, who encouraged him to reach his potential in the discus. At that point in his life, Dupuis wanted to stay on at P&G and also pursue his goal with the discus, but he discovered that his career and athletic goals were incompatible. There weren't enough hours to get everything in, so he and P&G came to an amicable parting.

"I will probably get back into business," he says, "but right now the Olympics are something I just can't pass up."

He became associated with the Pembroke-based Bob Backus Olympic Health Club in 1972. Bob helped him with travel expenses to various AAU meets. Later, Jack

McDonald of the Greater Boston Track Club approached him at a meet and asked him to join his club, which Mark did in 1974. The club offers no financial assistance but does set up meets and plans travel and team effort.

"Since Tech I have been financially on my own with the discus," Dupuis reveals. "At a minimum I've spent $3,000 of my own money. A discus costs $80 and a pair of track shoes $35. The money goes fast, especially when it comes to special equipment and travel expenses."

But Dupuis keeps on forging ahead in spite of financial problems and a lack of adequate places to train. "Only Boston College has an official discus circle in New England," he reports. "Most colleges and athletic clubs in the area don't know how to build a recessed circle with concrete, which gives the thrower a toe-board effect, as in the shot put."

The New England weather has been no asset to his training either. He has to train indoors much of the year, which he feels gives the edge to his west coast competitors who train outdoors all year. Also, the 20 to 25 mile per hour winds common in the west are more favorable to throwing. Generally the winds in the northeast are minimal. A favorable wind can make as much difference as 15 feet to a throw.

"If I were training on the west coast, by now I would have already qualified for the Olympic trials," Dupuis states flatly.

Western discus men can practice "sweaty and loose," usually in ideal 80 degree temperature. That's a decided advantage, says Dupuis, in a sport which is heavily affected by the whims of Mother Nature. On a rainy day a 200-foot throw could win the Olympics, while on a warm, windy day it might take a 225-footer, he explains.

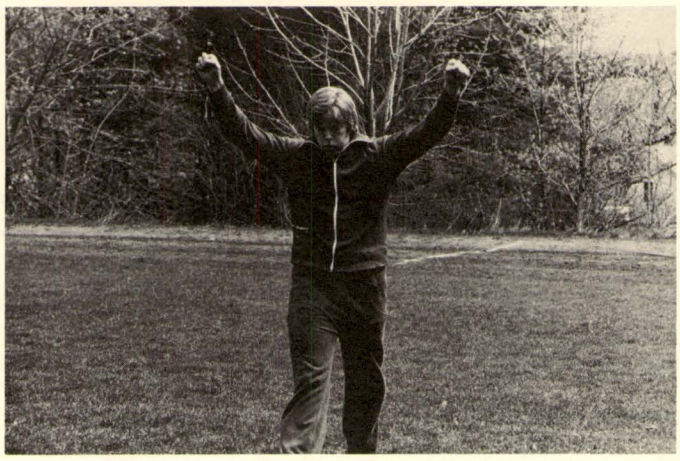
In spite of the vagaries of the New England weather, Dupuis is confident that he'll do well in the trials and eventually in the Olympics. "Ludvik Danek, the Czech discus champion, won a gold medal in the 1972 Olympics and he comes from a similar climate. If Danek can do it, Dupuis can do it."

Mark's weight coach, Joe Donahue of Northeastern University, is confident that he'll qualify for the Olympic trials in Eugene, Oregon, come June 10th. Last year, as New England discus champion, Dupuis threw for his best distance to date, 182'3"—a record breaker.

"In order to make the Olympic trials, I have to throw 196'10" [60 meters] in an official AAU meet by May 31st," he says. "Since I'm usually at my throwing peak during the middle of each month, I hope to qualify two weeks prior to the deadline."

Once the 196'10" mark is met, the AAU will pay his expenses for the first day of the Oregon trials. "That first day of the trials I'll have to hurl 196'10" again. The next day the top three hurlers make the Olympic team. And if I'm one of them, I'll go nuts," he exclaims.

Dupuis believes that if he can turn in a 210' throw, he'll make the Olympic team."But a competitor will probably have to hit between 212' to 224' to win a medal," he says. "As usual, a lot depends on the wind and rain factor."



In order to get himself ready for the time trials, Dupuis follows a rigid three-part training program. The first part consists of three hours of running and weight-lifting daily to help build strength and body weight. "The heavier the discus man, the more power he has to propel the discus," he says. So far he's increased his weight appreciably during the past year and is fast approaching his goal of 255 pounds. "Gaining weight is quite a trick," he admits, "when you work out as much as I do." (His wife Karen laughs and says, "He manages, though. He eats a lot!")

When forced to train indoors, Mark tapes a two kilogram discus to his hand and practices his footwork. on a concrete floor. He also uses a "secret weapon" he has devised to strengthen his midsection. The "weapon" is an eight-foot-long Olympic bar equipped with 300 pounds of weights which he rotates 360 degrees from side to side.

Part two of his program is concerned with power lifting. "This was an area which needed improvement," he confides. So far he has competed in a number of weight-lifting meets and built himself up to a 500 pound official squat, 370 pound bench press, and a deadlift of 600 pounds.

The third part of his training program involves continued power lifting and the introduction of running, throwing, and the explosive Olympic lifts.

What, if in spite of all the training and preparation, Dupuis should injure himself prior to the Olympic trials? What would his attitude be then?

"I've thought about this occasionally," he says "and decided that if God wants me to make the Olympics, I will. If I should become injured, I'll still have done the best I'm capable of doing. There will be no regrets."

Dupuis feels that the long hours of agonizing training have given him a valuable learning experience. He has acquired better techniques and gotten into the physics of the discus—how to improve its flight, acceleration, and explosion. "When it comes right down to it," he explains, "discus throwing is a very technical event. It is also a great challenge to the mind and body and has brought me closer to God."

Although he believes that God has been guiding him in his Olympic aspirations, he also believes in his own abilities and his personal capacity to endure. "I am not like Hercules holding up his magic ring to receive a lightning bolt of power from the heavens," he says. "God guides and I follow, but I know what I, myself, have to do to compete and win."

If the worst happens, however, and he does get hurt, he reports that he'd have to think twice before he'd consider trying out for the next Olympics. "It took me four years to get my weight up from 198 to 255. With a bad injury, all that I've accomplished would be lost. It would take another four years for me to get back where I am right now. Could I ask myself or my family to go through all this again?"

Still, weight men don't peak until age 32, and Dupuis is only 25. If for some reason he doesn't make it to the Olympics in 1976, Moscow and 1980 are coming up.

WHILE DUPUIS is anticipating participating in his first Olympic trials, **Jim Raslavsky** '68, has started out along his second tortuous trail to the Olympics and says he hasn't ruled out 1980 either. Back in 1968, his first time around, he was hampered by an injured back and arm and lost out in the rowing quarter-finals held in Long Beach, California.

But this time his prospects look considerably brighter. In top physical condition and with a string of recent wins under his belt, the world class heavyweight elite single sculler has Montreal firmly in his sights.

It was at St. John's High School in Shrewsbury, Mass. that Raslavsky discovered rowing and the first seeds of the Olympic dream took root. Pete Johnson, a national lightweight champion sculler was training at Lake Quinsigamond, where the St. John's crew rows, and invited Jim to work along with him. Before long the young heavyweight was outdistancing his teacher.

After graduating from St. John's, where he had competed in numerous sculling events, he entered WPI, which had no crew team at all. He quickly remedied that situation by *starting* a team. Four years later his eight-oared crew *won* the New England Small College Championship!

Since graduating from WPI, Jim has married, become the father of two daughters, built a house, and recently moved to Philadelphia where he is supervisor of pewter sculpture production at the Franklin Mint. In spite of a demanding job (especially in this bicentennial year), and a full family life, Jim's Olympic goals have not diminished. His schedule is mind boggling.

Every morning from March through November he gets up at 4:30 a.m. and drives from his apartment in suburban Philadelphia to the Undine Barge Club on the Schuylkill River. There, in the sometimes sub-freezing weather, he launches his 27-foot long, 34-pound single shell into the choppy waters and starts his practice session. It is a time for perfecting techniques, for building stamina, for battling pain.

An hour later he leaves the river and drives the 16 miles to the mint where his working day starts at 7:45. (The mint has agreed to give Jim a leave of absence should he make the Olympics.) At 4:30, his work day over, he drives back to the Undine Barge Club for two more hours of sculling under the supervision of Jim Barker, one of the country's top coaches.

During the off-season from November to May, Jim runs four to six miles each morning from his home in Newtown Square, Pa. Then there's the hill work, which Jim explains with a broad smile on his rugged face: "You look for the steepest hill you can find, then run up and down it as fast as you can. You do this five or six times until your legs refuse to carry you any farther."

Athletic Club, a training center for Philadelphia oarsmen. There, under the watchful eye of weight-lifting coach Al Nino, Jim lifts a total of up to 154,000 pounds during his workout.

Afterwards he tackles the "monster," a giant rowing machine made of pipes, pulleys, cables, and weights that can simulate the immense physical strain of a 2000-meter sculling race. Grasping the rowing bar, his face becomes a mask of intense concentration, every muscle tense, every movement part of a powerful rhythm. After 40 strokes his face contorts in pain. His temples throb and perspiration slicks his forehead. He passes 100 strokes, 200, 300. His eyes are glazed and he gulps for air. After 350 strokes, he leaves the "monster" and silently, trembling with fatigue, he walks away, leaving the machine for is teammates.

Is the pain and the agony worth it? Is the prospect of winning an Olympic gold medal worth the almost superhuman effort involved to get it?

"Yes," Raslavsky says in his soft-spoken manner. "And there are good reasons why we train as rigorously as we do. Sculling is the most exhausting sport there is. In a 2000-meter race a good sculler will burn up more energy in seven minutes than a pro football player uses in a 60-minute game. We have to work hard to build up our heart and lung capacity."

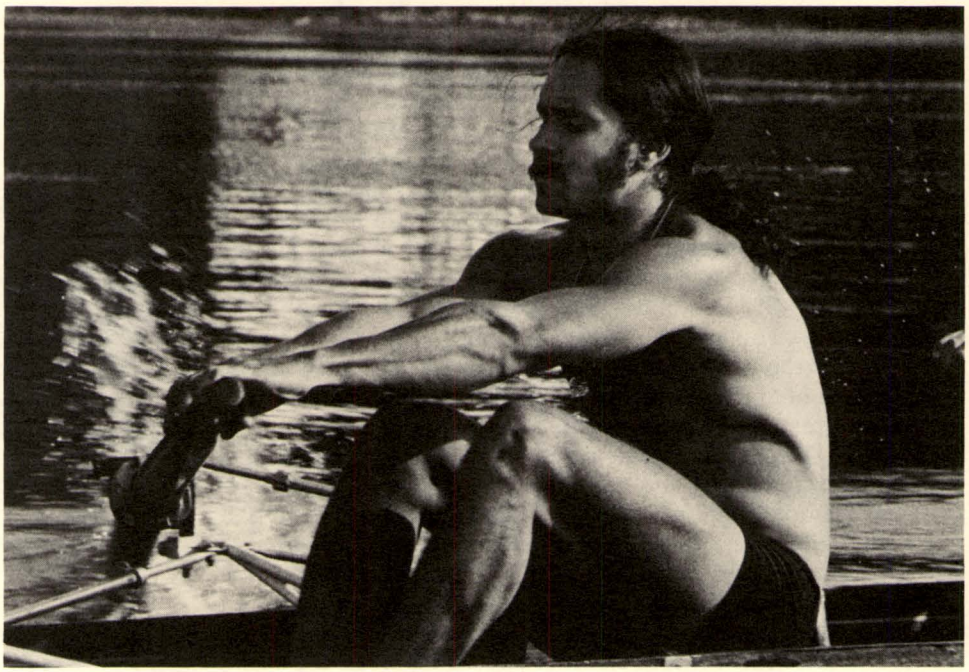
Strenuous workouts have slowed his normal pulse rate to an incredible 42 beats per minute and have really begun to pay off for him all around. Last year he took first place in the Middle States Regatta in Philadelphia and first place at the Head of the Connecticut Regatta in Middletown. Against several former national champions and top representatives of the Pan American team, he placed a respectable third in Boston's prestigious Head of the Charles Regatta last October. Such wins can't help but bolster his confidence as he looks ahead to the time trials and to Montreal. Beyond the agony of effort lies victory.

JIM'S BROTHER, BOB, '77, is his partner in pain. Bob and Jim, sons of Albert J. Raslavsky, '39, a star WPI athlete, both got their sculling starts at St. John's in Shrewsbury. Jim also took the time to teach his younger brother all that he knew about rowing during long afternoons on Lake Quinsigamond. Later Bob followed Jim to WPI.

Now Bob has transferred from WPI for a semester (to Villanova) so that he can be in Philadelphia to train for the Olympic trials with Jim. The trials are slated for June on Carnegie Lake near Princeton, N.J.

"I've been away from serious training for quite a while," Bob says. "But working out with Jim makes it easier. He even has a special weight-lifting room right in his apartment building."

Left: Jim Raslavsky enmeshed in the "Monster" rowing trainer, while club-mates wait their turns.
Right: Along on the Schuylkill, Jim rows his single shell for hours every day.



Bob, who also belongs to the Undine Barge Club, was a star schoolboy sculler at St. John's. He won the New England Singles High School Championship in 1969, just 20 minutes after he'd competed in the eight! The finish was so big that *Sports Illustrated* featured Bob in its "Faces in the Crowd" section. The magazine also awarded him a silver trophy.

In 1970 he was a member of the U.S. Youth Rowing Team and took part in the Junior World Championships held in Greece. While still at St. John's he came in second in the 1971 National High School Championships at Syracuse. In 1972 and 1973 he captained the freshman rowing team at Boston University and was awarded a special plaque for his contributions to freshman rowing.

After a year at Norton Company, he entered WPI and became a member of the crew team. His most recent official race was last year's Head of the Charles Regatta, which was coached by David Ploss, '70, former WPI coxswain.

Bob now follows essentially the same training program as Jim. He is also working toward achieving the world class heavyweight elite single classification that his brother holds.

ED D'ALBA, '73, has the April date of the Princeton pre-trial races inked in on his schedule. "And in June I'll try out for any spot I can get," he declares. "Singles, doubles, quads, whatever. There are only seven slots open on the U.S. Olympic sculling team, and I'm busting myself to qualify for one of them."

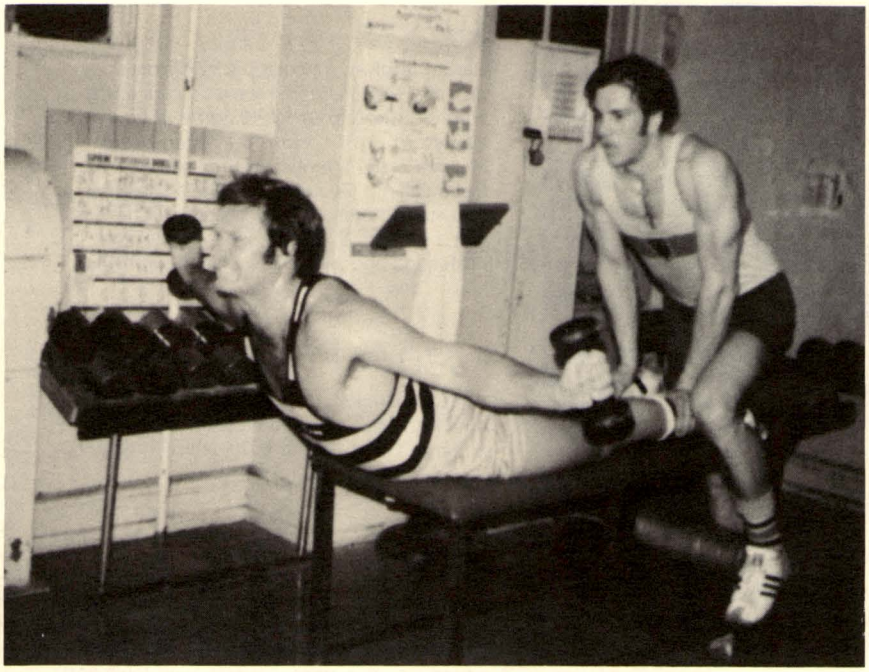
D'Alba is a top oarsman and former captain of the WPI crew and, like Jim Raslavsky, has to work around a full-time job to train for the trials. Currently he is a project engineer at Philadelphia International Airport on assignment from Urban Engineers, but he manages to budget his free time to train and compete.

"The amazing thing about this year's pre-Olympic crew competition is the large number of aspiring athletes from small colleges such as WPI," he says. "The usual big name colleges like Harvard will be represented, but they will not dominate the squad as they have in the past. WPI has, perhaps, more Olympic hopefuls training in Philadelphia (the rowing capital of the U.S.) than any other college or university. Training together with the hope that one or all of us will make the team provides added psych which is so necessary to get us through our workouts. A WPI oarsman on the Olympic squad would be a plus both for Tech and the WPI rowing program," he emphasizes.

At the end of his senior year at WPI, when Ed's team won a number of races, the thought of a berth on the Olympic team began to emerge. The thought now looks like more of a reality as the rewards of his intensive training have become apparent. For example, during the last race of the season, D'Alba won both the singles and doubles races at the Frost Bite Regatta.

Earlier, he teamed up with PKT fraternity brother Jim Raslavsky for the Undine Barge Club. They entered several doubles races, including the Middle States Regatta, where they finished several lengths ahead of the nearest rival, only to find that they had been disqualified for passing under the wrong bridge arch. Several weeks later, with no disqualifications, they placed second in a field of sixteen in the Head of the Schuylkill and fourth out of forty in the Head of the Charles.

"We never trained in the double—we just got in on race day and beat a lot of people," D'Alba reports. "Jim and I could really make the boat click. There's still a long road ahead of us before Montreal," he adds. "But we're giving it all we've got."



Left: Bob Raslavsky straining his way toward the hoped-for Olympic berth. Right: Ed D'Alba holds down John Mathews' legs during a workout.

JOHN MATHEWS, '74 recently gave up his civil engineering job and is already living on his own resources as he globe trots from one regatta to another posting remarkable results.

Affiliated with the Philadelphia Vesper Boat Club, he made his most important win to date when he rowed bow and helped capture a gold medal for the U.S. in the two-man shell-with-coxwain event at the Pan American Games in Mexico City on October 19th.

The December issue of *The Oarsman* magazine reported that prior to the all-important preliminary heat on Oct. 15th, Mathews said, "Let's not mess around. Let's just go kill 'em". . . and then proceeded to do exactly that. The Vesper boat spurted into the lead over Cuba, Uruguay, and Mexico in the semi-final, and was out of reach in the first 500. Rowing a solid 30-31 strokes per minute through the middle 1000 and increasing the rating slightly in the last quarter, the U.S. crew pulled ever further in front, besting second place Cuba by 21 seconds. The win put the Vesper team in the finals on Sunday when they rowed past the Canadian entry and brought the U.S. its first gold at the regatta.

The victory was doubly sweet for the former co-captain of the WPI crew. It made Montreal look like more of a sure thing, and it helped erase, or at least temper, the memories of Nottingham, England, and the disastrous 1975 World Rowing Championships.

Actually, Mathews and his teammate Darrell Vreugdenhil of Seattle (coxed pairs) were a couple of brighter lights for the U.S. at Nottingham last August. They started out on a positive note and had a little bit of luck in the Sept. 1 event. The September 8 issue of *Sports Illustrated* reported: "In the whole day's rowing only the "Monster" and his teammate placed." (Mathews, at 6'4" and 225 pounds, amiably invites people to call him "Monster," although at WPI and Phi Sigma Kappa, he was dubbed "Tree.")

Describing his effort involved in the event, "Tree" said, directly following the race, "I've never dug down inside so deep. I'm still all pain from the thighs down. When we were coming up from fifth place on Yugoslavia, just like it says in the stories, everything went black in front of me."

Exhausted but euphoric over the third place semi-final photo finish, Mathews walked into the boathouse. The next day at the finals, the rains came, and the winds, and Mathews and his teammate only managed a fifth. Said a dejected John Mathews, "It wasn't my day."

It wasn't a day for the U.S. either. For the first time in rowing history the U.S. did not appear at the medals table at the championships.

In June at Henley-on-the-Thames, England, Mathews and his Vesper teammates had fared considerably better snaring a second place in the straight four event. Later in the season he won two gold medals at the U.S. Nationals rowing the coxed-pair and coxed-four events. At the Head of the Charles Regatta in October rowing for Vesper he copped two firsts in the 8-man elite and elite four-oared shells and cox, simultaneously winning the Boston Globe Trophy and the Schaefer Trophy. This summer John will try for the U.S. team by competing in the U.S. coxed-pair trials.

THE ROAD to Montreal for all of WPI's athletes will be paved with similar victories and defeats. It will be paved with sweat, exhaustion, humiliation, determination, and immeasurable self-sacrifice. But, most of all, it will be paved with pain.

Every WPI Olympic hopeful knows that somewhere a Russian or a Norwegian athlete is straining every muscle, every nerve, to its utmost, and blinding himself to the agony. As Jim Raslavsky says, "It's the man who can stand the pain the longest who will win the Olympics."

The data on which these class notes are based had all been received by the Alumni Association before March 15, when it was compiled for publication. Information received after that date will be used in succeeding issues of the WPI Journal.

1914

R.H. Dufault and his wife, Chris, have moved from their Spencer home and joined forces with their daughter, Mrs. Claire D. Wilson at 32 Pine St., Wellesley Hills, Mass. 02181.

1916

Mrs. Robert E. Lamb broke her hip and leg last winter but is making good progress in her recovery and hopes to attend the 60th class reunion with Bob in June.

1925

Robert E. Quinlan has retired. He was a regional representative for Equity Funding Securities Corp. in Albuquerque, N.M.

1926

Warren P. Gleason currently serves as a trustee and a member of the planning board of the Maine Coast Memorial Hospital in Ellsworth, Me. He is also chairman of the utility committee in Winter Harbor.

1927

Charles MacLennan continues with the Canadian Executive Service Overseas and is still located with his host Brazilian family in Florianopolis. He writes that as an advisor in the electrical development in the area, he has experienced more personal satisfaction than at "any time during my previous working career." Recently he vacationed in Florida, Illinois, Nova Scotia, and England. He and his wife, Audrey, are building a house in River John, Nova Scotia.

1929

Paris Fletcher, an emeritus WPI trustee, and his wife, Marion, were recent visitors at the home of the **Arthur W. Knights** in Lower Waterford, Vt. . . . **Harold P. Richmond** became a Life Member of the Institute of Electrical and Electronics Engineers last fall. The status is reserved for those who have had a great deal of experience in the profession and a long association with IEEE.

1930

The **Carl Backstroms** toured six Central American countries and discovered that winter in Guatemala at 5000' is like spring in New England.

1931

The former corporate director of the contract management division at Collins Radio Co., Cedar Rapids, Iowa, **William Graham,** has retired. . . . A memorial communion table and linens were dedicated in memory of the Rev. **Walker T. Hawley** at Middlebury (Vt.) Congregational Church last December. Rev. Hawley, who had been pastor at the church from 1947 to 1968, died in 1974. . . . **H. Edwin Hosmer,** who was with Monsanto in Springfield, Mass., retired recently. . . . **Robert S. Williamson,** an industrial engineer who had been with Union Carbide Co., Cleveland for many years, has retired.

1932

Emile R. Dube is retired. He had been quality assurance manager for Swift & Company in Kearny, N.J. . . . **Elliot E. Jones** retired as a consultant for U.S. Steel last May.

1933

Arthur H. Dixon has retired. For many years he was with the U.S. Bureau of Reclamation in Denver, Colo. . . . **John J. Dwyer** has retired after serving 38 years as a teacher and director of Worcester Vocational Trade High School. He and his wife now expect to spend much of the time living on their new 36-foot cabin cruiser. Dwyer, who is the past president of the Massachusetts Association of Vocational Administrators, also plans to remain active with the association. . . . Also on the retired list is **Paul G. Guernsey.** He was sales manager of the credit card department at Mobil Oil Corp., New York City. . . . **Anthony Kapinos,** who was with Studebaker Worthington, Inc., of Springfield, Mass., for many years, has retired.

