Engineering the Thayer way

A small school at Dartmouth College is teaching something different: the practice of engineering

by Edward Gross

There are the giant schools of engineering, such as Rensselaer Polytechnic Institute, Massachusetts Institute of Technology and the California Institute of Technology. And then there's the Thayer School of Engineering at Dartmouth College in Hanover, N.H., founded in 1871 by General Sylvanus Thayer. The school, whose total engineering enrollment is about 200, including 70 graduate students, seems like an unlikely spot for a revolution in engineering education.

Nevertheless, one is going on there. And although it has made small ripples in the big-time world of the RPI's and MIT's, industry is watching with keen, interest. Major companies are helping because they see big payoffs down the road for themselves. For instance, contributions of over $225,000 this year alone will have come from such giants as General Foods, Hooker Chemical, 3M, General Cable, Scott Paper, DuPont, General Electric, Polaroid and Mobile Oil. In addition, engineering schools at Arizona State, Waterloo University in Canada, as well as RPI and MIT, have adapted parts of the Thayer program for their own use.

The unique Thayer curriculum came about because an engineer named Dr. Myron Tribus believed more in the value of a generalized education than a specialized one. "It is true," Dr. Tribus says, "that the broader your education, the more likely you are to be able to contribute in a fresh way to an engineering problem, because engineering means pulling facts from other fields . . . ."

In 1961 Dr. Tribus, now assistant secretary for science and technology at the Department of Commerce, took over as dean of Thayer and got a chance to implement his ideas.

He was also concerned then, as he is now, with the trend toward specialization and the early obsolescence to which it condemns engineers. He is backed up by Frederick G. Sawyer, an engineering consultant who estimates that many engineering students are obsolete by the time they graduate and that the average engineer is obsolete in about five years.

Furthermore, Dr. Tribus was, and still is, disturbed by the underemphasis on economics and the overemphasis on science in engineering, the result of which, he contends, is that there is less emphasis on the practice of engineering and "the creation of new things." Instead there is more analyzing of what has been done.

To overcome these problems, and specifically to answer industry's resultant complaint that engineering schools are turning out equation-twiddlers out of touch with reality, Dr. Tribus continued the reorganization at Thayer which had been started in 1959.

The watchword was practical experience: Everything that was done was done with real practice in mind. The courses were set up so that a student could graduate and fit easily into an industrial situation—just about any industrial situation or engineering activity.

"It's the only school to my knowledge that draws the bulk of its problems for design-oriented students from industry," says acting dean Dr. George A. Colligan. "We must depend on industry for these problems."

Because the education is so generalized, students untrained in chemical engineering, for example, can and have solved problems in air and water pollution, and initial patent applications on plastics have been made by mechanical engineering students.

An illustration of the extent to which the school is generalized is the fact that a caller who asks for the mechanical, chemical or electrical engineering departments is told there are none.

The two key words in the course work at Thayer are economics and design.

The students get their economics from four sources, points out Prof. Russell Stearns: from an undergraduate economics course, from an engineering, economics course, by applying economics in their projects, each of which must be economically sound, and from their teachers who constantly introduce it into the course work.

The design aspect emphasizes the need for first defining, analyzing and generating alternative solutions to a problem and then developing a process or product which provides the best answer.

The success of the idea is seen in the results of students who took just an introductory course in engineering. They devised toys for crippled children, a heated wet suit, an underwater communications system, a fire protection device, an improved windshield wiper, a curb-climbing wheelchair and a braille typewriter.

Working under the guidance of Dr. Thomas F. Piatkowski, advanced students have developed a portable computer teletype machine, the design of which has just been bought by a private firm. Although not all the undergraduate projects are marketable and patentable, all are technically feasible.

"We had a fruitful experience with one doctoral engineering candidate who had 30 days to work out a problem," relates Dr. G. Birtley Schneider, manager of engineering research for 3M Company. "We needed to clean up the waste effluent in the manufacture of one of our paper products, and he gave us alternative ways to remove the material."

There are two plans under which a company can join with Thayer. In one it becomes a partner by making an unrestricted annual grant of $20,000. In the other, it becomes an associate by granting at least $3,000. At present, nine partners and 17 associates are connected with Thayer. A tenth partner is close to signing, and that would be all that Thayer would want to handle now. The associates program is less limited.

Why does industry participate? Aside from the obvious answer of getting solutions to some of its problems, there is the mundane consideration of patent rights. In general, a company acquires some patent rights to solutions generated by its investment. The extent of the rights depends on whether the solution is for a specific problem applicable only to that company's process or device or if it has widespread application. If the solution is specific the company gets full rights; if applications are widespread, partial rights.

But patent rights are not that big a motivation. More importantly is that by working with students, a company builds up a source of potential employes. Not only are the students introduced to the company, but the organization gets a preview of whether or not he will work out