Richard T. Merrell retired from U.S. Steel on August 1, 1975 after 42 years of service. During his last assignment he was superintendent of Cyclone Fence in Oakland, Calif. . . . Recently retired are **Francis C. Moore** from the Water Resources Board of the State of New Hampshire in Concord and **John C. Spence** from Newark Caster & Truck Corp. in Newark, N.J. . . . **Philip Tripoli** is on the retired list. He was with Norair, a division of Northrop Corp., Hawthorne, Calif. . . . **Jeremiah H. Vail,** manager of equal employment opportunity for U.S. Steel in Pittsburgh, retired at the end of December.

1934

Dwight J. Dwinell, who retired in 1973 as manager of equipment design at GTE Sylvania's equipment development plant in Salem, Mass., was recently named a recipient of the Leslie H. Warner Technical Achievement Award for his part in the development of new equipment for the production of Magicubes. The award is designed to provide both recognition and substantial cash to employees whose outstanding technical achievements make important contributions to the growth and profitability of General Telephone & Electronics Corporation. Mr. Dwinell joined GTE Sylvania in Salem in 1936 as an assistant production supervisor. Later he served as an equipment designer and supervisor of equipment design. He holds 12 U.S. patents.

Edward R. Markert has retired. He had been chief of the factory branch at Springfield (Mass.) Armory. . . . Also retired is **Frederick G. Webber.** He was the former assistant to the vice president of engineering at General Instrument Corp., Chicopee, Mass.

1935

Edward J. Cove retired as a local test foreman for New England Telephone & Telegraph Co. in February. . . . **C. Marshall Dann,** U.S. Commissioner of Patents and Trademarks, spoke before the Los Angeles Area Chamber of Commerce in January. He explained how businessmen and exporters may benefit from patent and trademark protection. Last November the U.S. became the first country having major patent activity to ratify the "Patent Cooperative Treaty", a major advance which will help Americans get patent protection, Dann said. . . . **Weslye L. Martin,** a self-employed professional engineer, is located in Bennington, Vt.

1936

Retiring after 20 years of federal service as a civilian employe, **George E. Rocheford** was honored at a reception given by fellow employees of the New England Division of the U.S. Army Corps of Engineers, Waltham, in January. He had been assistant chief of the structural section in the engineering division at Corps headquarters.

1937

Prof. **Ray Linsley,** executive head of the civil engineering department at Stanford University, has retired.

1938

Currently **Jack Germain** serves as vice president of sales for New Britain (Conn.) Machinery, a division of Lucas Machine.

1939

Howard J. Blanchard is with Willamette Iron & Steel in Richmond, Calif. . . . Bryant Grinder Corporation, a unit of Ex-Cell-O Corp., has announced the appointment of **E. Bruce Crabtree** as general sales manager for Bryant grinding equipment. He will be responsible for all domestic and foreign sales. Prior to joining Bryant Grinder, he was director of marketing for Erickson Tool Co.

1940

Jeremie LaFrance, Jr. is a design engineer at Martin Marietta Corp. in Baltimore, Md. . . . **Gerald Lainer** holds the post of president at Telesco International Corp., Plainview, N.Y. . . . **Richard F. Scharmann** has retired. For many years he was a scientist and branch superintendent with U.S. Naval Air Development in Warminster, Pa. . . . **Harry Terkanian** currently serves as principal engineer at Raytheon Co. in Bedford, Mass.

1941

Leonard H. White has been elected a director of the Mechanics National Bank in Worcester. He is president and treasurer of R.H. White Construction Co., Inc., Auburn and president and director of the Milford Water Co. and the Whitinsville Water Co. An incorporator of Hahnemann Hospital, he is also past president of the Auburn Rotary; a member of NSPE; American Water Works Association; New England Water Works Assoc.; Massachusetts and New Hampshire Water Works associations; and New England Gas Association.

1942

Donald D. Alden works for Beringer Co., Inc., Marblehead, Mass. . . . **E. Curtis Ambler,** chief engineer in technical services at the Stanley Works, recently received the Jaycee Public Service Award in Newington, Conn. He is a town councilman, leader of the Republican minority, and has served as the town's representative to the Central Connecticut Refus3 Authority. For eight years he was on the town plan and zoning commission. A cofounder and president of Newington Antique Fire Apparatus, Inc., he is also a member of the volunteer fire department. He is a director of the Newington Children's Hospital and the first lay moderator in the 246-year history of the local Congregational Church. He is a charter member and past master of Sequin Lodge 140 A.F. & A.M. and a retired lieutenant commander in the Naval Reserve.

Prof. **Roy Bourgault** of WPI's mechanical engineering department was coauthor of the article "Teaching Failure Analysis: Two Approaches", which appeared in the January edition of *Engineering Education.* . . . **Paul C. Disario, Jr.** is now vice president of Burns and Roe Industrial Services Corp. in Paramus, N.J. . . . **Edward A. Hebditch** serves as principal at E.A. Hebditch Assoc. in Pittsburgh.

1943

Robert W. Alexander is with the Marine Plastics Division of Northern Petro-chemical Co. in Clinton, Mass. . . . **Jackson L. Durkee** has left Bethlehem Steel Corporation after a 28-year bridge building career in the firm's fabricated steel construction division, which is now being closed. Currently he is visiting professor of civil engineering at Cornell University. While with Bethlehem, he had been the company's chief bridge engineer since 1965 and was responsible for the structural integrity of major bridgework. . . . **Galpin M. Etherington** is employed by Birmingham (Ala.) Stove & Range Co. . . . **Robert A. Painter,** president of the Electronic Instrument & Specialty Corporation, Stoneham, Mass., was recently elected to the board of directors of the Smaller Business Association of New England (SBANE), Waltham. SBANE is a private non-profit association of over 1,200 smaller businesses in New England. . . . **Frank Szel** is now with the engineering and construction services division of Dow Chemical in Cleveland, Ohio.

1944

Irving James Donahue, Jr., president of Donahue Industries, Inc., Shrewsbury, Mass., has been elected a trustee of Memorial Hospital, Worcester. He is a WPI trustee, Shrewsbury Finance Committee chairman, and director of the Massachusetts Association of Finance Committees. A past director of the Worcester Area Chamber of Commerce, he is also past president and director of the Central Massachusetts Employers Association.

1945

Anson C. Fyler has resigned from Arrow-Hart as president to become the new president and chief executive officer of the Superior Electric Co., Bristol, Conn. Since 1946 he has been associated with the electrical industry, becoming the president of Arrow-Hart, Inc. in 1966. He was named chairman of the board in 1970. He is also a director of Crouse-Hinds which merged with Arrow-Hart last year. Presently he serves as a director of the Connecticut Bank & Trust Co., Phoenix Mutual Life Insurance Co., and Veeder Industries,Inc., and as a WPI trustee. . . . **Charles C. Shattuck** holds the post of director of manufacturing for Standard Electric Time in Springfield, Mass.

1946

Married: Robert D. Bartlett and Elva Grigsby on December 27, 1975. The Bartletts reside in Shawnee, Kansas.

Francis L. Bliven is an extrusion superintendent at Lloyd Mfg. Co., Inc., Warren, R.I. . . . **Lionel B. Brooks,** chairman of the board and chief executive officer of Eastco, New England distributors for Whirlpool, RCA, Lloyds, Monarch Carpets, and Congoleum, has been elected president of the Electric Institute, the electric industry association serving Eastern Massachusetts. He joined Eastco in 1946. . . . **Robert B. Charlton** is with Wallace McRoy & Assoc., Birmingham, Ala. . . . **Rudolf L. Hirss** is employed by Giroux Screen Print in Burlington, Vt.

Carlton G. Lutts, Jr. owns the Cabot Market Letter in Salem, Mass. . . . **James L. Sullivan** has joined Inland Ryerson Construction Products Co. in Milwaukee, Wis. . . . **Robert C. Taylor** works for Thermoplastics Co., Inc., Leicester, Mass. . . . **Miczyslaw J. Waclawek** is now with Lely Multipower and resides in Temple, Texas.

1947

Lawrence T. Garnett works for Statham Instruments, Inc., Oxnard, Calif. . . . Presently **John G. Hambor** is with Galileo Electro Optics in Eatontown, N.J. . . . **James J. Hierl** is employed in the magnetic peripherals division at Control Data Corp. in Oklahoma City, Okla. . . . **Stephen Koval** is with the Department of Youth Authority in Paso Robles, Calif. . . . **Paul D. O'Donnell,** division general manager of Westinghouse Electric Corporation in Tampa, Fla., has been elected as a member of the board of directors at the Exchange Bank of Westshore. Listed in *Who's Who,* he is also a director of IEM, Mexico City, one of the largest manufacturing concerns in Mexico and a past president of AIIE. He is on the board of governors of the Greater Tampa Chamber of Commerce and serves on the board of directors of Florida Gulf Coast Symphony, and Junior Achievement of Greater Tampa.

WE'VE BEEN WORKING ON FOR THE LAST 100 YEARS.

And we're still working on it.

You see, the invention of the telephone didn't stop with Alexander Graham Bell. It just started.

Because the telephone is just the beginning of a telephone call. It's part of an intricate network of a trillion parts and nearly a billion miles of circuits.

To build this network, we at Bell Labs and Western Electric have long worked as a team with AT&T and your Bell telephone company.

As a result, America has the best telecommunications system in the world.

And the world has the benefits of such Bell System innovations as the transistor, the coaxial cable and direct distance dialing.

Working together, we've created entirely new communication systems. Like our latest switching machine that can route 550,000 calls an hour.

At the same time, we're constantly improving existing systems. Like tripling the capacity of our major microwave radio system in the last ten years.

Even the standard telephone that you probably think never changes has had virtually every major part improved since 1972.

In fact, we've made more than 2,500 improvements in your phone in the last twenty-five years.

Not just to make it look different. But to make it work better.

And to keep its cost down.

Improvements like these don't just happen.

The Bell System invests more than $750 million a year in research and development.

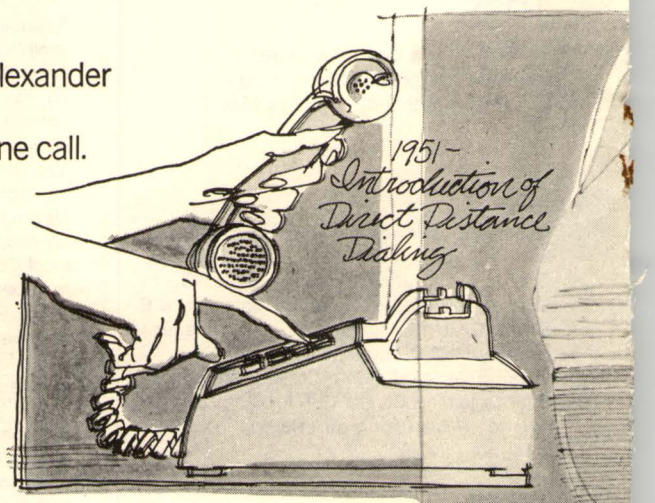
As an outgrowth, we receive an average of more than two patents every working day. And nearly half the things Western Electric will make this year didn't even exist four years ago.

In the next 10 years, we plan to expand the capacity of the telephone network as much as we have in the past 100 years.

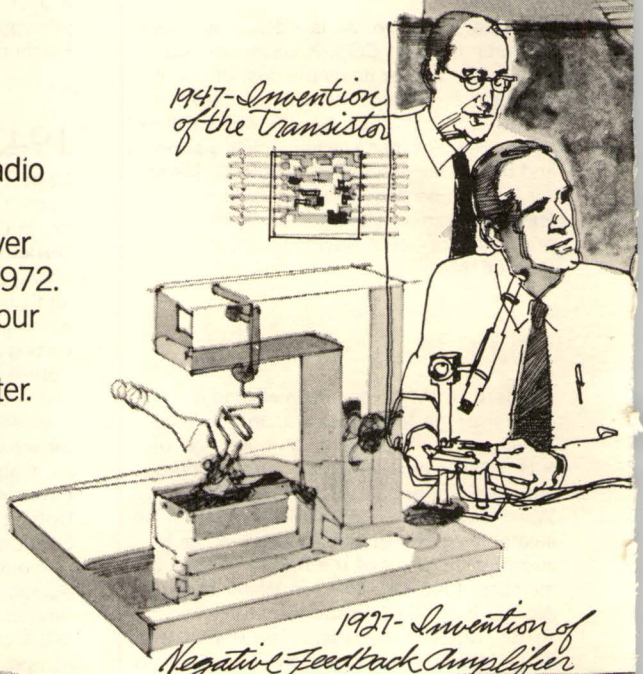
To keep this network operating and growing takes the innovative teamwork of Bell Labs and Western Electric.

The kind of innovative teamwork that makes us say:

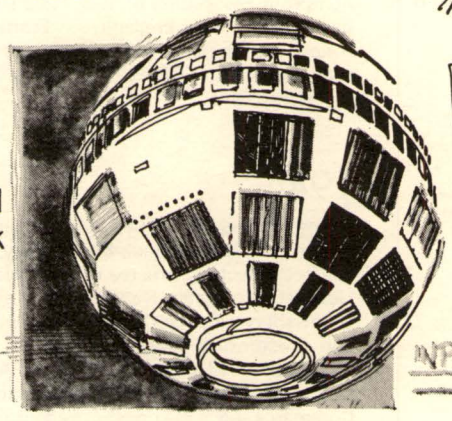
One Bell System. It works.



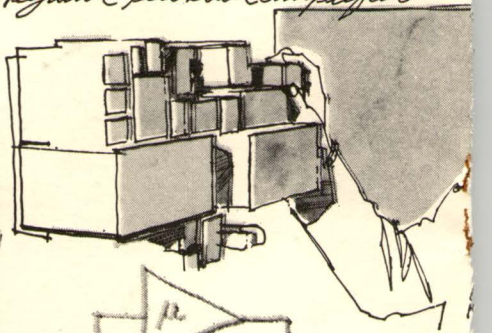
1951 - Introduction of Direct Distance Dialing



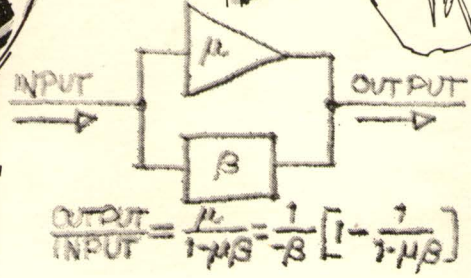
1947 - Invention of the Transistor



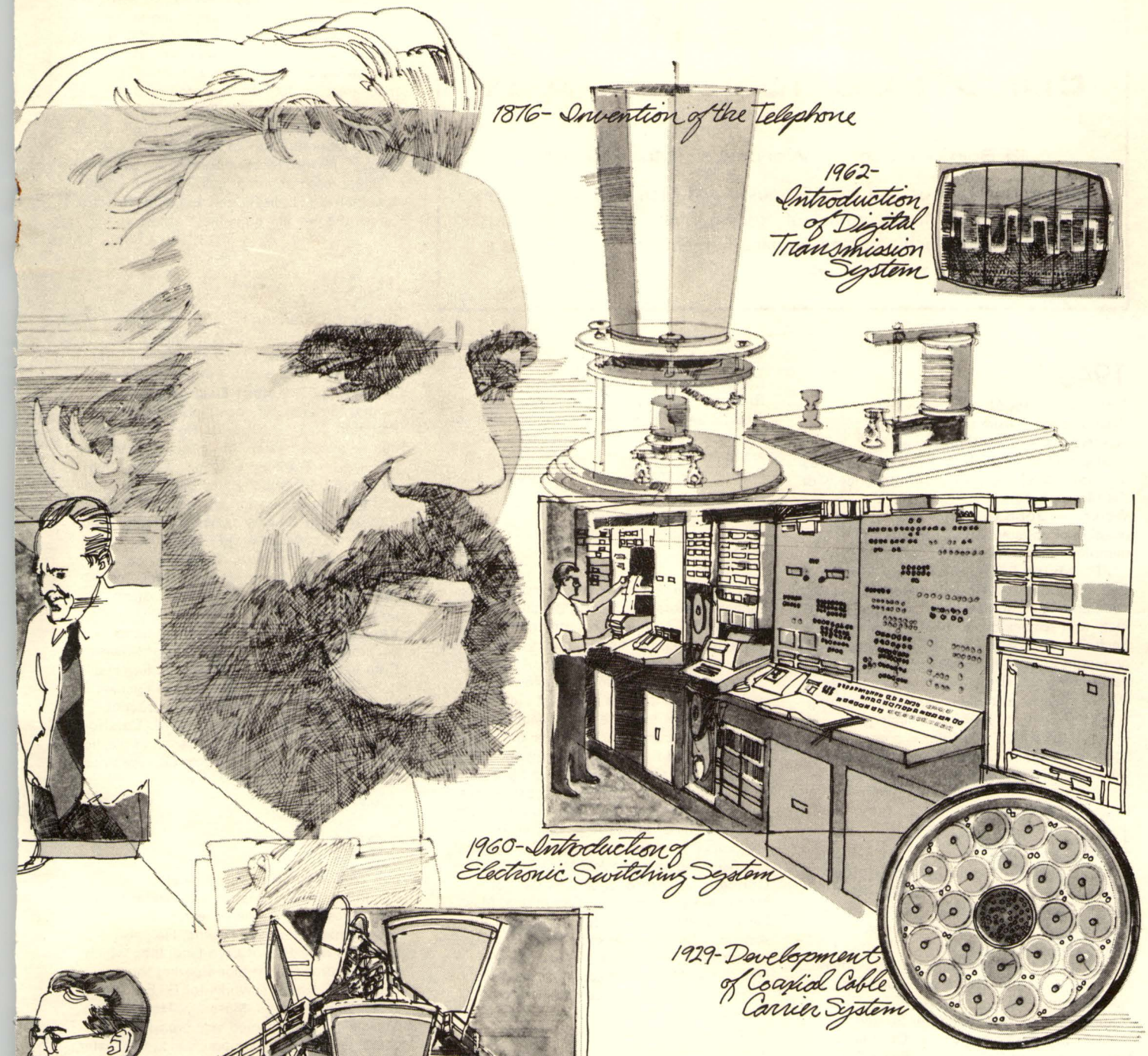
1962 - Launch of Telstar™ Communications Satellite



1927 - Invention of Negative Feedback Amplifier



YOUR NEXT PHONE CALL



Bell Labs
Western Electric

1948

Norman L. Diegoli received a 25-year Award of Merit from the American Association of State Highway and Transportation Officials in January. He serves as deputy chief engineer of maintenance with the Massachusetts Department of Public Works. . . . **John G. FitzPatrick** holds the position of assistant vice president of manufacturing at Lenox China, Linwood, N.J. . . . Dr. **Myron E. Lunchick** owns SEACO in Bethesda, Md. . . . **Albert J. Merlini** has been appointed an associate professor in the math and science department at Vocational-Technical College in Laconia, N.H. Previously he taught in the electrical engineering department at UNH. He has also served as staff supervisor to the director of engineering at AVCO Systems Division, Wilmington, Mass. . . . **Wesson C. Miller** is a general agent at Provident Life & Accident Insurance Co. in West Hartford, Conn.

1949

Dean P. Amidon and **Francis W. Holden** recently received 25-year Awards of Merit from the American Association of State Highway and Transportation Officials. Amidon is a highway engineer in District I (Pittsfield) of the Massachusetts Department of Public Works. Holden is a research and materials engineer with the DPW. . . . **Maurice Nirenstein** works for Ebasco Services in New York City. . . . **Claude F. Veraa** has joined Pallace, Inc., Silver Spring, Md.

1950

Edward L. Ahlstrom has joined Stone & Webster, Boston. . . . **John F. Gallagher** was recently awarded a 25-year Award of Merit by the American Associatidn of State Highway and Transportation Officials. He is a project development engineer with the Massachusetts Department of Public Works. . . . **William C. Griggs** is president of W.C. Griggs, Inc., Lakewood, Colorado. . . . **Richard F. Johnson, Jr.** serves as senior product engineer at Terry Steam Turbine in Windsor, Conn. . . . **James W. Marston** works for the State of New Hampshire Air Pollution Control Division in Campton, N.H. . . .

1951

Carl E. Johansson has been employed by Rachelle Laboratories, Long Beach, Calif. . . . **Thomas M. June** was recently named manager of the building materials department of the organic materials division of Koppers Company, Inc., Pittsburgh, Pa. He will supervise sales and marketing of built-up roofing and roof maintenance materials for building and architectural applications. In 1951 he joined the firm as a cadet engineer and later held several management positions in the division. Prior to his latest promotion he was chemical group production manager. He is a member of the American Wood Preservers' Association and the Professional Engineers Society of West Virginia. . . . **Duncan W. Munro,** superintendent of Mount Auburn Cemetery, Cambridge, Mass., has been elected first vice president of the American Cemetery Association. The post includes membership on the executive committee. Munro has served as director, secretary and second vice president of ACA and has written many articles for technical journals. . . . **Vartkes K. Sohigian** is now director of industrial relations for the Simonds Cutting Tool Division of Wallace Murray Corp. in Fitchburg, Mass. He will be responsible for planning, developing and coordinating programs to meet the division's personnel goals and objectives of improving organization results. Sohigian, who began at Simonds in 1971, will be involved with career planning, labor relations, and communications. . . . **Joseph S. Vitalis, Jr.** is with the U.S. Environmental Protection Agency in Washington, D.C. From 1972 to 1974 he served as mayor of Crestwood, Missouri.

1952

Prof. **Robert Goff** has been named associate dean of the College of Engineering at the University of Rhode Island. Since 1953 he has been a member of the department of mechanical engineering and applied mechanics. In 1967 he was promoted to associate professor. . . . Currently **Robert A. Meyer** is a senior manufacturing engineer for Martin Marietta Corp. in New Orleans, La. . . . **"Buzz" Moore** recently formed his own sales representation company, Castle Moore Associates, Inc., in Ridgewood, N.J. His firm serves the process equipment industry.

1953

Richard R. Carlson is a project engineer at Dresser Industries, Inc., Westboro, Mass. He also holds the post of vice chairman of the Worcester Chapter of the American Society for Metals. . . . **Robert Eisenberg** is a self-employed computer consultant in West Paterson, N.J. . . . **Charles Horne** has been named needle bearing group quality control manager at Torrington, (Conn.) Co. In 1956 he joined the company as a bearing designer and became application engineer in 1969. Subsequently he was named chief application engineer. . . . Simplatrol Products Corp., a subsidiary of Formsprag Company, has moved from Auburn (Mass.) to Webster. **Herbert S. Peterson** holds the post of president at the firm. . . . **David T. VanCovern** left Exxon after 21 years to become corporate vice president of Rowe Corporation in Charlotte, N.C. His firm is a holding company with member companies operating in several different construction and manufacturing fields. . . . **S.M. Vershon** is director of finance in the foam and plastics division at Tenneco Chemicals Co., Paramus, N.J.

1954

Lee W. Catineau is with Reynolds Securities, Inc., in Boston. . . . **William H. Hills,** president of Hills Research & Development, Inc., Melbourne, Fla., also serves as president of Cryo-Line, Inc., which manufactures Dam-it pipe freezing tool. . . . **George H. Kay, Jr.** works for GTE Sylvania in Needham Heights, Mass. . . . **Harry L. Mirick** has been named vice president for operations at Time Computer, Inc., Lancaster, Pa. Previously he was with Hamilton Watch Co. and IBM. . . . **Wilfred F. Taylor,** who is self-employed at Crowell & Taylor Corp., Yarmouthport, Mass., writes that his oldest son, Robert, is now attending WPI. . . . **Richard H. Wheelock** is sales manager at Topaz Electronics, a subsidiary of Intermark, Inc., San Diego, Calif.

1955

Robert L. Chang is with the Aernutronic Corp., a subsidiary of Ford Motor Co. in Palo Alto, Calif. . . . **Lawrence F. Dennis** presently serves as a deputy director of product assurance at Fort Monmouth, N.J. . . . **Brian J. Kelly** holds the position of division operations manager at Bell Telephone in Pittsburgh. . . . **Richard J. Lucey** works for Teredyne, Inc., Boston. . . . **Edwin F. Nesman** is an electronic engineer at MIT. . . . Currently **Martin A. Rafferty** is senior engineering supervisor for Esso Standard Libya, Inc., Tripoli, Libya. . . . **Donald F. Zwiers** serves as chief engineer at Kemlite Corp. in Joliet, Ill.

1956

Robert R. Baer, who was recently in management and marketing services on the West Coast, has completed his postgraduate management program at UCLA. He is looking forward to the prospect of returning to the East Coast and a long-term assignment in marketing, sales, or training.

1957

Murray A. Cappers, Jr. works as a consultant for Allied Chemical in Morristown, N.J. . . . **Seymour L. Friedman** owns Tri-K Industries, Westwood, N.J. . . . **David W. Hoskinson** was recently named vice president of operations at United Illuminating in New Haven, Conn. (He succeeds Classmate **Leon Morgan,** who was promoted to executive vice president.) He joined the firm in 1957 and was later appointed superintendent of Steel Point Station. He was vice chairman of the New Haven Chapter of ASME and is a director of the Quinnipiac Council, BSA. He is also past president of the Hamden Youth Hockey Association and the Connecticut Hockey Conference.

Carl J. Kennen, SIM, has been appointed superintendent of the Coes Knife Co., Worcester. He has been with the company for 30 years. . . . **Richard F. Moore** is chief engineer at FAG Bearings Corp., Stamford, Conn. . . . **Leon A. Morgan** now holds the new position of executive vice president of operations engineering and customer services at United Illuminating, New Haven, Conn. He began work at UI in 1957 as an assistant engineer and rose to vice president of operations in 1973. A registered professional engineer, he is also a member of the American Management Association. He has been affiliated with the North Branford (Conn.) Economic Development Foundation, the Jaycees, and BSA, which he serves as director. . . . **Charles M. Stasey** holds the post of director of engineering at Advanced Metals Research in Bedford, Mass.

1958

Gary C. Blodgett was recently appointed manager of igniter products for Norton Company's Industrial Ceramics Division. He will be responsible for the manufacture and marketing of the division's new silicon carbide igniter, part of a direct electrical ignition system used to replace pilot lights in gas appliances. Since joining Norton in 1959, he has held several engineering and management positions. He holds an MBA from Clark. . . . **Charles B. Cushman** is with Pedersen Golf, New Haven, Conn. . . . **David B. Denniston** is marketing manager of customer service at Digital Equipment Corp. in Maynard, Mass. . . . **Anthony J. DiGiovanni** serves as general superintendent at Boston Gas Co. . . . **Jasper Freese** of Freese Engineering is located in Greeley, Colo. . . . **Robert Jacobson** currently serves as a market representative for IBM in Hamden, Conn.

James J. Johnson continues with New Jersey Bell Telephone in Camden, N.J. where he is presently area plant manager. . . . **John H. Porter** is with AMS Associates in Darien, Conn. . . . **Stewart L. Staples** of Staples Building & Development, Inc., is located in Tucson, Ariz. . . . **George F. Walker,** SIM, has been promoted to vice president of administration at Johnson Steel and Wire, Inc., Worcester. He will be responsible for industrial relations, purchasing, traffic and engineering. Previously he had been production manager, production superintendent, and director of industrial relations and personnel. . . . **Robert F. Wolff** holds the post of manager of the systems operations department at Consolidated Edison in New York City.

1959

Anthony E. Engstrom is manager at Fox & Carskadon in San Rafael, Calif. . . . Dr. **David A. Evensen,** who recently left TRW, is now employed by J.H. Wiggins Co., Redondo Beach, Calif. He has written over 40 technical papers, the most recent being "Vibration Analysis of Multisymmetric Structures" which will appear in an upcoming issue of the *AIAA Journal.* The Evensens reside in Torrance, Calif. . . . **Oscar H. Hawley** serves as principal at Sayre School, Lexington, Ky. . . . **William R. Schnitzler** works for U.S. Surgical in Stamford, Conn. . . . **Edwin D. Tenney** is a product manager in the Buell Emission Control Division of Envirotech Corp., Lebanon, Pa. . . . **William C. Whitehead** is employed by Harris Corp. in Palm Bay, Fla. . . . **Ernest F. Woodtli** has joined GE in Valley Forge, Pa.

1960

Robert W. Jebens is with RCA Lab., Princeton, N.J. . . . **John F. Kirkpatrick** is a system consultant with System Resources, Inc. in Salt Lake City, Utah. . . . **Alexander J. Kowalewski** holds the post of engineering manager at Hooker Chemical Corp., Burlington, N.J. . . . Formerly chief engineer of the Mattabassett District (New Britain, Conn. area), **Stanley L. Kubas** is now director of plant operations and maintenance for Camp Dresser & McKee, Inc., Boston. He will be responsible for scheduling operations, staffing, operational start-up, and maintenance services for multimillion dollar water and waste water facilities. . . . **Peter A. Lajoie** serves as sales manager of the Trump-Ross Division of Datametrics, a subsidiary of ITE Imperial in North Billerica, Mass. . . . **Donald MacMillan** is with Instrumentation Lab., Lexington, Mass., and **Bruce A. MacPhetres** is an inventory and cost engineer in economic studies for New England Telephone in Boston. . . . Dr. **Ronald J. Richard,** assistant professor of physics at Benedictine College, received his PhD in astronomy from UCLA in December. He earned his MA in astronomy at UCLA and his MS in aeronautics and astronautics from the University of Michigan. Prior to joining Benedictine in 1970, he was with Clevite Transistor Corp., Cambridge, Mass. Later he helped design spacecraft trajectories for the Ranger, Surveyor and Mariner missions, while he was at the Jet Propulsion Lab. in Pasadena, Calif. Dr. Richard won a NASA traineeship to work on his doctorate. He has written numerous published reports and articles. . . . Presently **Bernard L. Tetreault** holds the post of executive director of the Housing Opportunities Commission of Montgomery County, Silver Spring, Md.

1961

Born: to Mr. and Mrs. **Henry P. Allessio,** their first son, Henry Paul, on August 12, 1975. The Allessios also have two daughters. Hank is with William E. Hill & Co., Inc., New York City.

John Buckley of Buckley & Co., Wellesley Hills, Mass., conducted a seminar, "New Product-Service Planning and Development" at Bentley College in Waltham in January. The seminar was the first of a series of 14 one-day programs sponsored by the Smaller Business Association of New England, Inc. . . . Dr. **Jack Gabarro,** who teaches in the MBA program at Harvard Business School, is also head of the faculty group teaching Human Behavior in Organizations. Recently he has been serving as a director of Town and Country Jewelry Manufacturing, acting as an adviser to the NSF's outside evaluation team on the WPI Plan, and doing consulting work. He, his wife, Marilyn, and daughter, Jana, live in Cambridge. . . . **Charles R. Mixer** is engineering sections head for Sperry Systems Management in Great Neck, N.Y. . . . **Herbert S. Moores** serves as town engineer in Newburgh, N.Y.

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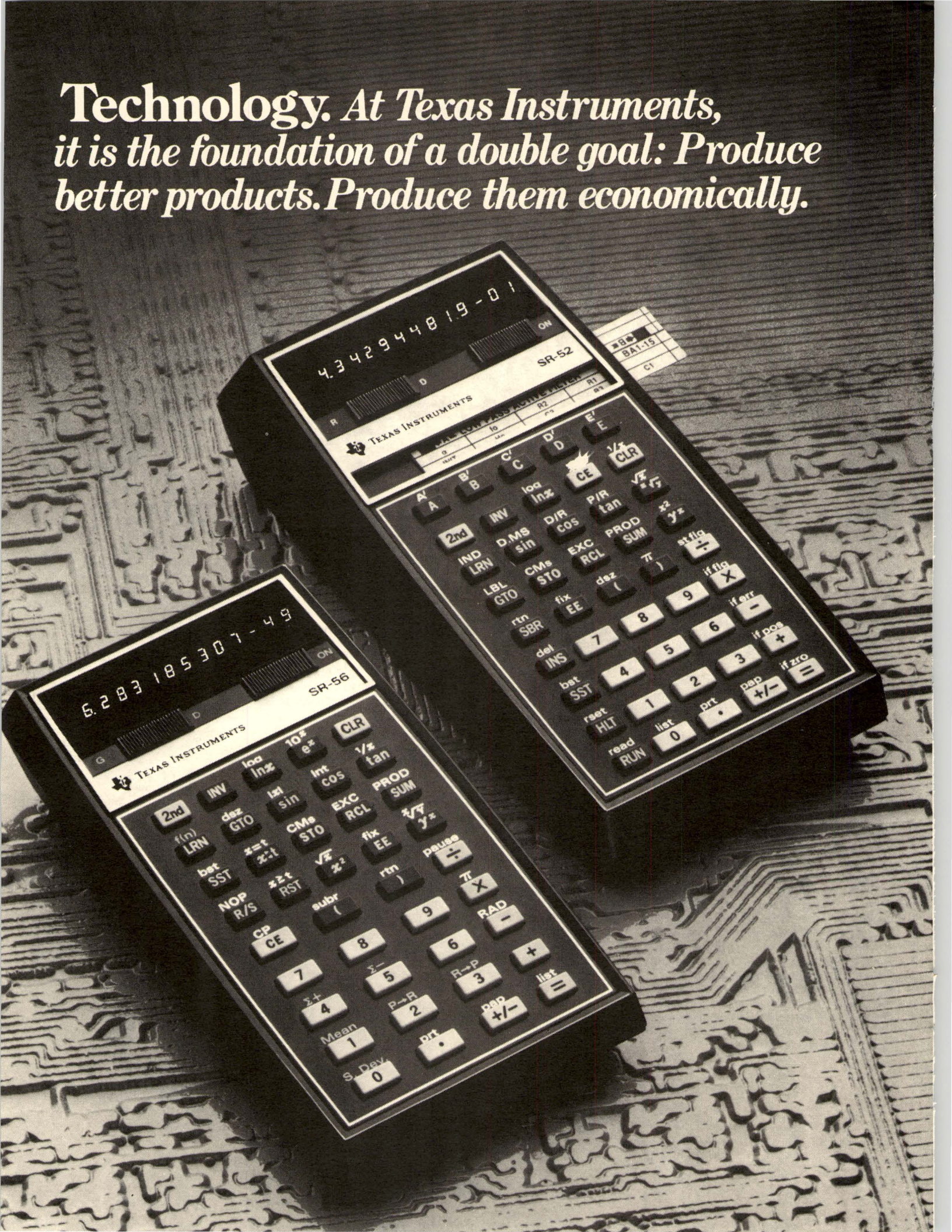

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Most of the important decision-making functions found on computers are available on TI programmables: Looping. Branching. Flags. Sub-routines. Yet there's no special language to learn. TI's full Algebraic Operating System (AOS) is natural—left-to-right. It's easy to use, and so flexible that you can apply it to your own personal problem solving techniques.

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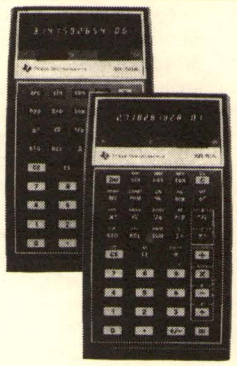

SR-50A $79.95* Full function, on-the-go portable featuring algebraic entry with sum-of-products capability. Performs trig and hyperbolic functions, logs, e to the x power, xth root of y and much more.

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The ideal student programmable. No programmable is easier to master. Use up to 100 programming steps with 10 user memories, nine levels of parentheses, plus an eight-register stack that handles up to seven pending operations. Add, subtract, multiply, divide within a register without affecting the calculation in progress.

Two unique features. A special test register permits comparison with the displayed value at any point in a calculation—without interfering with what's in progress. A pause key keeps the display visible for ½-second during program execution. It also lets you go through a problem one step at a time.

Supply the input data, then execute the solution of a stored sequence automatically. Get answers without the tedium of remembering and pressing keys repetitively. Three unconditional branches and six conditional branches—which includes four levels of subroutine and two loop control instructions – give the SR-56 great decision making power.

An Applications Book containing over 50 programs in math, electrical engineering, finance, statistics, surveying, etc. comes with an SR-56.

For more details on TI's programmables the SR-52 or SR-56. Or, economical slide-rule calculators—SR-51A, SR-50A. Write Texas Instruments P.O. Box 22013 CE, M/S 358, Dallas, Texas 75222.

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Moussit Noradoukian has joined Timeplex, Inc. in Hackensack, N.J. . . . **Paul E. Nordborg** is with Management Recruiters in Nashua, N.H. . . . Dr. **Erik W. Pottala,** an electrical engineering lecturer at the University of Maryland and staff engineer with the Laboratory of Applied Studies, has constructed a working model of the human nerve cell, the neuron. The model, stimulated by messages transmitted by tiny computers, reacts exactly as a human (animal) neuron would react in sensing and initiating muscular movements of the body. It is expected that the model will be invaluable in the research of the human nervous system and its diseases. . . . **John A. Quagliaroli,** president of F.L. Mannix & Company, Inc., Wellesley, Mass., recently graduated from Harvard Business School's Program for Management Development. . . . **Joseph W. Simonis** has been promoted to engineering and construction manager for the northern division of General Telephone Co. of Ohio. After graduating from West Point and serving as a captain in Vietnam, he joined General Telephone in 1970. He is a professional engineer. . . . **Robert Zimmerman** works for Acme Plumbing in Hartford, Conn.

1962

Dr. **Charles F. Belanger** has been granted courtesy staff privileges in pediatrics and family practice at Worcester's Hahnemann Hospital. He is a member of the University of Massachusetts School of Medicine faculty. . . . **Arthur E. Dobreski** now holds the position of manager of plant engineering and maintenance at West End Brewing Co., Utica, N.Y. The Dobreskis and their three children, Michael, 12, Kathleen, 9, and Maureen, 5, have moved into a 100-year-old house in Clinton, N.Y. . . . Presently **Richard W. Frost** serves as assistant district supervisor for Massachusetts Electric in Lowell. . . . **Robert A. Hansen** has joined Northrop Corp. in Norwood, Mass. . . . **Joseph D. LeBlanc** is director of technical services at Central Maine Power Co. in Augusta.

Continuing with Gillette Safety Razor Co., Boston, **Howard L. McGill, Jr.** currently holds the post of production manager. . . . **Edmund B. Pyle III** is manager of preclinical and biostatistics data systems at Smith Kline Corp. in Philadelphia. . . . **William J. Shepherd** is a sales representative for Rapidata, Inc. in New York City. . . . **Stephen M. Wells** continues with ITT where he is now manager of organization planning for the firm in New York City. He was recently transferred from St. Louis. . . . **Stanley M. Wilbur** is vice president at Webster-Martin, Inc., South Burlington, Vt.

1963

Donald L. Chaffee has joined Litton Industries in Van Nuys, Calif. . . . **Alberto D. DeLima** works for Crescent Construction in West Caldwell, N.J. . . . **Stephen D. Donahue, Jr.** still with Procter & Gamble, is presently plant industrial engineer at the firm's detergent factory at Mataro (Barcelona) Spain. . . . **Henry A. Dowgielewicz** is employed by Virginia Electric & Power Co. in Richmond. . . . **Francis Dusza,** SIM, has been named manager of manufacturing processing at Russell Harrington Cutlery Co. in Southbridge, Mass. He has been with the firm for 34 years. . . . Formerly a systems analyst for Blue Cross-Blue Shield, **Lawrence N. Escott** now holds the same position at Lane Bryant, Inc., New York City. . . . Dr. **Robert H. Gowdy** is an assistant professor in the department of physics and astronomy at the University of Maryland. . . . Major **Herbert W. Head,** U.S. Army, is currently located in Alexandria, Va. . . . **Edward J. Kalinowski** is manager of European requirements and planning for the Elizabeth Arden division of Eli Lilly International Corp. in London, England.

James D. Keating serves as a senior marketing representative for IBM in Hamden, Conn. The Keatings have four daughters, from 5 to 11 years of age. . . . Following the receipt of his PhD from Boston University, Dr. **Joseph R. Mancuso** has been promoted to the rank of associate professor of management engineering at WPI. Recently he was elected a member of the board of directors of ARP Instruments, Newton, Mass., Polyform Industries, Westboro, and the Frank E. Sessions Company of Worcester. . . . Continuing with Chevron Oil Company, **Roger C. McGee** is now staff analyst for the firm in Denver, Colo. . . . **Joseph J. Mielinski, Jr.,** projects director at WPI, has been named business manager at Alden Labs. The new post is a part-time position and he will continue as projects director. . . . **A. Edward Scherer** has been promoted to manager of licensing for nuclear power systems in the power systems group of Combustion Engineering, Inc., Windsor, Conn. He will direct the efforts required to gain government regulatory licenses, authorizations and permits for all nuclear steam supply systems and fuel ordered from the firm. Scherer joined C-E in 1968 and has held reactor design and project engineering positions, most recently serving as supervisor of licensing standards. A registered professional engineer, he belongs to the American Nuclear Society, ASME, and Sigma Xi. . . . **Dennis E. Snay** was recently appointed division marketing manager in Worcester for Massachusetts Electric Co. He started with the utility in 1963 in Malden and has been district marketing manager in Marlboro. He is a registered professional engineer.

1964

Arthur R. Bodwell has joined Samuel S. Graham Co., Hanover, N.J. . . . **Richard C. DeLong,** SIM, is now manager of product engineering at Bay State Abrasives, Dresser Industries, Inc., Westboro, Mass. He started with the company as a product engineering trainee in 1952 and is a registered professional engineer. . . . **David A. Dimock** serves as an electronics engineer with the U.S. Postal Service in Rockville, Md. . . . Currently **William Dowd** holds the post of vice president of the grocery products group at Heublein (food and alcoholic beverages) in Hartford, Conn. . . . **Charles Ennis** has been promoted to associate professor at Thames Valley State Technical College in Norwich, Conn. A registered professional engineer, he was an electrical and project engineer for the Rogers Corp. prior to joining the college in 1968. . . . **Stephen J. McCabe,** SIM, was recently appointed director of manufacturing for Norton Company's coated abrasive division. He will direct the start-up aspects and line management for the division's new coated abrasive plant in Brownsville, Texas and for all coated abrasive divison conversion operations. He joined Norton in 1957 as a manufacturing control engineer.

Stephen G. O'Brian holds the position of senior engineer at Analytics, Inc. in McLean, Va. . . . **Michael P. Penti,** project manager for NPS Construction Co., Craig, Colo., is involved in construction of two 500 MW coal-fired power plants. . . . **Brian Sinder** works for Picker Corp. in New Haven, Conn. . . . Camp Dresser & McKee, Inc., Boston, has promoted **Peter J. Tancredi** from project manager to project director. His responsibilities include the design of more than 32.5 miles of sanitary intercepting and storm sewers for the city and county of Denver, Colo. The estimated cost of the project is $23 million. Tancredi joined the firm's Boston office in 1970 and was transferred as a project manager to Denver in 1974. He belongs to ASCE and the Rocky Mountain Section of the Water Pollution Control Association. . . . Dr. **Elliot F. Wyner** is a physicist for GTE Sylvania, Inc. in Danvers, Mass.

1965

Philip G. Baker was recently promoted to principal engineer in the product engineering division at Polaroid Corporation, Cambridge, Mass. . . . **Walter Chang** has joined General Electric Co., Lynn, Mass., as project engineer with the aircraft engine group. His responsibility involves the flight test program of the F-18 Navy fighter plane engine. . . . **Roy G. Cornelius, Jr.** was appointed director of support services in the Newton (Mass.) public schools. Previously he was a senior supervising estimator at Stone & Webster, Boston, where he was in charge of estimating for several nuclear power plants. In 1974 he received his MBA from Boston University. . . . **Leonard G. Feldman,** who joined the Construction Products Division of W.R. Grace & Co. in Cambridge, Mass. as a quality assurance engineer in 1974, has been promoted to quality control manager for its building and horticultural product lines. Earlier he was a chemist with Itek Corp., Lexington and a quality control engineer for Precision Control Products in Waltham. He is active in the American Society for Testing and Materials and the American Society for Quality Control.

Philip D. Giantris is manager of environmental engineering at Metcalf & Eddy, Inc., DesPlaines, Ill. . . . **Russell Koelsch,** who was with Gilbert Associates, Inc., in Reading, Pa., for 5½ years, is looking forward to his new position as a senior engineer for the power division of C.F. Braun & Co. in Alhambra, Calif. . . . **James F. Mills** works for Foster Grant Co. in Manchester, N.H. . . . Dr. **Thomas Moriarty** is associate professor in the school of architecture at the University of Tennessee in Knoxville. . . . **Scott Sargent,** SIM, has been elected controller and assistant treasurer of Morgan Construction Co., Worcester. He has been with Morgan for 18 years. He is a director of Friendly House and a member of the Financial Executives Institute and the Risk and Insurance Management Society. . . . **Anthony A. Smalarz** works for Kratos in Pasadena, Calif. . . . **Eugene G. Sweeney, Jr.** is a senior applications engineer at Hydraulic Research & Mfg. Co., a division of Textron in Richmond, Va. . . . **Jeffrey W. Thwing** is employed by the Federal Highway Administration in Washington, D.C.

1966

William R. Bond, Jr. serves as plant engineer at Chesapeake Finish Metals in Baltimore, Md. . . . **Christopher G. Bradbury** has been promoted to manager of development engineering at Cumberland Engineering in Providence, R.I. In his new position he will be responsible for research and development of new products to expand the Cumberland product line. He joined the company in 1972. Currently he is completing his MBA at Boston University. . . . **Thomas P. Brasiskis** is with Balco, Inc., Newton, Mass. . . . **John H. Carosella** serves as a senior engineer at Eastman Kodak in Rochester, N.Y. . . . **Robert J. Coates** works as a sales representative for the Torrington (Conn.) Co.

Capt. **Eugene R. Dionne,** manager of launch vehicle systems for the Defense Meteorological Satellite Program at the Air Force Space and Missile Systems Organization, El Segundo, Calif., recently received the Roland R. Obenland Junior Officer Engineering Award in ceremonies at El Segundo. The $100 honorarium and citation is given annually to recognize an outstanding contribution by a young officer to an engineering development effort. Capt. Dionne was honored for his role in designing integration of second and third stages of a launch vehicle with a new, advanced military weather satellite. The design allows this new larger satellite to be used on the same low cost launch vehicle previously used for weather satellites.

Formerly with the California Division of Highways, **Albert J. DiPietro** is now a quality control engineer for Bechtel Power Corp. in Sanatoga, Pa. . . . **Steven J. Erhard** is a member of the technical staff at GTE Laboratories in Waltham, Mass. . . . **Donald Morse,** MNS, has been named director of the Claremont extension evening program at Nathaniel Hawthorne College of Antrim, N.H. He has had 23 years experience in teaching and school administration and has done graduate work at Harvard, Purdue, LSU and UVM. . . . **Oleg V. Nedzelnitsky, Jr.** currently is a graduate student at Carnegie-Mellon University in Pittsburgh. . . . **Stewart W. Nelson** has become the principal of Nelson Scribner Associates, South Hamilton, Mass. The firm has served New England as an engineering and sales representative organization in the field of electric heating and control since 1964.

Raymond G. O'Connell, Jr., a development engineer for Hewlett-Packard, was a member of an electronics engineering team which was cited by *Industrial Research* magazine for designing a new medical instrument, the HP oximeter, described as "one of the best product designs of the year." The oximeter continuously measures oxygen saturation in a patient's blood while connected to him only by an earprobe. The instrument is expected to be valuable in respiratory care with special application in the diagnosis, care, and rehabilitation of patients with chronic lung disease. . . . **Raymond J. Pavlosky** is employed by the Department of Defense in Ft. Meade, Md. . . . **Melvyn L. Sack** has been promoted to assistant vice president for new products and electronic funds transfer systems marketing at First National City Bank in New York City. . . .

Ronald A. Seskevich is with the Navy Department in Arlington, Va. . . . **Donald G. Simpson** owns S & S Distributors, Inc., Keene, N.H. . . . **Bruce Sturtevant** serves as an analytical chemist at TRW, Inc., Philadelphia. . . . Dr. **Paul C.C. Ting** is on leave as a professor of electrical engineering from the University of New Brunswick in Fredericton, N.B., Canada.

1967

Capt. **Herbert R. Brown III** has received his master's degree at the Air Force Institute of Technology. An honor graduate of the aeronautical engineering course, he is remaining at Wright-Patterson AFB for duty with a unit of the Air Force Systems Command. . . . Dr. **William E. Cobb** is senior resident and instructor in medicine at the University of Connecticut Health Center in Farmington. In July he will be a fellow in clinical endocrinology at Tufts University New England Medical Center, Boston. . . . **Joseph L. Ferrantino** continues at Monsanto, Springfield (Mass.), where he is senior research engineer. . . . Currently **Lawrence R. Gooch,** who is with Farrel Co., holds the posts of resident engineer and project manager on a processing line installation at Chemetron in Stockertown, Pa. . . . **Richard G. Jewell** serves as product engineering group leader at Analog Devices Semiconductor in Wilmington, Mass.

Anthony F. Kunsaitis, Jr. is an assistant computer analyst for the U.S. Army at Fort Monmouth, N.J. . . . **Russell A. Lukes** works as a computer system sales engineer at Hewlett-Packard Co. in Lexington, Mass. . . . **Joseph J. Maggi** holds the position of senior tax accountant at Arthur Andersen & Co. in Hartford, Conn. . . . **Mukundray N. Patel** has been appointed project manager in the project operations department of Power Systems Services at Combustion Engineering, Inc., Windsor, Conn. He will be responsible for managing selected project contracts. Since joining the firm in 1967, he has held various positions in the construction services department, most recently as senior construction engineer. . . . **William F. Pratt** is now with South Central Bell Telephone in Hattiesburg, Miss. . . . Dr. **John E. Sonne** serves as a veterinarian in Syracuse, N.Y.

1968

Married: **Arnold J. Antak** and Miss Paula M. McGillicuddy on December 6, 1975 in Wollaston, Massachusetts. Ken Gminski was best man. Mrs. Antak graduated from the Chandler School for Women and is employed by State Street Research and Management Co., Boston. Her husband, who received his master's degree from the University of Rhode Island, is with Howard, Needles, Tammen & Bergendoff. . . . **David P. Crockett** to Miss Joan M. Balzarini in Rocky River, Ohio on November 29, 1975. The bride graduated from John Carroll University, Cleveland, and is a commercial account executive for Allstate Insurance Co. The groom is a sales representative for Buffalo Sales of Cleveland.

. . . **John W. Elphinstone** and Miss Tillie Martinez last August. The groom holds the post of office manager at L'eggs Products, Inc. in Mesilla Park, N.M. . . . **Robert J. Horansky** and Miss Katherine Truslow on October 11, 1975 in New Britain, Connecticut. Mrs. Horansky graduated from New Britain High School. Her husband is with Northeast Utilities in Berlin, Conn.

. . . **Mark Hubelbank** to Miss Jeanne C. Henderson on a 35-foot sailboat under sail near Boston Harbor on September 27, 1975. The bride received her BA from Cedar Crest College, Allentown, Pa. and her master's from BU. She is a research assistant at Harvard Medical School for Community Health. Her husband, who has his doctor of science degree from MIT, recently took part in a seminar on ultrasonics in Rotterdam, Holland.

Born: to Mr. and Mrs. **Phillip LaRoe** a son, Christian Otto, on September 18, 1975. Phil is the chairman of the science department at Boys Town High School, Boys Town, Neb. In addition to his duties as chairman, he has added two new courses, one in astronomy and one in environment to the department's curriculum. Phil, his wife, Kathy, and their two sons (Lincoln is 3), reside in Wahoo, Neb. . . . to Mr. and Mrs. **Geoffrey P. Tamulonis** a son, Phillip, on July 14, 1975. Currently Tamulonis is a system engineer on assignment in Jordan for ITT Space Communications of Ramsey, N.J.

George W. Cumming, Jr. is a project engineer for Missouri Valley Inc. in Amarillo, Texas, where a power plant is under construction. . . . **Robert D. Hickey** presently serves as a senior systems analyst for Honeywell in McLean, Va. Last year he received his MSEE from Arizona State University. Recently he was married to Miss Charlotte Daum of Glendale, Arizona. . . . **Larry Johnson** is with Honeywell Information Systems in Cambridge, Mass. . . . **Thomas M. Kiely** works for Philadelphia Suburban Water Co. in Bryn Mawr, Pa. . . . **Richard Makohon,** who received his master's degree from the University of Alabama last year, is presently a graduate student at Oregon State University in Corvallis. . . . **Robert Meader** is with the U.S. Army Corps of Engineers in Mobile, Ala. . . . **John J. Orciuch** is employed by Ionics, Inc. in Watertown, Mass. . . . **Barrie M. Peterson** works for the Birchwood Organization, Inc., Centreville, Va. . . . Dr. **Louis H. Strong,** who received his PhD in biophysics from the University of Michigan last year, is now at Harvard Medical School and Boston Biomedical Institute.

1969

Born: to Mr. and Mrs. **Daniel A. Lipcan** their first child, Daniel Patrick, on October 4, 1975. Lipcan is a plant superintendent at Boston Insulated Wire & Cable in Boston.

William A. Chudzik is a graduate student at the University of Massachusetts in Amherst. . . . **Roger E. Dennison** of Burlington, Mass. is a self-employed consultant. . . . **Richard C. Furman** serves as a staff researcher for the New England Energy Policy Council in Boston. . . . **Mark S. Gerber,** who received his PhD last year from Ohio State University in the nuclear engineering field, continues at the university in a research position. His work involves many areas, the main research area being the development of the instrumentation for a clinical gamma ray camera for use in nuclear medicine imaging. This work has led to a number of publications including his dissertation. Gerber writes: "I am enjoying the academic life as a non-student and hope to stay in this environment for many years to come."

Currently **Lawrence Katzman** holds the post of principal engineer at Walden Research Division of Abcor, Inc., Cambridge, Mass. . . . **Robert A. Orenberg** is a programmer analyst at Data Terminal Systems in Maynard, Mass. . . . **Alvin B. Pauly** works for Michelin Tire Corp., Greenville, S.C. . . . Continuing with DuPont, **Donald F. Rapp** is now assistant department engineer for the firm in Wilmington, Del. He is married and has a son. . . . **Michael J. Scelzo** is employed by Panametrics, Inc. in Waltham, Mass. . . . **Raymond B. Stanley** works for the Electric Boat Division of General Dynamics in Groton, Conn. . . . **Stewart T. Stocking** is with Feroni Heating and Plumbing Co. in Springfield, Mass. . . . **Robert S. Templin,** who is registered to practice before the U.S. Patent Office, is now engaged in the general practice of law at Stokes and Himmelein Roads in Medford, N.J. . . . **Harold S. Wyzansky** is a mathematician at the U.S. Naval Air Station in Lakehurst, N.J. He is also a part-time graduate student in computer science at the University of Pennsylvania.

1970

Married: **Craig C. Chase** and Miss Patricia C. Theile on November 29, 1975 in Livingston, New Jersey. Mrs. Chase graduated from Katharine Gibbs School in Montclair. Both she and her husband are employed by Porter and Ripa Associates, Inc., Morristown, N.J. . . . **Kenneth H. Morgan, Jr.** and Miss Carol Ann Stepp in Waltham, Massachusetts on October 4, 1975. The bride graduated from Massachusetts Bay College and is a private secretary at Raytheon. Her husband is a senior engineer with the Massachusetts Department of Health.

Born: to Mr. and Mrs. **Clark Knickerbocker** their first child, Steven Joseph, on September 18, 1975. Clark is an account manager at Hooker Chemical in Niagara Falls, N.Y.

James F. Bagaglio is with the department of laboratory medicine at the University of Massachusetts Medical School Hospital in Worcester. . . . **Peter G. Bladen** is a resident service engineer at Riley Stoker Corp. in Madison Heights, Mich. . . . **Alan S. Breitman** serves as an actuarial assistant for Boston Mutual Life Insurance Co. in Canton, Mass. . . . **Joseph M. Chwalek, Jr.** works for CEEIA in Fort Ritchie, Md. . . . In May **Lawrence B. Cohen** will join Union Carbide, Sistersville, West Va., where he will serve as a research chemist. . . . **William F. Dudzik** is a civil service operations research analyst at the Washington (D.C.) Navy Yard.

Roger P. Henze has just started work as a transportation planner with the Capital District Transportation Committee and will be working out of the Albany (N.Y.) County Planning Board. His job entails the coordination of all transportation planning activities and federal funds for transportation improvements. His wife, Judy, plans to enter graduate school. . . . **Neil M. Hodes** is construction manager at McKee, Berger, Mansueto in Washington, D.C. . . . **Jerry L. Johnson,** a fourth year graduate student at Dartmouth College, was recently awarded the annual $4,200 fellowship in chemistry endowed by the Goodyear Tire and Rubber Company Educational Fund. In 1974 he was a research assistant working on a National Institute of Health grant awarded to his superior, Prof. Gordon W. Gribble. He was a Dartmouth Fellow in 1972 and 1973. . . . **Robert C. Keenan** works for Centronics Data Computer Corp. in Hudson, N.H.

Robert J. Mulcahy serves as a planning staff supervisor at New England Telephone in Boston. . . . Dr. **Alexander Murdoch,** who received his PhD from Purdue recently, is now an application engineer at GE in Schenectady, N.Y. . . . **John A. Pelli** holds the post of sales manager at Berkshire Trane Air Conditioning in Springfield, Mass. . . . **Barry W. Soden** is an assistant engineer for the City of Chicopee (Mass.). . . . Presently **John O. Tarpinian** works as a research assistant at MIT's National Magnet Labs in Boston.

1971

Married: **Robert E. Jolda** and Miss Nancy E. McKee in Oakland, California on November 29, 1975. Mrs. Jolda graduated from the University of California at Berkeley and did graduate work at Holy Names College, Oakland. She teaches high school in San Bruno, Calif. The groom graduated from Stanford University and is an economist with the U.S. government in San Francisco. . . . **Robert P. Mills, Jr.** to Miss Sheila Logan on August 23, 1975 in Morningdale, Massachusetts. The bride attended Quinsigamond Community College and San Mateo (Calif.) Junior College. She is a marketing research assistant at State Mutual Life Assurance Co. The bridegroom is an actuary at State Mutual, Worcester. . . . **Paul Popinchalk** and Miss **Nancy E. Wood,** '73 in the state of Washington on February 14, 1976. The bride is with Westinghouse Hanford Co. and the groom is with Bovee & Crail, Richland, Wash. . . . **Noel Totti** III to Miss Margarita Vizcarrondo in Mayaguez, Puerto Rico on December 20, 1975. Starting in July the groom will be an intern in internal medicine at UPR's University District Hospital.

Robert C. Blaisdell serves as an economist at NE Power Planning, West Springfield, Mass. . . . **Ellen L. Brueck** is a teacher and department chairman at Westchester Academy in High Point, N.C. . . . **Barry L. Chesebro** is a graduate student at Lowell Tech. . . .**Thomas R. Copp** works for Montrose Products Co., Inc. in Auburn, Mass. . . . **Scott M. Dineen** is employed as a sales engineer at American Heat Reclaiming

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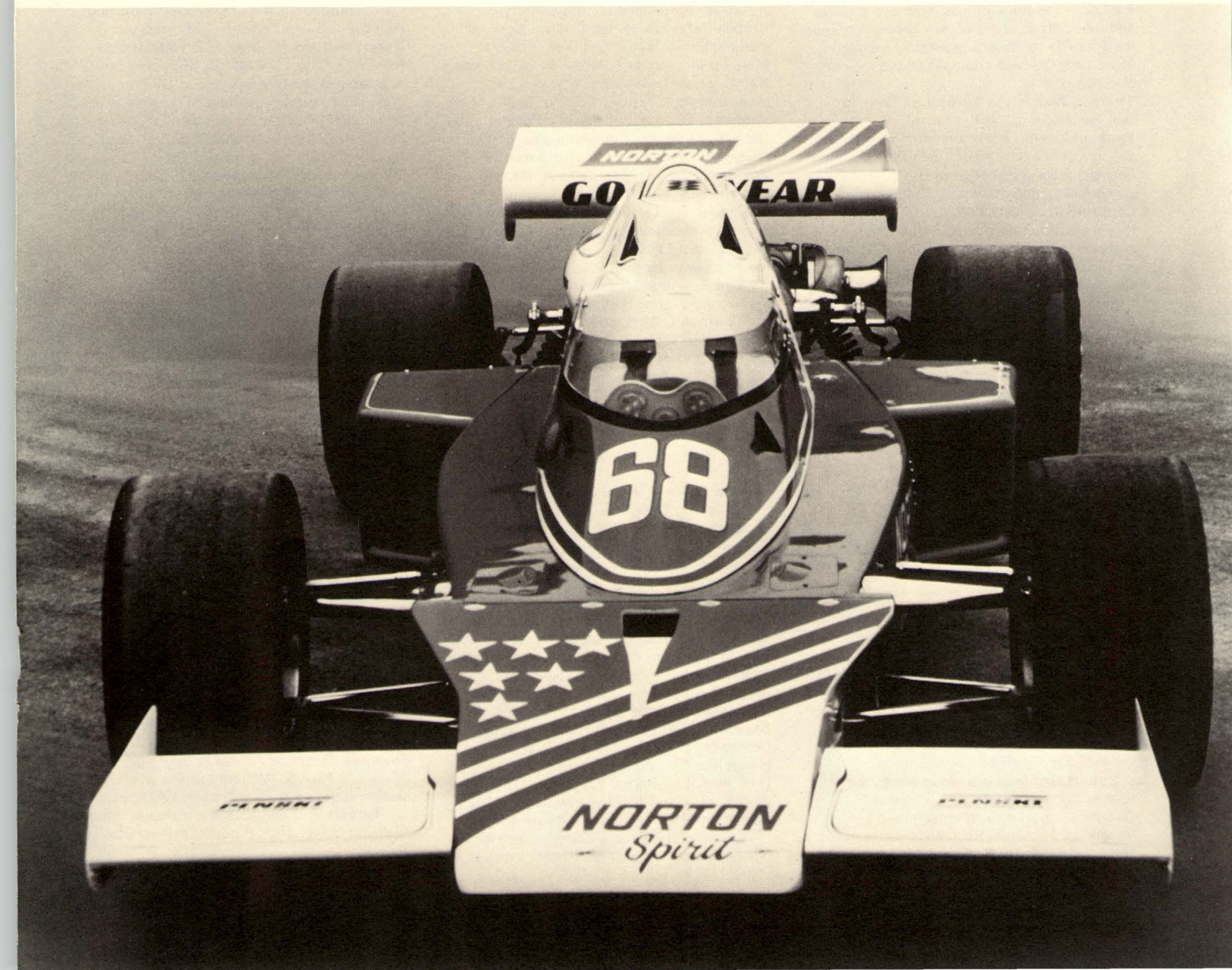

Corp. in New York City. . . . **Donald G. Fogg,** Jr. holds the post of quality control manager at Procter & Gamble (Folger's Coffee) in New Orleans, La. . . . Presently Dr. **Paul S. Furcinitti** serves as a research associate in the physics department at WPI. . . . **John A. Giordano** has been elected assistant planning officer at Worcester Bancorp, Inc. He joined the firm as a planning assistant in 1973 after receiving his MBA from the University of Rhode Island.

Kenneth R. Perkins is a captain with the U.S. Army at Ft. Riley, Kansas. . . . **Ralph H. Reddick** is a graduate student at the University of Connecticut. . . . Currently **Peter Salis** serves as assistant superintendent of engineering at the National Starch & Chemical Corp. in Indianapolis, Ind. . . . **Anthony Schepis** works as a sales engineer for DeLaval Separator Co. in Hyde Park, Mass. . . . **Joseph J. Spezeski** is a doctoral candidate at the University of Arizona in Tucson. . . . **Robert Stein,** an electrical engineer who has participated in the long-range power supply planning of the New England regional electric system, has joined the staff of the Massachusetts Municipal Wholesale Electric Co. in Littleton, Mass. His major responsibility, when he was with the planning arm of the New England Power Pool, was the study of load flow and stability and the analysis of major new generation and transmission facilities proposed by member utility companies as additions to the regional electric system.

Thomas Weil works for Bechtel Corp. in San Francisco. . . . **A.E. "Tony" Yankauskas** has been promoted to assistant director of financial reporting in the corporate financial reporting section of the comptrollers' department at Continental Can Company, Inc., New York City. His most recent position was manager of special analyses in the department. Tony, who holds an MBA from Northeastern, joined Continental in 1973 as a finance trainee. . . . **Steven C. Watson** is at Harvard Business School and is social chairman of the Rugby Club. . . . **Ronald L. Zarrella** was recently promoted to manager of production planning and material control at Clairol. In addition to his production planning and material control duties, he is responsible for all raw material warehousing operations. Ron joined Clairol in 1971. Prior to his most recent promotion, he was department head of materials management. . . . **Michael P. Zarrilli** has been elected as assistant secretary in the Manufacturers Hanover Trust Company's national division western district. He will represent the bank in southern California, Montana, and Utah.

1972

Born: to **Jeffrey A. Petry** and **Mary Bellino Petry,** '74, a son, Anthony "Tony" James, on October 29, 1975. Tony has a brother, Jeff, Jr., 14 months old. Jeff is with the Torrington Co. as a district sales engineer for the Indianapolis office.

Robert S. Ames is a programmer with IBM in Boca Raton, Fla. . . . **Charles H. Bacon,** Jr. teaches at Montachusett Vocational Technical School in Fitchburg, Mass. . . . **Gregory S. Blood** is a sales unit superintendent at Swift Fresh Meats Co. in Rutland, Vt. . . . **William H. Degutis** works as a manufacturing engineer at Norton Co., Worcester. . . . **Jean Fraser** currently serves as town planner in the Department of Planning and Transportation, Greater London Council (the metropolitan government of London, England). Most of her work is on improving derelict canals and carrying out environmental improvements of various kinds in the East End of London. She expects to be qualified as a planner in the United Kingdom in October. . . . **James L. Jardine** holds the post of construction coordinator at Camp Dresser & McKee, Boston. . . . **William E. Kamb** serves as assistant superintendent for Turner Construction of Cleveland, Ohio.

Roy N. Lampinski is a self-employed medical equipment salesman in Valley Park, Mo. . . . **Douglas W. Mach** works for Motorola, Inc. in Schaumburg, Ill. . . . **Pramod D. Nayate** is with Raymond Control System in St. Charles, Ill. . . . **Robert I. Parry** is with Stone & Webster, Boston. . . . **Randy Partridge** has been awarded a three-year fellowship for his PhD from Mobil Oil Company. In the company-wide competition he received the only fellowship granted. Recently he spent several months in Moscow on a U.S.—U.S.S.R. research exchange program which WPI's Prof. Alvin H. Weiss coordinated for this country. . . . **Pratim Patel** has started his own business manufacturing coated and finely ground fillers for industry in Bombay, India. His wife, Nilima, whom he married in December, graduated from the University of Manitoba in Winnipeg, Canada. . . . **Paul C. Potvin** teaches in Putnam, Conn. and also lectures in physics at Annhurst College in South Woodstock. . . . Lt. **Marcello A. Ranalli** is with the U.S. Navy in Guam. . . . Formerly placement director, **Thomas A. Reynolds** is now an associate at Scientific Placement, Inc., Houston, Texas. . . . **Donald A. Taft** has been awarded first-year honors at Harvard Business School. He is presently in the second year of Harvard's MBA program. . . . **Thomas L. Terkanian** works as a construction engineer for George Macomber Co., and is located in Lexington, Mass. . . . **John (Jack) Zorabedian, Jr.** has joined Sweetheart Plastics in Wilmington, Mass.

1973

Married: **Mark P. Housman** to Miss Rhonda S. Lushan on December 21, 1975 in Boston, Massachusetts. The bride attended Skidmore College and is currently studying at the School of Public Communications, Boston University. The groom, who received his MBA from Boston University, is with Coopers & Lybrand. . . . **Thomas E. Radican** and Miss Kathie L. Birman on November 29, 1975 in Cranston, Rhode Island. Mrs. Radican attended the University of Oregon. Her husband is plant manager for Savage Industries in Camden, N.J. . . . **Joseph J. Staszowski** to Miss Jane Ann Caron on September 6, 1975 in Nashua, New Hampshire. The bride, who works for the N.H. Bureau of Dental Public Health, graduated with dental hygiene degrees from New Hampshire Technical Institute and the University of Bridgeport (Conn.) Currently her husband is working for his master's degree at Northeastern University. . . . **James A. Viveiros** and Miss Denise M. Roussel on November 29, 1975 in Fall River, Massachusetts. Mrs. Viveiros, a graduate of Southeastern Massachusetts University, is employed by the Worcester County Institution for Savings. The bridegroom is with Alden Research Labs. in Holden.

Bruce J. Baker is a project engineer at Holland Co., Inc. in Adams, Mass. . . . **David C. Bedard** is with the U.S. Army at Fort Bliss in El Paso, Texas. . . . **Tom Bileski** serves as a field sales engineer at Electro-Flex Heat, Inc., Bloomfield, Conn. . . . **Richard H. Birkenshaw** is with Chas. T. Main, Boston. . . . **Leo Buchakjian,** continuing with GE, is currently located in Evendale, Ohio. . . . **Philip N. Ciarlo** is unit level manager for shop operations in the D.C. Motor and Generator Dept. at GE in Erie, Pa. . . . **Clarence J. Dunnrowicz** works for Raytheon Research in Waltham, Mass. . . . **E. Granger Dyett III** is self-employed as president of his own firm in Needham Heights, Mass. . . . **Will Elliott** continues his globe-wide duties with GETSCO-DSOI. Recently he sent greetings from Brazil. He has served in Africa and expects to be in Taiwan this summer. The company headquarters are located in Salem, Va.

Jon Franson is a meteorologist in training with the U.S. Air Force. . . . **Thomas A. Gargiulo** works for Metcalf & Eddy, Inc. in New York City. . . . **John J. Gizienski** serves as a process control engineer at GE in Providence, R.I. . . . **Robert M. Laham** is a proposal engineer at Combustion Engineering, Inc., Windsor, Conn. . . . **Paul A. Lewis** is with Dittman and Greer, Middleton, Conn. . . . **Joseph J. Magri,** Jr. works for Sikorsky Aircraft in Stratford, Conn. . . . Dr. **R.N. Mathur,** an associate professor, teaches at Lock Haven (Pa.) State College. . . . **Barry Mendeloff** is a project engineer at Sundstrand Corp. in Rockford, Ill. . . . **Robert G. Nelson** is with Haestade Engineers in Waterbury, Conn. . . . **Bruce E. Nunn** is now a research engineer for the Beloit Corp., Jones Division, in Dalton, Mass. His wife, **Allison Huse Nunn,** works for the Chester (Mass.) Division of Bendix Abrasives.

Bill Owen and his father have opened a new Bill Owen Radio and TV Service store in Mansfield, Mass. . . . **Maryann Bagdis Pace** is a technical representative for National CSS, Inc., Philadelphia. Headquarters are in Stamford, Conn. . . . **James Risotti** is a processing supervisor at GE in Lynn, Mass. . . . **Gary K. Smolen** is doing graduate work at the University of Massachusetts. . . . **Richard F. Socha** is returning to WPI as a graduate student. . . . **John A. Taylor** serves as a design engineer at Shuster-Mettler Corp. in New Haven, Conn. . . . **Ralph J. Veenema** holds the post of development engineer in the central research department of Worthington Pump, Inc. and is located in Glen Rock, N.J. He received his MSME from UMass last June. . . . Having earned his MS at Yale, **David C. Wason** is currently a programmer with Associated Catholic Hospitals Computer Center in Brighton, Mass. . . . **Karl S. Williams** serves as a boiler design engineer at Riley Stoker, Worcester. . . . **Robert A. Yesukevich** is a design group leader at Universal Oil Products in Riverside, Ill.

1974

Married: **James D. Perrone** and Miss Karen McManus in Worcester on November 8, 1975. The bride graduated from Becker. Her husband is a health inspector for the Worcester Department of Public Health. . . . **Richard D. Ventre** to Miss Elaine S. Dyott of Dallas, Texas on February 14, 1976. **Steve Williams** was best man. Mrs. Ventre attended Trinity University in San Antonio, receiving a BS in business administration. Currently she is with the Hartford Insurance Company in Dallas. The groom is employed by the plastics department of DuPont at the Sabine River Works near Orange, Texas. . . . **Mark A. Wendell** and Miss Mary Nadolny on January 11, 1976 in Webster, Massachusetts. Mrs. Wendell graduated from Anna Maria and is a graphics designer for IBA of Millbury and editor of *Dairy World* magazine. Her husband is a development engineer with Hewlett-Packard Medical Electronics Group in Waltham.

Edward Arsnow works as a safety engineer at Travelers Insurance Co. in Reading, Pa. . . . **William M. Block** is a layout engineer for Environmental Builders in Manchester, Conn. . . . **Clayton E. Boyce** serves as a materials engineer at Ebasco Services, Inc., Killona, La. . . . **Roger J. Broeker,** Jr. works at Brown & Root, Inc. in Houston, Texas. . . . **Gerald G. Buzanoski** has joined Griswold & Fuss, Inc., Manchester, Conn. His wife, **Kara Hogan Buzanoski,** presently serves as an environmental engineer for the state of Connecticut in Hartford. . . . **Donald W. Campbell** is an analytical chemist at Liberty Mutual Research Center in Hopkinton, Mass. . . . **Robert P. Cikatz** works as a quality control engineer at United Nuclear Corp. in Uncasville, Conn. . . . **George A. Clark** is a database operations specialist at Norton Co. in Worcester. . . . **Steven D. Dettman** is with Sanders Associates, Ocean Systems Division, Nashua, N.H.

Arthur R. Dodd serves as an assistant electrical nuclear engineer at Gibbs & Hill, Inc., New York City. . . . **Robert H. Dutson** works for Factory Insurance Association, Towson, Md. . . . Presently Lt. **Robert F. Foley** is a radar intercept officer in the Marine Corps. . . . **Joseph H. Gaffen** is employed as an instrumentation and controls engineer at UOP, an Air Correction division in Darien, Conn. . . . **Donald R. Gettner** is assistant golf pro at Stanford (Calif.) Golf Course. His wife, **Linda Fritz Gettner,** is a graduate student at Stanford University. . . . **Dennis Hattem** is building canals with the Peace Corps in Malaysia. . . . Currently **Barry M. Hynds** holds the post of assistant quality control engineer at Stone & Webster in Mineral, Virginia. . . . **Ricardo** and **Gretchen Terri Lobo** are associate professors at Universidad Autonoma Metropolitana in Mexico. . . . 1/Lt. **James J. Martin,** who recently graduated from U.S. Air Force pilot training at Moody AFB, Ga., has received his silver wings. Presently he is at Reese AFB, Texas where he is flying the T-38 Talon and serving with a unit of the Air Training Command.

David F. McGuigan is a graduate student at the University of Rochester (N.Y.). . . . Lt. **David M. Nickless,** executive (Army) officer of Bravo Battery, directed the 21-gun salute given for President Ford at the first National Bicentennial Fair held in Oklahoma City. . . . **Paul Nordstrom** serves as a water quality control engineer for the state Water Resources Control Board in Sacramento, Calif. . . . **James T. O'Bray** is now a buyer for the Gillette Company in Andover, Mass. . . . **David A. Peterson** is a graduate student at Cornell University. . . . **Michael W. Pontbriand** is an office engineer at the Badger Company in Carville, La. . . . **Robert R. Rosander** holds the post of project manager at Brown & Williamson in Louisville, Ky. . . . Dr. **Alice A. Sayler** is an assistant professor of chemistry at Bloomfield (N.J.) College. . . . Presently **Dean F. Stratouly** is employed by Diamond Power Specialty Corp., a subsidiary of Babcock & Wilcox Co., in Lancaster, Ohio.

1975

Married: **Bruce D. Arey** and Miss Debra D. Dostoler in Worcester on November 8, 1975. The bride graduated from Burncoat Senior High School and is employed at Outlet Co., Auburn, Mass. . . . **Michael E. Aspinwall** and Miss Patricia A. Calce in Worcester on August 10, 1975. Mrs. Aspinwall graduated from Worcester State College and received her MA in special education and learning disabilities from Assumption College. She was a speech therapist in the Webster public schools. The groom was a systems analyst at Bay State Abrasives, Westboro, Mass. and is currently studying for his MBA at the University of Chicago. . . . **John M. FitzPatrick** and Miss **Virginia A. Giordano** on October 19, 1975 in Pawtucket, Rhode Island. **Denise Gorski** was the honor attendant. The couple is employed by the Charmin Paper Products Co. in Mehoopany, Pa. The bride is an industrial engineer and the bridegroom a production engineer. . . . **Scott K. Nelson** and Miss Marilyn L. Janes on November 29, 1975 in Athol, Massachusetts. Mrs. Nelson graduated from Becker. Her husband is with Keyes Construction Corp., Providence, R.I. . . . **David S. Roland** and Miss Cynthia L. Bubon in Worcester on October 25, 1975. The bride graduated from Auburn High School. The groom is a student at Rochester Institute of Technology and works for Eastman Kodak in Rochester, N.Y. . . . **William C. Rutter** and Miss Phyllis E. Poole in Worcester on November 29, 1975. Mrs. Rutter graduated from the Worcester Art Museum School and was a paste-up artist with Heffernan Press, Inc. The bridegroom is a chemical engineer with Eastman Kodak Co. in Rochester.

Bruce P. Altobelli is a project engineer trainee at Alpine American Corp. in Natick, Mass. . . . **Mark R. Antonio** has been named an assistant scientist in the new products development physical pharmacy department in the professional products research and development division of Warner-Lambert's research institute in Morris Plains, N.J. . . . **Kent E. Berwick** is with GTE Sylvania in Needham Heights, Mass. . . . **Bruce A. Chamberlin,** a field engineer for DuPont Co., Wilmington, Delaware, is presently working on a two-year assignment as a cost reduction consultant to Remington Arms Co. in Ilion, N.Y. The assignment is part of a six-year engineering management training program sponsored by DuPont's engineering services division. . . . **Mark M. Deming** has been employed as a junior engineer for the Metropolitan Area Planning Council in Boston. . . . **Mark J. Drown** is an occupational therapy assistant at Fernald State School in Waltham, Mass. . . . **Kenneth M. Dunn** serves as a technical representative for Betz Lab. in Chicago. He travels to check equipment in process plants.

Katherine R. Fowler is an electrical engineer at Digital Equipment Corp., Maynard, Mass. . . . **Martin Fugardi** works as a project engineer at Damon G. Douglas Co. in Newark, N.J. . . . **Denise Gorski** has been promoted to director of research in the Office of University Relations at WPI. . . . **Gary D. LaLiberty** is a process engineer at Hooker Chemical & Plastics, Niagara Falls, N.Y. . . . **Kimberley R. Mains** is employed as a computer programmer at Associated Catholic Hospitals Computer Center in Brighton, Mass. . . . **Martin Meyers** is a graduate teaching assistant at UMass, Amherst. . . . **John W. Murray** recently joined Unionmutual in Portland, Me. as an actuarial student. He has passed the first two parts of examinations leading to a fellowship in the Society of Actuaries. . . . **Judith B. Nitsch** is a project engineer with Schofield Brothers, Inc., in Framingham, Mass. . . . Presently **Michael S. Schultz** is at the U.S. Army Engineering Center in Fort Belvoir, Va. . . . **Hooshang Shamash** is a graduate student at UMass. . . . **Ralph F. Soucie** expects to begin graduate work in architecture at Arizona State University this fall. . . . **Wayne E. Stratton** is an electronics engineer at the Naval Surface Weapons Center in Silver Spring, Md. . . . **Jon C. Wyman** is at Naval Officer Candidate School at the Naval Educational and Training Center in Newport, R.I.

NOTE: Because of the special nature of this double issue of the *Journal,* we have deferred "Completed Careers" until next issue.

TRUSTEE NOMINATIONS

Proposals for the consideration of alumni as alumni term members of WPI's Board of Trustees are currently being sought. Valid proposals are due on or before June 16, 1976. Details may be obtained by contacting the Trustee Search Committee, c/o Stephen J. Hebert, '66, Alumni Secretary, Worcester Polytechnic Institute, Worcester, MA 01609.

Wyman-Gordon is the country's outstanding producer of forged components for America's key industries. Wyman-Gordon has supplied forgings for virtually every aircraft in the skies today, as well as for the Saturn and other space boosters. Equally important is its production of vital components for nuclear and turbine power plants, sea and undersea vessels, trucks, tractors and construction equipment.

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pate in a seminar as their final activity, one or two students presenting papers each week for a general group discussion. A student's grade on the entire sufficiency requirement reflects his work in the final term of independent study or seminar participation.

One fact of educational life emerged after several years of sufficiency advising: most WPI students are not ("sufficiently") well-prepared to undertake a sufficiency. They lack many of the basic skills and methodologies needed for investigation in the humanities. To remedy this, the humanities department has designed four "concept" courses to teach some of these practical skills and tools: literary analysis, analysis in philosophy, religion, and ethics, historical analysis, and an introduction to the arts.

That is the humanities sufficiency. But WPI students can major in English or history. They must develop a sufficiency in one of the areas of science or engineering in just the same way as other students work out their humanities sufficiencies. At least six courses are involved, and they must be thematically related and lead up to a final independent study in the student's chosen field of science or engineering.

How well has the sufficiency requirement worked as a part of the Plan? David Riesman of the NSF panel commented that, "I have been impressed by the degree to which WPI students have become more at home with the humanities, and even found arenas of contact which make the humanities more than a kind of gloss for prospective managers or for cocktail party conversation."

Brooke Hindle, director of the Smithsonian Institution's National Museum of History and Technology, had this observation to make: "This is a well-conceived effort to accomplish an objective which no engineering school so far has succeeded in attaining. It is being carried forward by a group, a primarily young group, of faculty members who are putting more into this effort than could ordinarily be expected from a faculty."

Reporting to the National Endowment for the Humanities, historian T.H. von Laue of Clark University recounted the following experience: "We asked the students if they would make the Humanities part of their degree requirement if they were free to legislate on the subject. The great majority raised their hands in the affirmative, with considerable enthusiasm for the present program."

And finally, in assessing the program, English professor Michael Wolff of the University of Massachusetts at Amherst had this to say: "WPI's Plan and the humanities program are, on paper, where they should be. We all need to share in the rediscovery of what an education in humanities ought to be. But surely the flexibility that will help students branch out in all sorts of humane endeavor while introducing them to the traditional bases of knowledge must be one way to go. Above all, you have committed yourselves against merely temporary effects and to the institutionalization of significant change . . . What I see is the opportunity for faculty and students together to reintroduce education and reality to each other as only a new but readily available vision of the humanities can do."

Jay Gainsboro—
Millionaire in the making?

Jay Gainsboro has set a goal for himself: he wants to be a millionaire by the time he is 35. He started off toward that goal by entering WPI to study electrical engineering as preparation for grad school and a career in business. And he very nearly flunked out. "My first year was characterized by a lot of fooling around, spending five or six hours a day in the computer center, things like that." When he began his second year, Jay was ready for EE . . . he thought. His first term he took three courses and physical education. He passed physical education.

"My parents weren't too impressed. They said, 'You've got the choice of producing, or you can leave school; we're not going to pay to have you fail three courses out of four.' It was a time to reevaluate my position. I realized that because I hadn't done too much studying my first year I didn't have the really good math background I needed for electrical engineering."

Jay went back to his original goals and decided to combine his business interests with engineering. He looked over the offerings and the faculty of the management engineering department and decided to make the switch. "At the time it really was a cop-out. Looking back on it now, I think it was a good decision. I think that if I had gone through WPI with my original plan, I would have come out with engineering but no business background at all. And had I done well in electrical engineering, I wouldn't be where I am now."

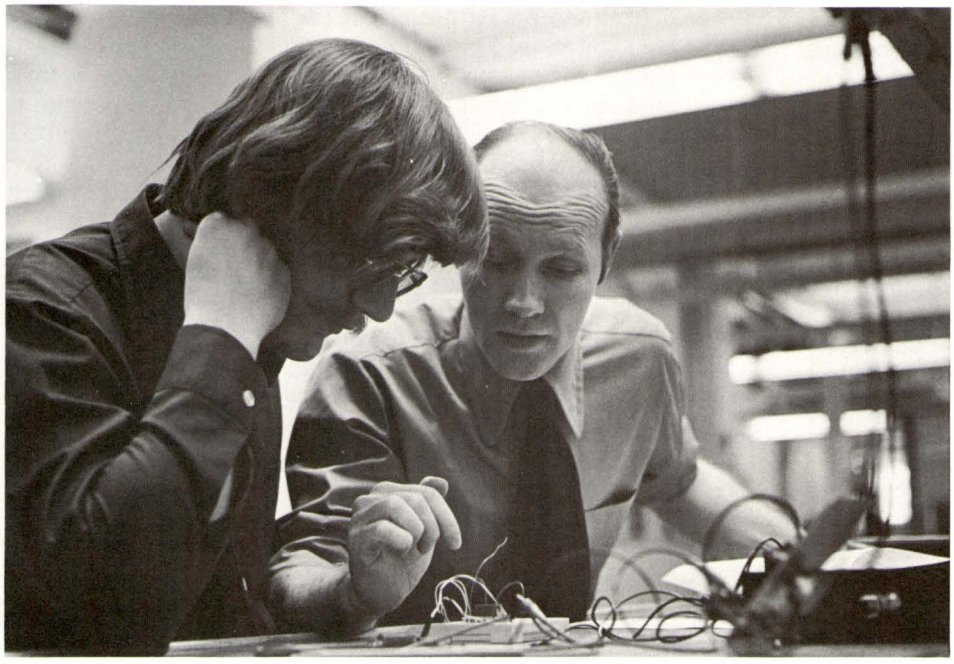
(Where he is now, at the time we interviewed Jay, was trying to decide among four job offers, all of which appealed to him.)

Once he had decided on management engineering, things took a decided turn for the better. Jay's grades pulled up, with about 50 percent distinctions, and he began putting some direction into his studies. Jay also realized that he worked better under pressure, and the normal load of three courses per term just wasn't supplying him with enough motivation to buckle down and study. So he registered for severe overloads, as many as six courses per term. He thrived under this kind of pressure, which would have submerged most other students. Although it was far out of the ordinary, it worked for Jay Gainsboro, and that's what counted.

Jay was no stranger to the ways of business. He started his first business, in fact, at about age fourteen. A skier himself, he and a friend made ski gaiters, cloth overboots to keep the snow out of one's socks. The two turned a profit of about $500. During Jay's first year at WPI he got a concession selling jewelry in the WPI bookstore. His second year, working for a local bottler, he sold soft drinks. This third year he sold books.

After his third year at WPI, Jay took off nine months to start up a new company with his father. When he returned to WPI in term C, he had a new perspective on the courses he took. "I went through different stages. My initial reaction was that this was all a bunch of bull, that there was nothing to the theoretical. But then, thinking about it a little bit more, I realized that there was a definite need for it. Theory gives you a place, a basis to start from. The practical is all right, but having the theoretical background and the knowledge to draw on is very important."

Jay's major and interactive qualifying projects were both concerned with solar energy, though in very different ways. For his major project, Jay was part of a three-



person team that designed and built a practical solar heater for a swimming pool. One student designed and build the working prototype, another designed the manufacturing process necessary to produce it, and Jay conducted extensive market research to determine how the heater should be marketed. The students put together a twenty-five page business plan, complete with cash flow projections and the amount of capital that would have to be invested.

For his IQP, Jay decided to try and share some of his knowledge. He went back to his school in Wayland, Massachusetts, and offered to conduct a class in solar energy for interested students. After considerable red tape, the idea was approved. Then Jay spent a day talking to each science class to drum up interest. He hoped to sign up ten or fifteen students, but fifty enrolled at the beginning—nearly one-fourth of all the students he had talked to. Jay's class ended up with twenty-five students, who got very involved indeed. As Jay put it, "I had two top students doing things that were even a little bit beyond me. One was building a working model of a satellite solar power station which would generate electricity and transmit it over a distance of twenty-five feet. Another made a steam engine powered by the sun." Jay aims high with all his work. "My ultimate goal with this course was to have NBC Nightly News come in and do a little thing about us. But the major thrust was to let people know that solar energy is practical."

Jay was disappointed with the results of his competency examination. "I put in as much work as I possibly could. I had about fifty-five hours to work on it, and I got about six hours of sleep. I felt I did a very good job. My oral exam, though, concentrated on one aspect, finance, and my written paper had dealt also with personnel, operations, and marketing. The hardest part of the competency exam is waiting for the results. After twenty minutes, the faculty group came out and said I passed. I was very disappointed. I got an Acceptable and I wanted a Distinction."

The last degree requirement Jay fulfilled was his sufficiency. For this Jay chose to study a somewhat different area. "I chose philosophy, the ethical issues in business. I figure I'm going to be spending the rest of my life in business if my plans go the way I want, and I feel I should have a philosophical point of view on it." Jay read extensively in John Stuart Mill, Adam Smith, and other classical economic philosophers, then explored particular issues in modern society, such as price-fixing and the social responsibility of large corporations.

At this point Jay is off working on his first million. The thing he remembers best about WPI is the flexibility of the WPI Plan. "It gives you an opportunity to go off on your own and to do what you want. I don't think I could have been happier in any other school. Everything worked out perfectly for me. I wouldn't have said this during my second year when I failed three courses, but looking back on it now and being out in the real world and experiencing it, I feel that WPI has provided me with a great basis from which to go out and conquer all."

WPI

How well the Plan is going

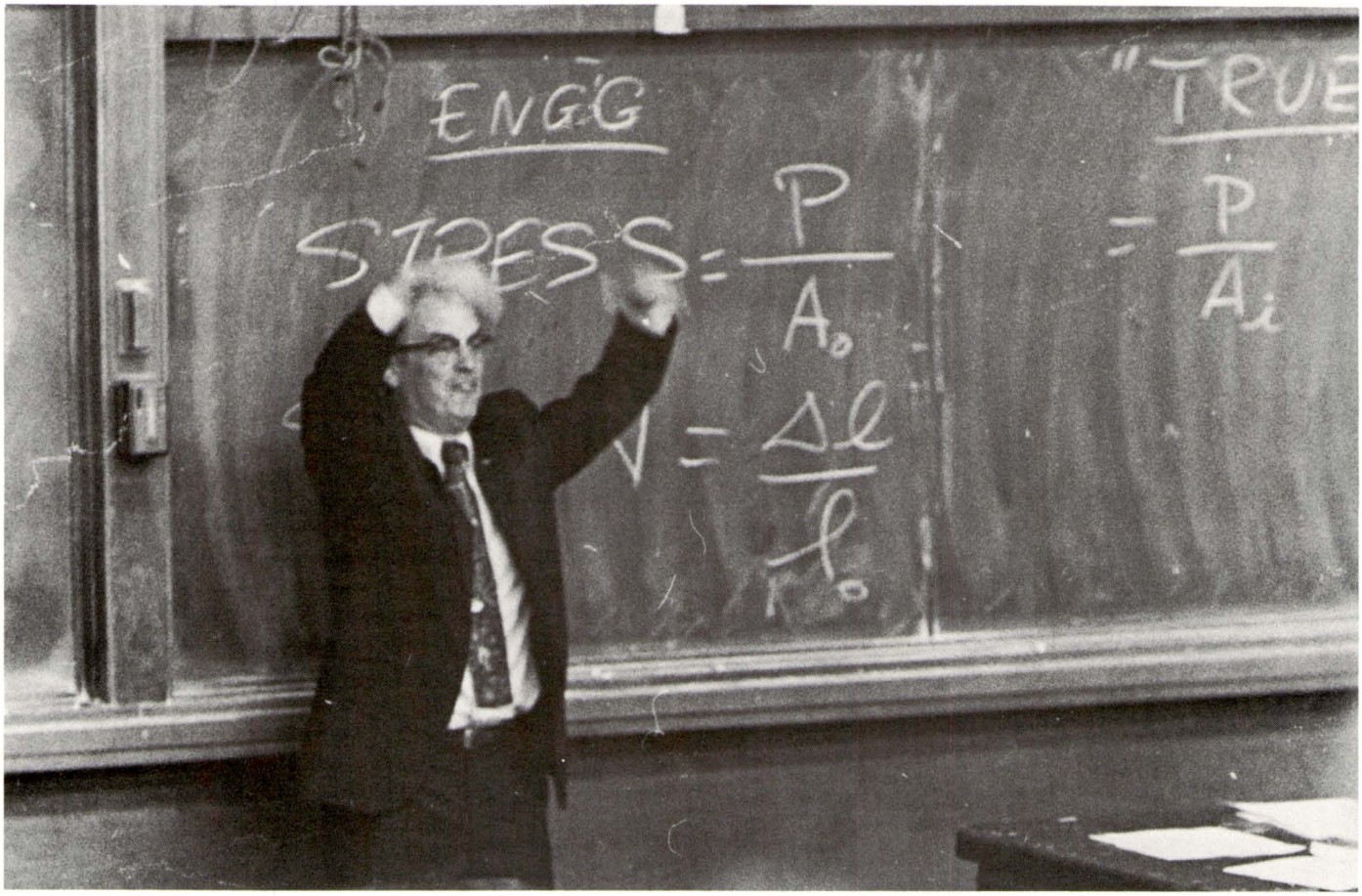
Everyone wants to know how well the Plan is working, and what people think of WPI these days. Probably the first place to start looking for some of those answers is on the campus itself. What do students and faculty—the people who live closest to the Plan—think, and how well does the Plan today compare with what they felt and expected a few years ago before the Plan became a reality?

Students

Those answers are readily available, because of two studies which have been carried out under the auspices of the National Science Foundation. The first, of students, has been conducted by Dr. Karen Cohen, an evaluator who is also affiliated with M.I.T. She was asked to evaluate the effects of the WPI Plan on the students. For three years she interviewed hundreds of students from all classes, and she also interviewed students at Clarkson College of Technology and at Stevens Institute of Technology, to provide a basis for comparison and to allow her to judge what observable differences were merely reflecting national trends. (Clarkson, which has a traditional program, was selected because it has about the same number of undergraduates as WPI . . . and they are remarkably similar in background. Stevens was picked because its faculty had recently undergone significant upheaval.)

Dr. Cohen's conclusions are reassuring. Plan students, she found, are by any available measure as competent as previous WPI students, if not more so. "Students at WPI spend more time on learning activities than those in comparison institutions, and the time spent in experiments and project work is greater than the amount of time spent in class. The WPI Plan is a feature that attracts students to the school more prominently than do the programs at comparison engineering schools. The program also attracts a more diverse group than used to come to WPI.

"Entering WPI students have higher educational goals in general. They value such things as the ability to work with ideas, the development of a capacity for life-long learning, being an interesting individual, being of service to others, and changing the world for the better more strongly than do students at the other engineering schools.



"Those in the program perform exceedingly well in job-oriented projects, both as rated by project industrial sponsors and by the students themselves. Furthermore, the quality of their academic work under the Plan is equivalent or slightly better overall than before the institution of this new system, as are their EIT scores, an external index of competency in engineering."

Faculty

During the turbulent three years of Plan implementation, faculty attitudes and actions were studied by Dr. Frank Baker, of the State University of New York at Buffalo, and Dr. John Babarro, '59 of Harvard University.

As has been indicated in other articles, demands on the faculty have been—and are—much higher than at other colleges. One faculty member put it this way: "Everyone is working much harder with longer hours. I never get a free evening because I have students in my office so much of the time."

And with all this extra load, what do the faculty think about the WPI Plan? To quote Baker and Gabarro,

"Nearly four-fifths of the faculty indicate they believe that the WPI Plan has been a successful experiment in educational reform. Comparing it to older patterns of engineering education, nearly two-thirds of the faculty indicate that they believe the Plan offers a science and engineering education which is superior to the traditional approach. Regarding the costs of the Plan, almost two-thirds of the faculty indicate a belief that the benefits derived from the WPI Plan justify its high costs in terms of their own workload and professional development.

". . . In assessing the success of the Plan, . . . almost two-thirds agree that the level of competence of WPI graduates is increasing as a result of the Plan."

Baker and Gabarro summarized their findings with this praise: "Even with the hardships and overextension the faculty experienced in implementing the Plan, more faculty now understand and support the Plan than did at its inception, and a new sense of confidence is developing among the faculty as a whole. . . .

"As external observers we have witnessed a substantial maturing within the faculty beyond that present in most institutions. It has manifested itself in the faculty's gradually developing confidence and ability to address bold and significant changes with an increasing sense of calmness and determination. In the same vein, the faculty has developed a tolerance for opposition and criticism which it did not possess three years earlier. . . . This consequence is an important effect of the Plan on the faculty. But it is also reflective of the quality of the faculty and its leadership. It may very well be, as several of the NSF panelists reported, that few other engineering faculties exist with the qualities necessary to implement a 'WPI Plan.'"

Recent alumni

Perhaps more important than the attitudes of students is the experience of those who *were* students under the Plan, graduates from the classes of 1972 through 1975.

The *Journal* interviewed several of them to find out just how they feel about WPI and the Plan now that they can look back on it with some perspective. We were particularly interested in their perceptions of how well WPI prepared them for their present jobs.

William Elliott, '73, an electrical engineering major, works as a field supervisor engineer with GETSCO, a division of General Electric, in Salem, Virginia.

"I didn't take as many technical courses as my colleagues at work, but my WPI education was more than adequate to take care of what I know and use in the technical area," Will said. "I am a firm supporter of the Plan. It has gone much farther and progressed much more than I anticipated." Will feels that the WPI Plan offers "a better education, better facts, and it's a character builder."

Will has especially fond memories of the faculty at WPI. "The personal contact with faculty members brings out the whole spirit of why one is learning something, and why a person is doing this work to begin with."

Barbara Bain, '74, majored in life sciences at WPI. She is currently a data systems analyst, part of a design team building a new data center for Southern New England Telephone Company in New Haven, Connecticut. "I think WPI education is far superior. The whole Plan—the competency and the projects—gives you working experience. When I'm working on a problem, my co-workers often ask, 'How did you get that answer?' And I can answer that it's because I did projects like this at school." Barbara changed from the traditional program to the Plan during her sophomore year. If she had it to do over again, she'd prefer to spend all four years on the Plan. Other comments: "When I took my competency exam, it was the only time I realized just how much knowledge I had actually stored up in four years of education."

John Chipman, '74, is another EE graduate. Currently an electronic instrumentation engineer for GTE-Sylvania in Needham, Massachusetts, John rates his WPI education "better than the education at the average school. Projects give a student a chance to do realistic things. They prepare you most for the kind of work you do in engineering." Although he wishes he had a better background in engineering economics—"being aware of engineering costs when you design something"—and he feels this has handicapped him in his job, he has nevertheless progressed more quickly than his co-workers. Dave Hatch, John's supervisor at GTE, observed that he "was very much impressed by John's maturity in engineering. I felt he was much better prepared. John is way ahead of himself compared to graduates from other schools." Hatch also commented that WPI seems to offer a more wide open set of choices in school, that it is not so restrictive as other colleges, and that a really noticeable difference is the projects the students must do.

John Barnes, '74, is a mechanical engineer and director of the power systems group at Combustion Engineering Corporation in Windsor, Connecticut. John also feels that his WPI preparation was better than that of his colleagues from other schools. "It's very much better," he said, "in that it was much more rounded. I'm in a technical atmosphere, and no one here seems to have had much exposure to anything other than technical areas. I feel I have an advantage over my colleagues because of my well-rounded education.

"The Plan put the burden of my education on myself. It allowed me the freedom to get myself educated. And that in itself, over four years, leaves a remarkable imprint."

What outsiders see in the WPI Plan

Perhaps more important in the long run than what students and faculty think of the WPI Plan are the opinions of the outside world—particularly business and industry, the ultimate judges of how well most of WPI's graduates perform.

One recent indicator involved the class of 1975 (which was half Plan and half non-Plan) and their performance on the Engineer-In-Training examination last spring. In all of Massachusetts, 88 percent of those who took the examination passed it. 86 percent of WPI non-Plan students passed, while 93 percent of Plan students passed. Furthermore, the distribution of scores was quite distinctive: Plan students received higher scores than did the group of non-Plan students who took the exam at the same time. Although this index is only one indication of actual engineering competence, and many other factors must be taken into account, many professionals in the field regard the EIT test scores as significant and "hard" data which indicates the value of a person as an engineer.

The NSF Visiting Committee

Mention has been made throughout this publication of the National Science Foundation Visiting Committee. This group was established in 1972, under the terms of WPI's record grant from NSF, as an independent committee of outside educators and industry people, who would "monitor" the development of the WPI Plan, both as feedback to NSF and to WPI. The group was a blue-ribbon panel, including:

Dr. Lee Harrisberger, dean of science and engineering, University of Texas at Permian Basin
Dr. Bruce Mazlish, head of the department of humanities, Massachusetts Institute of Technology
Dr. George Pake, vice president, Xerox Corporation, Palo Alto Research Center
Dr. Kenneth Picha, dean of the school of engineering, University of Massachusetts
Dr. Eugene Reed, executive director, Bell Telephone Laboratories
Dr. David Riesman, Henry Ford II Professor of social sciences, Harvard University
Dr. John Whinnery, professor of electrical engineering, University of California—Berkeley

The group visited the WPI campus twice a year for three years. The scope of their visits is described by George Pake: "A typical meeting comprised two days of both structured and unstructured sessions with students, faculty, and administrators, as well as executive sessions of the Panel. Panelists were given access to any data or individuals they asked to see: all of WPI became an open book which we were free to puruse or study in depth as we wished. The Panel involvement extended to attendance of faculty meetings, meeting with such committees as the faculty committee on tenure, visiting with professors in their homes, lunching with students, and one-on-one interviews with student, faculty, and administrative personnel. A few panelists made additional visits on their own to talk with faculty and students, to attend classes, etc. *It is quite possible that some academic members of the Panel have a better overview of WPI than they do of their home institutions.*" (italics added)

After three years of watching the WPI Plan progress from concept to reality, the NSF panel was in a unique position to judge WPI's accomplishments. The panel started off skeptical: "I frankly did not think the Plan would last as long as the three years of our panel, but well before that a crisis would occur which could not be solved," said David Riesman, echoing the feelings of the other panelists.

But in those three years, the panel's skepticism turned to belief that WPI might be able to pull it off after all, and finally to enthusiasm at our achievement.

Bruce Mazlish: "How can I sum up except to say that a plan that seemed impossible of implementation three years ago is now moving along briskly and well."

David Riesman: "In the dawn's early light, the Plan is still there, still in major part uncompromised and relentless in its demands on faculty energies and student talents. And it seems clear that for the best students, WPI has provided a better education than they would have received at the comparison colleges, and that the faculty themselves have learned more than they would have, even at engineering schools of higher reputation and greater national visibility prior to the Plan."

Kenneth Picha: "The faculty and administration are to be commended for the excellent progress in implementing the innovative WPI Plan."

George Pake: "My conclusion after three years during which I have seen the first class of graduates who have been fully under the WPI Plan: *It is the most successful experiment in educational reform with which I am familiar."*

Lee Harrisberger: "This is one of the best administered projects I have seen, and it has met its objectives for the three-year period exceedingly well. Problems of implementation were met and solved with very little compromise of objectives. The Plan is essentially operational, and the problems that remain can be solved in the same competent manner as all in the past."

John Whinnery: "There is a spirit, pride, and justified self-confidence among the graduates and other students we met that signals success in achieving the most important objective of the program. . . I have not seen a more ambitious undertaking in any project for educational innovation, nor one at any level carried out better."

Eugene Reed: "With the graduation of the first generation of Plan students, an important milestone has been reached and the results of WPI's institutional transformation are beginning to emerge. We met with six seniors selected at random. . . They were an impressive group: articulate, self-confident, mature, knowledgeable in their fields, and wholly sold on the Plan. . . This group of young men and women are a credit to WPI. They will go out into the world, including top graduate schools, as living advertisements of the Plan."

In the harsh light of business and industry

Perhaps the most important judges of the WPI Plan, particularly for students, are the people who have to hire and work with Plan graduates, who have to compare WPI's end product with the students from other colleges.

In these economic times, jobs are an especially sensitive area. And ultimately the success of the WPI Plan will rest on whether WPI graduates can get at least as good and as many jobs as graduates from other schools. And what does the business world think?

"Interviewing your students calls for a slightly different, but much more enjoyable, approach than that used at other colleges. Thanks to their project work, I found the typical candidate to be more outgoing in describing his Worcester Polytechnic Institute experiences; more practical in his attitudes toward a career; and really, much more "at home" with himself in terms of confidence in his abilities. It's very much akin to interviewing a student who has participated in a cooperative education program throughout his college years—having applied his engineering knowledge to some extent, the candidate has already made a partial mental transition from student to industrial/business worker.

". . . Like other industrial representatives, I had some initial concern about whether or not the Plan would graduate fully qualified chemical, mechanical engineers, etc. Based upon this past visit, I'm no longer worried and hope instead that the concept spreads to other, more rigid engineering curricula around the country."

—R.C. Hawkins, Manager, Selection & Placement, Koppers Company, Inc., Pittsburgh

"A short while ago our personnel representative held interviews at various colleges in the New York and Boston metropolitan areas as well as at Worcester Polytechnic Institute.

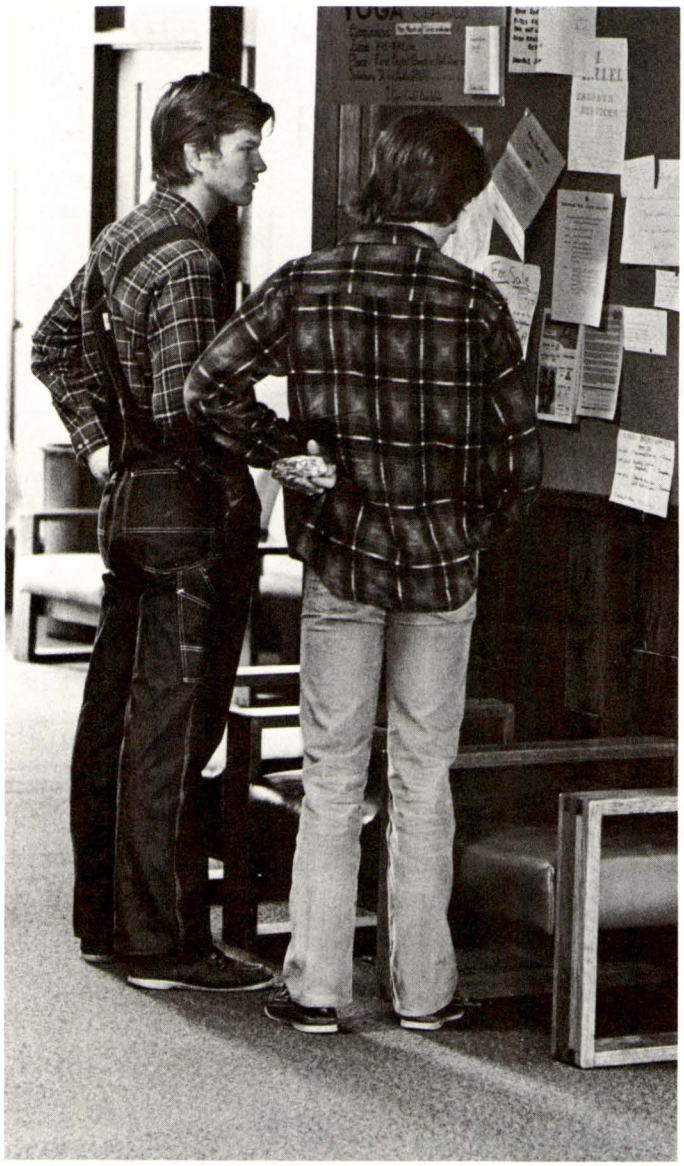
"In making a verbal report, he commented that, of all students interviewed, Worcester was the standout for responsiveness, knowledgeability, appearance, and type.

"Further, the head of our Process Department added the important point that, based on his experience, the Worcester B.S. graduate today belongs at the top of the undergraduate league . . . I should mention that he is an M.I.T. man."

—J.M. Driscoll, senior vice president, Stone & Webster Engineering Corporation, New York City

"I was recruiting at Tech last month for the Center. I was very impressed with the quality of the students this year. My last visit was three years ago when the Plan was in its infancy—what a difference now! The exposure to real world problems is putting your students far ahead of those from other colleges in coping with real life situations. They are much more conversant, self-assured, and accustomed to solving problems for which the answers are yet unknown. I was very impressed. Keep up the good work."
—Christopher G. Foster, "Naval Underwater Systems Center, New London, Connecticut

"WPI Plan graduates are coming out just as good engineers as our older grads, but they are much more aware of the society in which they are doing engineering."
—J.S.S. Ribeiro, '58, treasurer, Jamesbury Corporation, Worcester.



And on to graduate school

But not all students are ready to begin a career after four years at WPI. What about those who want to go on to graduate or professional schools? From the Class of '75, 22 percent of Plan students and 16 percent of non-Plan students went on to grad school. It would appear that Plan students tended to go to grad school farther away from WPI than did non-Plan students, and we could make a good case that, by and large, Plan students went to more prestigious graduate schools than the non-Plan alumni. But see for yourself. Here's where they went:

School	*No. Plan students*	*No. Non-Plan students*
Boston College		1
Boston University	1	
Brandeis University	1	
Case Western Reserve University	1	
Colorado School of Mines		1
Cornell University		4
Dartmouth	2	1
Fairleigh Dickinson University		1
Georgia Tech	1	
Harvard University	1	
Mass. College of Optometry	1	
M.I.T.	2	2
Ohio State University	1	
Pennsylvania State University	1	1
Stanford University	3	
SUNY at Stony Brook		1
Tufts University	1	
University of California at Berkeley	1	
University of Colorado	2	
Univ. of Connecticut Med School	1	
University of New Hampshire		1
University of Illinois		1
University of Massachusetts	2	1
University of Pennsylvania	2	
University of Rochester	2	1
University of Wisconsin	1	
Virginia Polytechnic Institute	1	
WPI	4	7
Yale University	2	

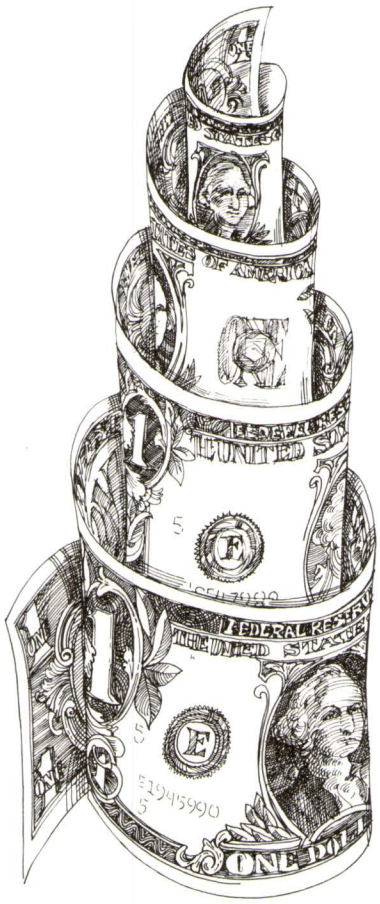
Dollars and cents support

The WPI Plan has been expensive. The amount of time and effort involved in changing an institution's entire curriculum can hardly be guessed at . . . but it's a lot. New facilities and new resources had to be added, too, and none of this came during times of economic plenty. As the size of the undergraduate student body grew from 1,600 to 2,100—as new programs and new departments had to be developed—as rising costs quickly outstripped rising income—all the while the traditional WPI educational program had to be maintained, salaries paid, buildings maintained and in some cases renovated.

And the WPI Plan itself is not a cheaper form of education. Quite the contrary. According to Eugene Reed of Bell Labs, "The major problem is cost. The Plan represents education inherently more expensive than the traditional format. I don't know how much more expensive—my estimate: 30% to 50%—nor do I know how WPI will pay for it."

That seems like a gloomy picture. How could WPI possibly have created the WPI Plan—much less be able to maintain it—under those circumstances without incurring crippling budget deficits?

The answer lies in large part with special financial support given to WPI specifically because of the Plan. In fact, a list of foundations and corporations that have made major grants to the WPI Plan—not to buildings or endowment—reads like a Who's Who of the major supporters of higher education in this country. Here are some of them:



April 1970 **The Alfred P. Sloan Foundation, $200,000:** to fund the Environmental Systems Study Program, a prototype of project work under the Plan.

June 1971 **Carnegie Corporation of New York, $188,000:** to fund the remodeling of courses and "design" work leading to the Plan's beginning.

October 1972 **National Science Foundation, $733,400:** A three year grant, the largest ever given by NSF under its College Science Improvement Program, to fund implementation of the Plan.

February 1973 **The Kresge Foundation, $150,000:** to provide, by renovation, a technical support and service center for project work located in the old Foundry.

January 1974 **National Endowment for the Humanities, $180,000:** to promote the teaching of humanities in a technical school by developing the WPI Plan sufficiency.

April 1974 **The Alfred P. Sloan Foundation, $350,000:** to strengthen social science competence of both faculty and students by supporting interactive project activity and special summer programs for training faculty.

July 1974 **The Ford Foundation, $180,000:** in recognition of WPI's achievement and innovation, a Venture Fund grant to encourage and support other improvements in undergraduate education, to be used at the discretion of the institution.

October 1974 **The Andrew W. Mellon Foundation, $150,000:** to support faculty development in the humanities.

June 1975 **The Alfred P. Sloan Foundation, $85,000:** to aid in developing audio-visual programs and instructional methods.

June 1975 **National Science Foundation, $430,100:** to continue with Plan implementation, in recognition of WPI's position as a national leader in engineering education.

October 1975 **National Foundation for Arts and Humanities, $82,500:** to further the use and development of audio-visual aids to instruction.

March 1976 **Lilly Endowment, $123,000:** to support and develop social science faculty and programs.

The WPI Plan . . . What it isn't

One of the problems in talking about the WPI Plan is that people tend to fasten onto a number of highly visible changes that have been made in the academic structure, saying "These are part of the WPI Plan"—or even, "These *are* the WPI Plan." But a significant number of those changes are *not* part of the Plan; they just happen to have been instituted at the same time as the Plan. They help the Plan, but they are not essential to the concept.

Three of these interesting but nonessential elements have been widely publicized: Intersession, videotape-aided individually paced teaching techniques, and WPI's negotiated admissions program. Two others, the 7-week terms and the changed grading system, have been the focal points of considerable on-campus controversy though this has been little publicized off campus.

To complete an understanding of the WPI Plan, these other elements must also be understood. They play an important role in shaping academic life on campus.

Intersession

Two or three weeks in January devoted to a different sort of academic enterprise: this is the basic recipe for Intersession, which is modeled after January programs held at scores of colleges. At WPI the ingredients generally include 150 or so short courses, running from one evening to ten days. Technical subjects are covered, but many other courses are far afield of the usual WPI coursework: gourmet cooking, teaching contract bridge, winter mountaineering trips, bartending, pipe-organ construction, and the list goes on.

Why? The fundamental reason for beginning the Intersession program was to help break down the rigid structure that had the faculty member engaged in teaching and research, but seeing his students in almost no other situation. Intersession was designed to draw out faculty members and students to discover common interests, to meet each other as people and not as adversaries in a classroom situation. In the words of David Riesman, NSF panel member, "It is rewarding for students to discover that their feared professor of physics is teaching them how to build harpsichords, or that a chemical engineer is giving an Intersession course on Chinese cooking, or that a professor of history is taking them to Florida to do oral history among the remaining indigenous residents of the Florida Keys. Faculty and students discover each other in new ways, increase the range of mutually shared interests, break the routines of formal relationships—which are particularly striking at WPI because of the near total lack of any non-classroom residential contact between students and faculty."

Thus the intent of Intersession was to build bridges of communication between students and faculty, to help foster a sense of community on campus. In five years, though, Intersession's impact has changed somewhat. In the beginning, the hoped-for goals were indeed achieved. But student participation has dropped somewhat each year, leveling off at about 50 percent each year. One thing that has happened is that students have learned to use Intersession for other purposes, for special projects of their own, and as a period in which to help organize or wrap up projects and sufficiencies.

Intersession has played a large role in helping faculty and students get to understand each other better, and that has been an important factor in the success of the sweeping changes that have been going on in other areas.

7-week terms

The first visible aspect of the WPI Plan changes came about in 1972 when 7-week terms hit the campus. Discussing the initial reaction of many that 7-week terms had been a mistake, David Riesman says, "I thought instead it was a stroke of genius. It made clear that the Plan was a revolution, that it required rethinking one's subject matter and stripping it to its essentials, and altering one's relations to students so as to put them on their own."

There were several reasons for making the change. First, it was designed to enable students to devote an entire term to working on a project, perhaps off campus, and made the formation of project groups possible. Second, the 7-week terms were designed to make the overall academic calendar more flexible, by enabling students to enter and leave the college at different times in the year, to take a term off with relatively little disruption in their careers. Third, the workload would remain the same, but students would study only three courses at a time, instead of the former five or six during a 14-week semester. By doing this, it was hoped that students could more thoroughly immerse themselves in their coursework, learning more efficiently.

Of course, things never work out in practice quite the way their designers intended. After an intensive two-summer-long effort, financed in part by a grant from the Carnegie Corporation and in part by faculty members donating two weeks their time, the college's course offerings were completely revamped. When classes opened in September 1972, though, the snags in the design soon became apparent. The rapid pace of learning proved a hardship on returning students, who were simply unprepared for the change it would require in their studying and learning habits. Faculty, too, couldn't adapt overnight. Many tried to teach their material in the same old ways, just twice as fast, and that often didn't work. In some subject areas—mathematics and the humanities, for example—the newly required pace was simply too fast. It didn't allow the time needed for concepts and insights to develop and mature. It seemed to threaten the basic process of understanding in those areas.

But solutions were found. Experience taught many faculty how to deal with the new time frame. For a few areas, the faculty decided to ignore the 7-week term, running a course for 14 weeks at its previous rate of teaching. With occasional modification, the 7-week terms have proved effective. The WPI Plan could be operated with 7- or 10- or 14-week terms, once the college's structure of courses has been designed to accommodate the interval. Though not essential to the Plan, the 7-week terms have helped to signal the sort of drastic change that the Plan embodies, telling students, faculty, and outsiders alike that something different is indeed happening in Worcester.

Grades

Under the WPI Plan, three basic grades exist: *Acceptable, Acceptable with Distinction, (AD)* and *No Record* (NR which means that no record is made on the transcript of the student's having taken that particular course). A grade of *Not Acceptable* is recorded only for project work or independent study.

This change from the traditional A-B-C-D-F was made to help break away from the tyranny of a quality point average, with a view to letting students worry more about studying their subject to understand it than about getting a good enough grade to raise their QPA a certain amount. The AD grade still allowed recognition of superior performance, while the NR would hopefully encourage students to venture into areas with which they might not be too familiar because there was no stigma attached to failure, no permanent brand on the record.

All grading systems have their plusses and minuses. At WPI, it seemed there were—and are—some students for whom the grading system is inadequate. If they have no hope of distinction, then there is no intermediate grade to help spur them on to make an effort greater than that required simply to get by. Although this affects only a minority of the students, it is a real problem nonetheless. About the only answer to it, though, is that any other grading system will also work to the disadvantage of certain students. Changing the grading system would only shift the burden to a different group.

Along with the recorded grades, a student's transcript also contains written descriptions of his or her work in projects and independent study. By detailing a student's accomplishments and performance in these self-motivated areas, the Plan transcript actually gives a better and clearer picture of that student's real achievement at WPI.

Whenever you change a grading system, it seems, you are stuck with the task of teaching outsiders how to use and interpret the new system. Industrial recruiters balked at first at the Plan grades: without a QPA, how could they adequately judge a student's record? It was a case of unfamiliarity breeding contempt—or at least caution. But most of them soon learned that descriptions and evaluations of degree-qualifying projects gave them a much better indicator—one more relevant to their own job-filling requirements—of a student's potential and performance than a simple succession of letter grades could ever do.

The one remaining bastion of required QPAs, it appears, is for admission to certain types of professional school—notably medicine and law. Such institutions may have 40 people applying for every available opening, and many of them feel, rightly or wrongly, that they simply don't have to be bothered looking at a student's record unless there is a number attached to it. This has created a problem for some WPI students, and for these cases (and *only* in these cases) a compromise with the grading system is made, computing an "artificial" QPA which is accompanied by a disclaimer to the effect that Plan grades are *not* translatable into numerical averages. The "number" is just to help those students get past the initial screening—it is, in fact, exactly what many of these professional schools do themselves anyway.

Television teaching and setting your own pace

It was apparent right from the beginning that WPI faculty were going to be utterly overloaded if they tried just to add on project supervision, advising, and competency exams to their regular teaching load. With this in mind, WPI has made a big commitment to the use of television and videotape as a medium of instruction. When a professor can record his lectures once, perhaps doing several of them in one day, he is freed of an enormous burden. The second time around, particularly, he has more time available to meet with students on an individual basis and to advise project groups. Updating a course becomes a simple matter of redoing only those things which need changing.

A second benefit of putting instruction on videotape, which is then available at the library, is that a student can study at his own speed, and according to his own schedule. If 10 p.m. is convenient for him, then it is also convenient for the videotape. And if the student wants to go through four lectures at a sitting, he can. While videotape removes the possibility of a student interrupting to ask a question and have it answered immediately, it also adds the possibility of viewing the lecture or parts of it two or more times.

A number of courses are offered in a completely self-paced version (called IPI, for individually prescribed instruction) using programmed-learning texts, videotapes, and periodic tests, or"assessments," which must be mastered before the student can go on to the next unit of instruction. There are also regular conference sessions where students can get help on trouble spots. The IPI system puts a great deal of responsibility on the student: there is nothing but the calendar to force the pace, and if the student goofs off and doesn't get going, there is no one else to do it for him. But for the student who can handle it, IPI offers a marvelous bonus. Because the student must master one unit before moving on, he can't get in over his head because he missed out on a vital background area. It may take the student three weeks to finish a course, or it may take him twelve, but when he is through he has demonstrated a grasp of the subject.

Because so much of the WPI Plan depends on the student's own initiative and participation in the educational process, IPI is especially suited to WPI. It is not adaptable to every subject, but it offers significant benefits to students, faculty, and the college. While not a part of the Plan, IPI has been a very important factor in helping it succeed.

Negotiated admissions

WPI's negotiated admissions process is unlike the other things discussed in this article. It wasn't instituted along with the Plan; it came later.

Basically, the negotiated admissions process involves a very heavy counseling role by the admissions staff with each prospective applicant. The interested candidate is exposed to a wide variety of WPI experiences and literature, including interviews, tours, taped presentations, perhaps sitting in on a class. Then, providing only that the prospect meets the minimal requirements of four years of high school math, three of science, and four of English (this requirement, in itself, will weed out perhaps 90 percent of high school students), the decision to admit is made by the applicant himself or herself, not by the admissions office.

Because of the high self-motivation required of students under the WPI Plan, it seemed only logical that the admissions process should reflect the need for participation. The student is told about WPI and shown what will be expected; told how his or her test scores relate to those of current students; and finally asked to assess his or her own chances. It happens occasionally that a student opts to admit himself, even though the admissions staff are convinced that the student probably won't be able to make it through. In this case, the student is given the opportunity to withdraw, with his deposit returned. But if the student has enough confidence in himself, despite the warnings, then WPI will give him a chance to try.

"There's no way we can measure a student's motivation," says Admissions Director John Brandon. "It's not a matter of test scores or class rank. And motivation is really important under the WPI Plan, more so than at most schools. So if a student is willing to bet on himself, we're not going to tell him no."

When negotiated admissions was first adopted in 1972, there was some fear that this meant a lowering of standards and would result in ill-prepared students. This was in spite of the fact that, just prior to the new system, WPI was accepting 1200 of its 1300 applicants. In practice, there has been little change in the student body which can be attributed to negotiated admissions. It appears that there are slightly more "superstars" and slightly more students at the bottom end of the scale. But this may also reflect differences in the type of student who is attracted by the Plan.

Genesis—
The birth of the WPI Plan

by Andreas de Rhoda

Perhaps the most striking thing about the WPI Plan is that it was designed not from the top down but from the bottom up. Its creators didn't start by changing academic courses, the usual route of college reform. They weren't even content to stop at the next and far more basic stage, rebalancing the distribution of requirements, the mix of educational courses and programs which is rarely changed, especially in colleges of science and engineering. Instead, these "radicals" went right to the foundation of the college's educational goals.

The overall goal of WPI, like that of most of its sister institutions, has remained the same since its founding: to educate professional engineers and scientists. In the more modest language of WPI's 1865 motto, *Lehr und Kunst,* it reads, "to combine theoretical knowledge with practical learning."

To the people who designed the WPI Plan, this statement was no longer sufficient for the world in which higher education exists today. And so they reconceived that goal completely.

What made these quiet, nonideological professors throw away the known recipes for academic reform and start from scratch? Were they naive idealists who knew so little about the myriad of things that could go wrong in such a basically new and complex program? Were they opportunists who sensed more quickly than others the new wind blowing through the halls of ivy, and who responded with an effective public relations device?

Such suggestions overlook the most obvious explanation. Most of the designers of the WPI Plan were engineers. They tackled the educational problem before them in much the same way any engineer would tackle a technological problem. They began with a set of basic "specifications" that needed to be achieved, and then they translated them into a basic new design.

The faculty members who planned WPI's future had not only to create the design but also to set the specifications. They recognized the rapidly growing need to direct the development of technology more wisely, more sanely, and more efficiently. They realized that to graduate people capable of doing this would require an entirely new educational process.

Yet this birth of a new educational concept could hardly have happened at a less likely place. In 1968, Worcester Tech was a fairly stodgy little school dozing in the sunlight of its past achievements. Founded in 1865, it had been one of the country's first three independent technical schools—schools that had pioneered undergraduate education in science and engineering. Worcester Tech, along with others, had graduated the men who built the railroads, the steamships, the oil refineries, the assembly lines, the highways, and the computers—in short, the economic base of our modern technological American society.

While these pioneering days were long gone, it was difficult for the school to resist the temptation to assume that the outlook and methods that had been effective for a century would continue to serve for at least another decade.

Some of the faculty, though, saw the situation differently. They saw that the momentum of growth in engineering schools—triggered largely by the post-World War II GI Bill and a wave of governmental research grants—had largely passed the old college by. They saw that the acceleration of change in technology was obsoleting for seniors much of what they learned as freshmen. These faculty members realized that the mushrooming of state-operated, low-tuition, tax-supported colleges threatened the very survival of privately controlled and financed colleges such as Worcester Tech. They understood that a new social conscience had been born out of the growing realization of the impact of technology on human values and ways of life.

In their eyes, the school had missed the boat of the post-war research boom and was about to miss the next one which they saw ahead—the massive reorientation of science and engineering resulting from the new social and environmental ethic. To them, the school was also a cultural wasteland. The curriculum contained eight courses in English and six in history.

Finally, the faculty looked at their own role in the institution. Decision-making and academic planning were completely monopolized by an executive committee composed of the powerful entrenched heads of the academic departments. "Faculty meetings here were held twice or three times a year," recalls electrical engineering professor Romeo Moruzzi. "No more were needed. We simply marched in, listened to the decisions that had been made, and then marched out again." Stephen Weininger, chemistry, said: "This place was like a federation of baronial fiefs. Between them, the barons ran this place by a kind of gentle interdepartmental log-rolling. The peasants gave the barons their due and in return were granted unwritten economic security."

Despite these sobering assessments of the state of WPI, many of the faculty realized that if there was ever to be a basic change in undergraduate science and engineering instruction, it would have to be done at a college very much like this one—an institution small enough to make overall change effective, and unsophisticated enough to not resist change effectively. (As Harvard sociologist David Riesman later put it, "WPI furnishes a marvelous illustration which I think can be generalized: namely, that some of the best chances for reform lie in institutions with a loyalist faculty, with no other opportunities elsewhere, who care about the institution's survival in part out of loyalty and idealism, and in part because it is the only source of their academic survival.")

The academic earthquake that took place at the college between 1968 and 1970 was preceded by two smaller tremors: a drive for faculty tenure, and a curriculum reform.

Tenure, the formal recognition of permanent faculty status, is generally viewed as the economic basis of academic freedom in higher education. Before 1968 there had been a kind of quasi-tenure at WPI. Faculty members who had been at the college for more than seven years were tacitly assumed to be there for good. But it was not a specific right. A group of faculty who had begun their academic careers at other institutions formed a local chapter of the American Association of University Professors, which called on the faculty to establish a formal tenure system. The faculty appointed a committee to study the problem. The committee also called for a tenure system, and so the faculty voted it in. "Tenure was the first significant act initiated by the faculty in the entire history of this college," says Professor Moruzzi, who chaired the tenure study committee.

After this first act of independence, a group of faculty members in electrical engineering called for modernization of the freshman curriculum, which they charged was hopelessly outdated. "This curriculum of ours would drive a modern Atwater Kent from this school," protested Professor William R. Grogan, a WPI graduate who became one of the top leaders of the reform movement. (Atwater Kent, one of the pioneers of radio manufacturing in the first part of the century, had flunked out of Worcester Tech for failing to pass certain required courses.)

WPI President Harry Storke, who had been aware of the need for change, moved to keep the department heads from dominating the reform process. He asked each department head to nominate three of his faculty for a curriculum committee. Storke and Dean of Faculty M. Lawrence Price picked one from each department, then named Grogan chairman.

The group produced sweeping recommendations for a new freshman-sophomore curriculum. It called for elective courses in the very first year, and for minor programs in English, history, and humanities and technology, a new program concept. Later the committee proposed establishing degree programs in economics, business, humanities and technology, and interdisciplinary studies, another new program.

The resulting faculty debate over the new curriculum was heated. In the end it revolved around a single technical question: should "graphics" (technical drawing) remain compulsory? The reformers thought graphics should not be required for every student; the traditionalists insisted it was a key to technical education. The vote was close—54 to 48. One dissident committee member, in protest, resigned from the panel and from the college.

The rapidly growing dissatisfaction of the faculty with the established way of doing things was one crucial factor for change. The other was President Storke himself. A retired Army general with virtually no background as an educator, Storke seemed a most unlikely reformer. Yet soon after taking office in 1962, he had recognized that something was wrong. He had asked the department heads to draw up a long-range plan to assure the college's financial survival in an age of increasing competition from public institutions.

The department heads' response struck him as indifferent and meaningless. He decided that if there was to be any substantial improvement at all, he would have to look for support somewhere else. The success of the curriculum reform convinced him he would find his allies in the rank and file of the faculty.

Storke's opportunity to move came in the wake of a faculty meeting held on June 14, 1968. At that session, chemical engineering professor C. William Shipman stood up, took the everpresent pipe from his mouth, and addressed his faculty colleagues in his laconic and gently ironic way. One of his Sunday School pupils, a brilliant high school student, Shipman recounted, had recently asked him what engineering college he would recommend.

"I was about to say 'Worcester Tech, of course,' but then I stopped right in my tracks. It suddenly dawned on me that I could not cite one convincing reason. I couldn't think of one good argument why this promising young fellow should join the school where I teach." Shipman became passionate in his quiet way. The college, he charged, was drifting without any definite academic purpose except the one phrased a hundred years earlier. Wasn't it about time to redefine that purpose?

Storke

Two others, mathematics professor John P. van Alstyne and electrical engineering professor William R. Roadstrum, rose in support of Shipman.

Shortly afterwards, President Storke dropped in on Shipman. "If I appoint a planning committee," he said, "will you chair it?"

"If I get the support I need from you, I will," replied Shipman.

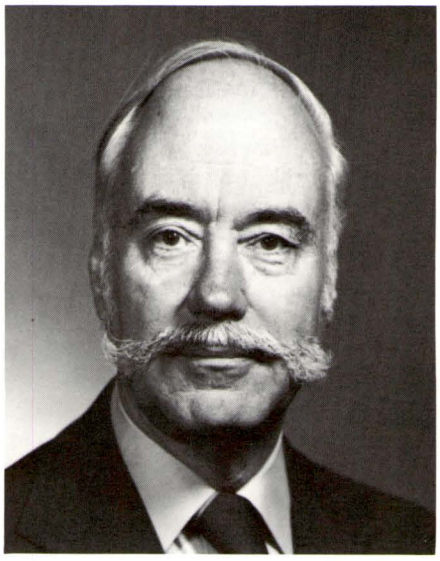
"You've got it."

Storke, Shipman, and van Alstyne drew up a list of prospective committee members, making sure no department was represented more than once. They asked for and got acceptances from John Boyd (mechanical engineering), Charles R. Heventhal (English), Roadstrum, and Weininger, who at 32 was the youngest committee member.

Before the momentous decision was announced, several committee members talked with key faculty to reassure them that they weren't "selling out."

"We were in an awkward position," Weininger says. "Several of us had just helped fight to win the faculty a voice in academic matters, and here we found ourselves suddenly on a planning group named by presidential fiat. We told our colleagues that this new committee would be the only one besides Grogan's that wasn't dominated by the department heads. If anything significant were to be achieved, it would have to be done through this group."

Storke approved the membership. On December 12, 1968, he called the department heads to a special meeting and announced what he had done. A five-minute recess had to be ordered so that everyone present could regain his composure.



Roadstrum

The next day the President's Planning Group met for the first time. The task given them by Storke was to draw up a plan for long-range development, which included possible academic changes but stressed sound financing. At this very first session, the six men realized they could not do their job adequately without reviewing everything about the college, right down to its basic educational philosophy.

"We felt we were touching the latch of a window on the future that was about to open to us," says Weininger. "Everything depended on Storke's approval of this much wider goal." Shipman went to Storke and told him. Storke said to go ahead.

One of the central motivations behind the group's decision to take the widest possible approach, Weininger believes, was an article by mechanical engineering professor Charles Feldman published the previous year in the *Journal*. In it, Dr. Feldman called for basic academic reform by cold-bloodedly arguing institutional survival.

The enormous expansion of tax-supported public colleges and universities, he warned, was certain to bury the "privates" in a decade—unless the privates found something special to offer students and became the best in that special field. Feldman called for unstructured study, project work, self-paced learning, a value-oriented humanities program, and an end to compulsory classes and grading. This would have been a radical proposal for any engineering school; for WPI it was dizzying.

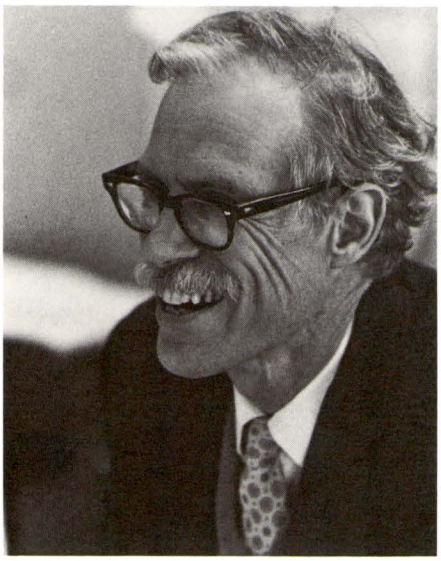
The President's Planning Group began its work by assessing the college's current academic assets and by collecting any and all ideas for "alternative futures." Roadstrum suggested that each alternative should be researched and argued as if it were the only one in existence, even if it meant turning the argument around to win it. This they did. Each member wrote a proposal, then the others talked it to shreds and rewrote it even more persuasively. This technique proved one of the most helpful moves in the entire study.

The group came up with twelve possible alternative futures:

1. To become a research-oriented graduate center in engineering and science.
2. To become a "middle college."
3. To provide a classical education in engineering and science in the Oxford-Cambridge manner.
4. To provide high quality pre-graduate education in engineering and science.
5. To educate for leadership and decision-making in a technological society.
6. To specialize in educating the underprivileged.
7. To train students for a bachelor of science degree in technology.
8. To promote invention and entrepreneurship.
9. To transform WPI into a general university.
10. To join the state university.
11. To maintain the status quo.
12. To create an appropriate combination of any or all of these possibilities.

Although all six group members were teaching full class loads during this period, they came up with a report in March 1969, just three months after their formation. Entitled *The Future of Two Towers,* the report included a preliminary planning schedule, a partial analysis of the school's current status, a list of the twelve alternative futures with arguments for four, and summaries of the results of questionnaires that had been sent out to the college community.

Shipman



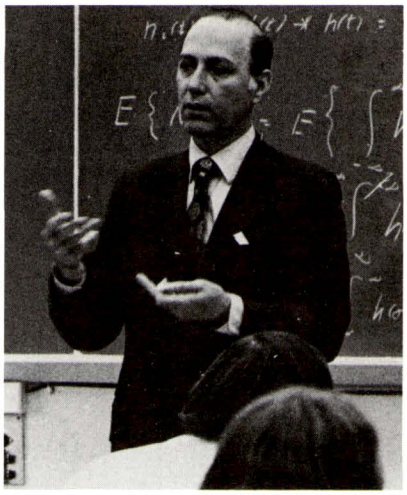
van Alstyne

President Storke sent the report to faculty, the Board of Trustees, staff, and selected students and alumni. Then the group mailed another questionnaire to those who had received the report. On April 16, 1969, all classes were canceled and everyone on campus was invited to join in discussing WPI's future. Some 150 students—10 percent of the total population—and 130 faculty—80 percent—took part in a number of small group sessions.

"It was the healthiest day we ever had here," van Alstyne recalls enthusiastically. "For the first time in our history, we honestly faced up to the problems before us and talked about them freely. And this was done with extraordinarily broad participation."

By June 30, the group had published *Two Towers II,* including essays on the remaining futures, a summary of the answers received to the last questionnaire, conclusions drawn from Planning Day, and the completion of their analysis of the college's current status, mostly from the financial standpoint.

Boyd



Moruzzi

Right into this process of rapidly accelerating discussion and planning fell a critical event. General Storke had decided to retire for personal reasons, and a new college president had to be selected.

A presidential search committee had come up with two prime candidates. One was an industrial engineer and dean of the engineering school at a large state university. The other was a physicist and vice chancellor of Washington University in St. Louis.

The department heads wanted the industrial engineer. The President's Planning Group, which had managed to meet with the Washington University man informally for half an hour, strongly preferred him. When Storke saw who was backing whom, he adroitly threw his support behind the choice of the six planners. The Trustees offered the job to him, and he accepted. Thus George W. Hazzard became president of Worcester Polytechnic Institute and the man who would have to bring the WPI Plan into being.

Dr. Hazzard admitted to an interviewer that at first Worcester Tech did not interest him very much. What changed his mind was that half-hour meeting with the Plan Group. It convinced him that the old college had an unusual opportunity to create something entirely new in education.

Meanwhile, the President's Planning Group had resigned as a committee. They urged the faculty to name a successor panel. "The ball had been set rolling," van Alstyne explains. 'If it was to keep on going, the faculty as a body would have to be responsible and in control from then on."

Impressed with the swift motion of events, the faculty established a Faculty Planning Committee to continue the work. Four of the six planners were elected to the new committee—van Alstyne, Boyd, Heventhal, and Shipman—along with Moruzzi, who had headed the tenure drive, and Grogan, who had led the curriculum reform. Thus the two preceding movements for change were, in a sense, merged with the third and most profound into a single, forwardgoing drive.

The new group began its work July 1. Shipman, again elected chairman, asked each member to write a statement of goals for the college.

"The papers were remarkably similar," he recalls. "In turning each of those twelve future possibilities around in our minds, in trying to look at the positive side of each, we had in effect been forcing out into the open our own innermost thoughts and feelings about what a good educational program ought to be."

John van Alstyne put it this way: "At this point, the wisdom of having evaluated and seriously argued each of the various alternative futures became fully apparent. We now realized that while none of these alternatives represented an exclusive description of the future that its advocate would have seriously put forth, all did contain crucial and common threads of educational philosophy which went into the genesis of the model that finally emerged." A striking synthesis—conscious, unconscious, or both—had taken place.

The faculty committee spent the summer of 1969 writing *Two Towers III* the definitive design for the future of WPI. It was published in mid-September at the opening of the fall semester. This report surprised and shocked many members of the faculty.

"I think this was because of the timing," Dr. Shipman later told the student yearbook. "We had done this work during the summer. Most of the faculty were on vacation and had not read the second report. To return in the fall and discover that we had produced something that much different, something that threatened the organizational structure of the college and which had been done without most of the faculty being on campus—and certainly very few of the students—caused a bit of shock. I think that if we had presented it in a different way, there would have been less of an upset."

Two Towers III called for setting up nine subcommittees, each dealing with various aspects of the proposal. Ultimately, some 90 students and 74 faculty served on these panels.

Grogan

Heventhal

Weininger

Then Planning Day II was held in October to discuss the plan. Committee members went all over the campus talking to faculty and students, explaining the proposals. The sharpest debates took place over the proposed elimination of academic departments. Reformers saw this as one of the keys to the success of the new program, at the heart of which would be interdisciplinary cooperation; they felt that academic compartmentalization had to go. Opponents saw this as an invitation to institutional chaos. Because of strong opposition, this part of the plan had to be dropped.

On December 17, 1969, the faculty adopted a statement which summed up the new overall goal of the college in a few paragraphs. In January and February, the reports issued by the nine subcommittees were distributed, unedited and without comment.

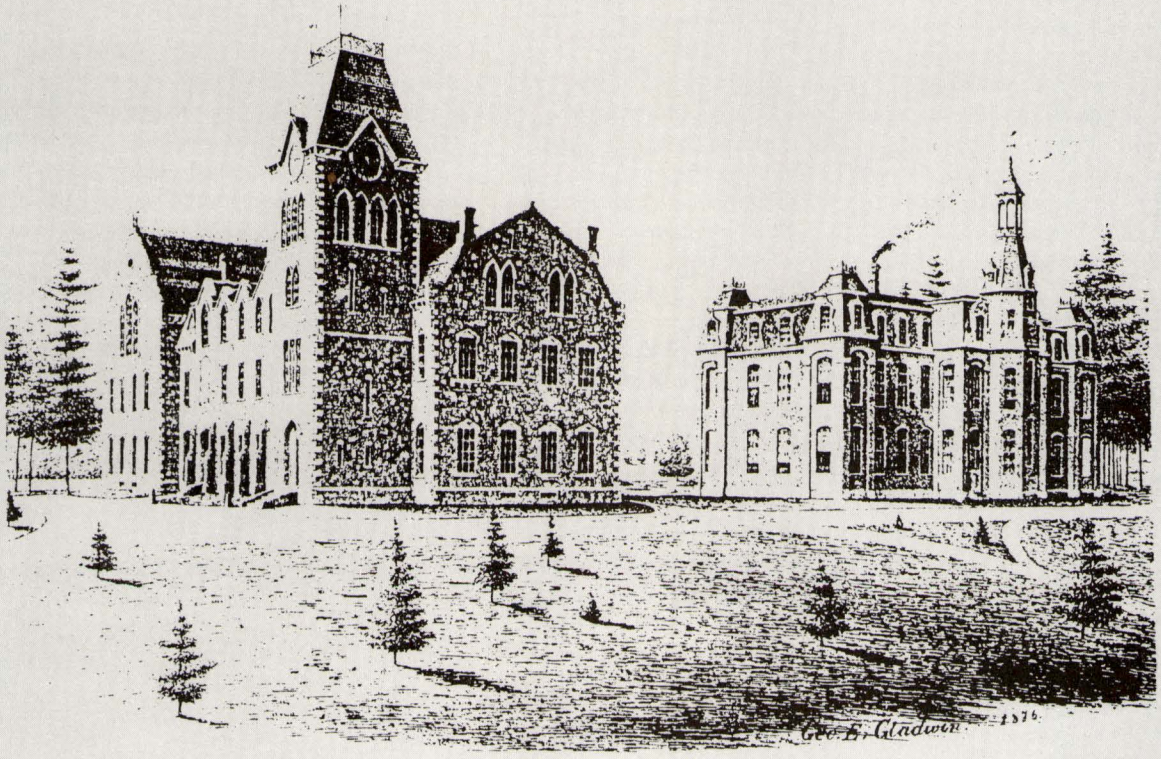
Now the six planning committee members put together their final report, *Two Towers IV: A Plan,* which was published in March 1970. The plan—now the WPI Plan—was presented to the faculty for approval in June 1970. During those final discussions, it was modified in two places: physical education was retained as a requirement, and an amendment by Dr. Wilmer L. Kranich, head of chemical engineering, required students to complete the equivalent of 12 units of work before being allowed to take the competency examination.

By a two-to-one majority, the faculty adopted the proposal. Two years of hard work by the faculty had brought into being a new educational program and a new future for WPI. Conception, labor pains, and the trauma of birth were now over for the WPI Plan. What remained ahead, however, was an even harder task: over a seven-year period the infant WPI Plan had to be nurtured, trained, and made into a functioning and productive member of educational society.

And now it is.

WPI

A FRESHPERSON GUIDE TO WPI



Editor's Note: On the next few pages are excerpts from "A Freshperson Guide to WPI," a 32-page booklet introducing the WPI Plan to incoming students. It was written and edited by Rob Granger, '75, John Zimmerman, '77, and Marion Bishop, '76, as part of a degree qualifying project.

The Case for Creativity in Technical Education: A Faculty ViewPoint

All of you who have decided to enter WPI have more than a casual interest in science and technology or you would have considered a different kind of college. I don't have to debate here the importance of technology, for good or ill, in our lives. You recognize these impacts or you wouldn't be here. I would like to make some points about technical education at WPI that may not be so obvious, leading to a plea for you to experiment and grow by designing a creative educational program for yourself. I'll get to that in a bit.

To start, do you realize the potential for educational flexibility that exists here? Almost every school and college says, for example, that grades in courses are not important but that it's what you learn that counts; while you know that in reality grades are the most important thing. After all, let's face it, that's how you get the degree. We are trying here to get around this little Catch 22 by not having courses and grade accumulation be the degree requirement. The degree at WPI is based upon your ability to perform competently in projects in your fields of interest. This means that grades in courses at WPI are to help you evaluate your own understanding of the course material and are not the certification for your degree, which is as it should be. This also means that instead of the faculty and the students being adversaries in grade grubbing, they can be on the same side of the learning fence -- and cooperate. Even better, we don't have a failing grade here, so you can experiment without punishment. This type of curriculum is really very unusual if you compare it to those of most other colleges, and it provides a potential for achieving greatness, we think, for us as a college and you as a person.

Notice that I used the word "potential" twice in the last paragraph. This is because we are still in a state of development at WPI. There are internal and external pressures to gradually revert to a more traditional educational system. We have already faced most of the external pressures, grad schools for example, and we pretty well have them licked. The internal pressures are where you come in. As Walt Kelley's Pogo used to say, "We have met the enemy and they is us." Our PLAN is very different from the formal education of our own faculty and the high school backgrounds of most of our students. The flexibility of the PLAN carries with it a lot of responsibility, for it means that you (with advice) have to learn how to make decisions on which courses and projects you are going to undertake. Some faculty and students find this too scary or too fuzzy. You students are the ones that have to show that you can learn to use this freedom to deepen your intellectual grasp and to broaden your emotional horizons. Your success, however you choose to measure it, is our success.

But what does all this have to do with creativity? Lots of Engineers and scientists study, build, and play with things to create new stuff. You see, to create is at the center of it. Yet traditional technical training tends to stifle the urge to create by an endless sequence of passive "course sitting." At WPI we urge you to do projects and to create -- right from the start. We want to combine the languages of science, mathematics, social science and the humanities in a creative stretching of your mind.

That last sentence is pretty heavy, and to lighten it, I like the essay by George Nelson about the difference between art and design that I've excerpted below. It is pretty long, but, I think, worth reading.

> "For a number of reasons -- good and bad -- design is a confusing subject. Among the good reasons is the elusiveness of definition: a person who does a line of dresses for a couturier house and someone who draws a plan for a jet engine are both called designers. It is hard to see what they have in common.
>
> What both people share, I think, is the process: each starts with a problem, one related to the female figure and the other related to propulsion. Each arrives at solutions within a context: money limitations, materials available, skills and tools at hand, existing state of the art, competition, the nature of the art, competition, the nature of the

"When a student is absent without previous excuse, he shall present two excuses, one for the absence and one for failure to secure permission to be absent."

--WPI Rule, 1874

J. Himpan and R. Reichel prepared calculations and designs for a 50-ton moon rocket. It was shown "possible with very great expenditure of labor, materials, and money, to send a payload of 10 kg to the moon. (And we have) demonstrated that it is not possible in principle to improve on this very low ratio of payload to total weight as long as chemical propellants are used. It was further deduced that a rocket capable of carrying a man to the moon and back would need to be of fantastic size and weight -- so large indeed, that the project could be classed as impossible . . . . The dream of human beings to fly to the stars must, as far as we can see, remain a dream." (J. Himpan and R. Reichel, "Can We Fly to the Moon?" *American Journal of Physics, May, 1949, 262-263.)*

THE O'NEILL SCALE*

Do not fear. You are not about to be exposed to a dissertation on the values of different grading systems. What follows is a grading system, but it will not be defended or criticized. It is included for two reasons. First, it seems like a reasonable possibility. Second, it's kind of cute.

It is a remarkable simple system. Everything is marked with a number from one to five. And that's it.

If the Score is:	It means that the person evaluated:
5	demonstrates mastery
4	demonstrates competence
3	suggests competence
2	suggests incompetence
1	demonstrates incompetence
0	died.

THINK ABOUT IT, YOU MIGHT LIKE IT!

*Thanks to Professor O'Neill, Physics

"We think union with Polytech (WPI) would be a good thing, but it isn't worth going to Worcester for."

--Spokesman for MIT, 1910

"If you stay with a problem long enough you will get the answer. It may not be the one you expected, but chances are it will be the truth. If you really want to learn anything from an experiment, change only one condition at a time.

Never hesitate to try a hunch. If it turns out OK, the theoretical chap will tell you why.

If practice and theory don't agree, investigate the theory."

--Observations of
Prof. Charles Allen, WPI

market. In the end, each has designed an item that must work: the dress has to enchance the wearer; the engine has to drive the plane.

A design may be very beautiful, but it is not art; a design has to do something. The artist works to make a kind of visual statement that has, for him, some important connection with reality as he perceives it. The designer needs a client to present a problem, and a factory to make his design in quantity.

The scientist believes that problems can be solved with his intellectual equipment plus instruments. His answers are always quantifiable. The designer goes along with this to a great extent, but he also relies on the evidence of his senses and his intuition. So his work falls somewhere between art and science.

A very bad reason for the confusion about design is the prevailing notion that it is a kind of frosting, an aesthetic overlay that makes humdrum objects more appetizing. No responsible designer believes this. In nature, organic designs (our best models) never show decoration that isn't functional, never show the slightest concern for aesthetics, and always try to match the organism with its environment so that it will survive.

Misconceptions about design also arise because modern technology isolates so many people from the processes of designing and making. Considering how little we are taught about such things, autos and stereo sets might just as well grow on trees. Technological society has created the visual illiterate, a new barbarian who thinks people have eyes so that they can tell when traffic lights turn red or green, and who lacks the faintest idea of how his complex environment is put together.

One way to learn something about design is to dust off your old college text for Biology I and read about the way the forms, structures, and colors of organisms relate to what they do. Another is to look around and ask questions:

Why do perfectly good metal station wagons have panels of fake wood?

If you went through the house looking for honest designs, would you find more in the kitchen or the living room?

Why are so many big TV sets encased in phony antique credenzas? If you have one, why did you buy it?

How do you feel about "Louis XV" chairs of injection - molded plastic, or supersonic steam irons?

If you were offered the choice of a free trip to London, Paris, Zurich, Venice, and Rome, or a tour of the twelve biggest shopping centers in the U.S., which would you choose? Why?

Designs have a curious quality, one that practically nobody knows anything about. They can be "read," just like a magazine, and they never lie. When the Victorian nouveau riche built a suburban mansion that looked like a castle on the Rhine, the neighbors knew he was not a German feudal lord but just a guy scrambling up the social ladder. It is worthwhile to learn to decode the messages in objects -- they are full of information about the state of the society.

If you start reading the objects in your environment, whether buildings or strip developments or manhole covers or consumer items, and the result makes you feel slightly ill, don't worry. It just means that you are well on the way to visual literacy."

I think that Mr. Nelson has a lot to say to us at WPI. Good design is based on sound methodology (courses), but good design integrates and transcends the methodology to achieve a new whole. Anyway, we want to get more of the creative dimension into our project work here. That doesn't mean that scientific principles can be ignored. Some beautiful creative technology, clipper ships of the past and some jet airplanes of today, are certainly examples of beautiful creative solutions. But their beauty is in good part because of the need to satisfy scientific and tech-

nical requirements. Creative solutions, however, also require a playfulness of mind that we find lacking in too much technical education. To emphasize this, I've got another excerpt that you might like. I think that it describes a kind of creative project, combining theory and practice, that we need more of at WPI.

"Two scientists from California have combined their scientific training and a great deal of technical-ingenuity to make what appears to be a significant improvement in one of the oldest modern sports -- the game of golf. Fred E. Holmstrom, a physicist at San Jose State University, and Daniel A. Nepela, an advisory chemist at IBM Corporation in San Jose, are both nongolfers, but they may have solved one of the greatest plagues of amateur golfers by inventing a ball that resists hooking or slicing.

The modern golf ball, as defined by the United States Golf Association (USGA), must meet only three requirements: It must weigh no more than 1.62 ounces, must measure no less than 1.68 inches in diameter, and must not exceed a velocity of 250 feet per second when subjected to a standard impact. Within these constraints, modern golf ball manufacturers have produced what is considered to be the optimum ball by covering the rubber surface with dimples that provide aero-dynamic lift and thus yield the maximum distance. If the ball is not hit squarely, however, the club face imparts an unwanted spin in which these dimples exert a sideways thrust. The principle is the same as that employed by a baseball pitcher in producing a curve ball, but the dimples accentuate the effect substantially.

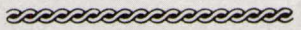
The dimples produce a turbulent air flow around the ball that is markedly different from the laminar flow around the smooth surface of, for example, a Ping-Pong ball. Theoretical equations describing laminar flow can be solved relatively easily, but those for turbulent flow, Holmstrom and Nepela found, were far too difficult for them to make any realistic attempt to solve them. But they found that simpler equations could be used in conjunction with experimental results to predict the effect of small changes in the surface. What they found when they analyzed golf balls, in simplest terms, is that removing some of the dimples will decrease the tendency to hook or slice, but reduces the potential distance that the ball can travel.

To offset the distance penalty, they also incorporated a principle from Newtonian mechanics that might be termed the "spinning dumbbell rule." In simple terms, this rule predicts that two rigidly connected weights tend to spin around only one axis at a time. This angular stability is observed, for instance, when a twirled baton is tossed in the air: the baton continues to twirl in only one plane.

Combining the two concepts, then, Holmstrom and Nepela designed a ball in which dimples covering about 50 percent of the surface are confined to a band around the equator of the ball, with the poles remaining smooth. The mass of the skin, furthermore, is so distributed that there is a very slight concentration of mass in each of the poles. The ball is still spherical, however, and the changes do not effect putting.

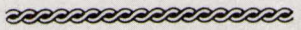
In tests by a professional golfer, the ball -- dubbed the "Happy Non Hooker" -- achieved more than 90 percent of the distance of a conventional ball. Holmstrom argues that the potential distance could be made comparable by minor refinements of the design. Most important, though, hooking and slicing were reduced by about 75 to 80 percent. With one golfer, for instance, the amount of slice in a 200-yard drive was reduced from 50 yards to about 10 yards.

The revolutionary ball, U.S. Pat 3,819,190 was inspired by a trade-journal article on the aerodynamics of golf balls; it was conceived over lunch and developed in 2 years of the men's spare time. It can be manufactured for substantially the same price as conventional golf balls and theoretically should meet all requirements of the USGA,



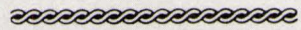
"Specialization has bred feelings of isolation, futility and confusion in individuals. It has also resulted in the individuals leaving responsibility for thinking and social action to others. Specialization breeds biases that ultimately aggregate as international and ideological discord, which, in turn, leads to war."

--Buckminster Fuller
Synergetics (1975)



"Since we can't know what knowledge will be most needed in the future, it is senseless to try to teach it in advance. Instead, we should try to turn out people who love learning so much and learn so well that they will be able to learn whatever needs to be learned."

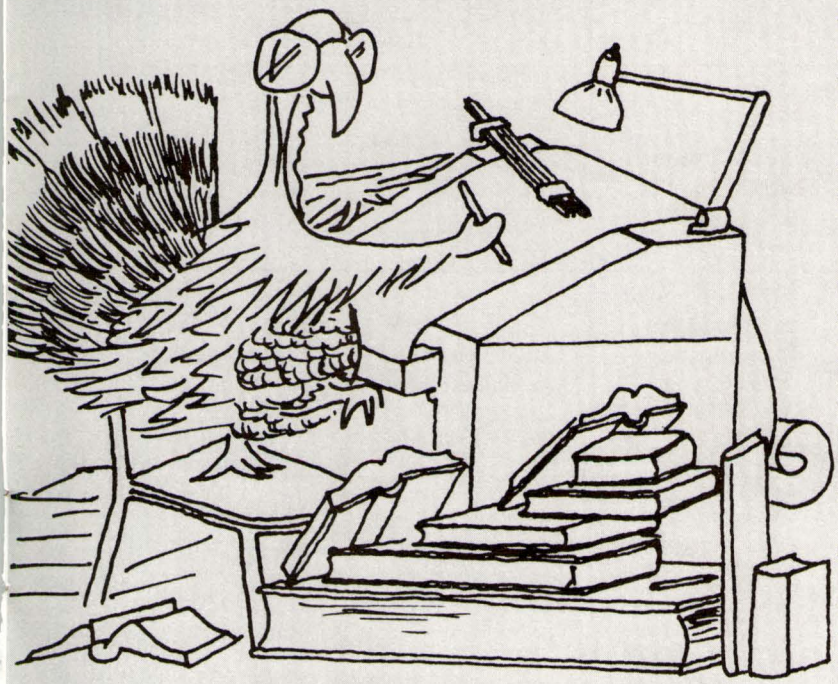
--John Holt
How Children Fail (1964)



although it has not yet been submitted to them for testing. Several ball manufacturers are interested and, if further testing is successful, the ball may be manufactured in the near future. The potential financial reward for the two inventors is quite high, but their expenses are a model of frugality in science that would have pleased Benjamin Franklin. Their total expenditures -- for rubber bands, plastic kitchen wrap, and household adhesive -- were approximately $2.75."

I think that the "Happy Non Hooker" is a good example of creativity in engineering. By the way, does that word creativity bother you? I haven't defined it, and you may be scared off because you may think that everybody in the world but you is creative. That's not true; everyone has a strong creative urge. Creative solutions are simply new combinations of existing ideas. The only trick then to encourage creativity is to provide an environment where people can combine old ideas in new ways without being stifled by habit, conformity, and anxiety. Again the good old WPI PLAN has the potential (catch that word potential again) to provide the environment.

The key phrase around here is creative education. Get involved in projects right away. You're ready. There are all kinds of project levels, so at the start see your advisor or contact us about some creative design experience. As one result of a good project you will certainly see the need for technical and analytical background to make your creative ideas work, but without that creative urge the resulting design will look like the architecture of Morgan Hall. The same applies to the design of your educational program here. It's up to you, so go fly.



" TECH TURKEY "

How I Learned To Stop Worrying and To Love The PLAN

I came to WPI for reasons that probably aren't too different from those of a lot of people. It was pretty much a lucky accident. They gave me enough money; I liked the campus; the people were really friendly, and they sent me a lot of mail.

I found out about the PLAN mostly at my interview. I had read about it before, but at the interview it was really explained to me. The admissions interviewer told me that when I got out of here I'd be able to learn on my own. In other schools you learn from a course and that's it. But if you know how to learn on your own, without someone standing over you with a whip, you can keep up with your field, and you'll have it all over someone who only does things the way he was taught in school. He also told me that I'd have to do a professional level project before I could graduate. That was down-right terrifying. The only way I could cope with the idea was that I'd have four years to get used to it. You could be a course credit collector anyplace else, learn enough to pass the courses, and graduate. Here your Qualifying Projects tie it all together, put everything in perspective, and test that learning-on-your-own idea. If there's something you don't know while you're doing a project, you don't put it off until you can take a course. It doesn't work that way in industry. You pick people's brains; you look up things in books; and you learn all about the problem, a lot more than you'd learn in a course. It becomes important to you to know.

People come to WPI for many reasons. For some, their parents were pushing. After all, this is a pretty sure-fire way to get a good-paying job. Engineering holds a lot more promise in finding a job than liberal arts. Other students just aren't ready to go to work yet. It's a safe way of gaining your independence while still having the bills paid. For some it's the thing to do if you're not a dummy.

Then there are the enlightened few who seem to know what it's all about. They came to WPI for a reason; they can see what's at the end of this road and how to make the most of it. They take the courses they want without worrying about details like prerequisites. They're constantly coming up with new ideas and things they just have to try. They can be pretty intimidating. They have so much confidence and insight into who they are and what they can do. The key to the whole thing is that they know what they want to do. Around here that's really what's important. The hardest thing to find out is what you want to do. This whole campus is here to help bewildered students, like you, do what you want to do and learn what you want to learn. So finding out what you want is pretty important. Believe it or not you already have a lot to go on. Your future interests will probably be based on your past interests. That almost seems logical.

It might help to write down the stuff you did during high school that you really enjoyed, and not anything necessarily in classes. Perhaps you can list what you liked about them as well. It should give you some insight into what you are interested in. This is a pretty big decision you're trying to make. If you liked running a show in high school, management might be for you. If you had a ham rig you might become an electrical engineer, that sort of thing. You have the time now as a freshman, use it to find what you want. Talk to other students and find out what they're doing. It's a course of inspiration. Get to know what's available on campus -- by using it. Take a chance to get acquainted with the DEC-10. The games programs are frowned upon, but they're a nifty way to get to find your way around the system. You can get your project-programmer number from the computer center in the library, and there's a video-tape about the terminals in the audio visual room. Those tapes are great. They can give you an idea of what you'd learn in a course, ROTC, interview techniques, all sorts of stuff. There just isn't time to see them all, and all that knowledge is just waiting to be soaked up. You might also want to talk to a faculty member. They're probably not like those you had in high school. They care! (You hit a lemon now and then, but you can't win them all.) All they want is for you to be a

little bit hungry for what they've got to offer. You might want to try the Pub some Friday afternoon. It's amazing the people that turn up there.

Once you find out what you want to do, the rest is easy. I'm not saying that you won't have doubts, but the hard part will be over. Then when you start to get guilt feelings about the money you're spending here, you'll at least be pretty sure you're doing something worthwhile, something that's important to you.

If when you get out of here you feel as if you could have learned it all on your own, then you have mastered the fine art of self-learning. Practice learning on your own; it'll give you confidence. Don't hesitate to expose yourself to new ideas. Look through professional journals in your field and others. You may not understand a whole lot at first, but you can keep an eye on what the real world is doing. Independent studies are a nice way to round out your experience. It can really build up your confidence because so often you'll do something you never thought you could. A graduation class was once told: "A degree from even the best of universities is not an inside track to success; it is just a hunting license to go out and find the kind of career satisfaction you are willing to earn." So, keep your eyes open!

Technical expertise will only take you so far. Engineers aren't shuffled away in a corner to quietly work on equations. In industry there's a lot of group effort, and you have to get along with people. The best way to get along with other people is to get along with yourself, and to do that you have to know yourself. Socrates said that an unexamined life is no life at all. Again, expose yourself (not indecently)! Part of this can be done in your humanities sufficiency, but it shouldn't stop there, by any means. If you expose yourself to new ideas, even if you don't agree with them, you've opened new windows into the world. New ideas are a form of freedom. If you've been exposed to new ideas, you have a choice of adopting them, or just accepting them as someone else's philosophy, or you can reject them completely. But at least you have a choice, which is what freedom is all about. If you never heard of this or that outlook you have no choice. One book I am pretty impressed with is, How I Found Freedom In An Unfree World, by Harry Browne. He has some strange ideas; they're not right for everyone. But if you've read his book you can reject him as a fool, say, okay, that's fine for him, or you can adopt some of his ideas. If you've read it you have the choice.

This college has a lot to offer, you just have to take it. Personally, I think the school motto should be changed to "the more you put into it, the more you'll get out of it." I wonder how that would translate into Latin. Excuse me . . .

RATE YOUR ADVISOR

	Far Exceeds Requirements	**Exceeds Requirements**	**Meets Requirements**	**Needs Some Improvement**	**Doesn't Meet Minimum Requirements**
Communication	You have a telepathic link	You know his home phone number	You can find him in his office	Hasn't been in his office for three weeks	Calls you Joe when your name is Lois
Personal Problems	Pays for a Psychiatrist in Boston	Sends you to a Psychiatric Clinic in Worcester	Sends you to **WPI** counselor	Sends you to your RA	Tells you that you're a pervert
Sufficiency Topic -- Mystic Influences in Modern Literature	Gets in touch with Carlos Castenada for you	Watches Star-Trek with you	Offers to advise although he doesn't know much about the subject	Laughs when you suggest subject	Thinks mystic phenomena is some kind of masking tape
Competency Exam	Convinces your board you are so good that you can skip it	Brings you three home-cooked hot meals a day during competency	Advises you what he feels you need to pass it and helps you learn it	Prepares you by making sure you take courses in 1965 curriculum	Tells you that you'll never pass it and suggests 30 more courses
Projects	Helps you to publish your project report in prestige journal	Visits you at G.E. in Schnectady during your MQP project work there	Suggests a challenging problem and gives you ideas when you get stuck	Sends you on a project at DEC and doesn't see you again until you hand in your report	When you find an ingenious but simple way to do MQP he decides that project now isn't challenging enough for MQP

REUNION '76

JUNE 3-6

Reunion Classes: 1916, 1921, 1926, 1931, 1936, 1941, 1946, 1951, 1956, 1961
All these classes have received detailed schedule and reservation information through their class mailings.

SCHEDULE:

Friday, June 4	"Good Old Days Get-together" at the Goat's Head Pub (Sanford Riley), 9 pm - 1 am. Banjo Band, draught beer, wine & peanuts.
Saturday, June 5	Reunion Luncheon and Awards Presentation on the lawn of the Higgins House.
All through the weekend	Campus tours, Worcester Art Museum tour, class parties and dinners, access to the gym, pool and tennis courts.

Inexpensive campus housing available
Call or write the Alumni Office with reservations or questions.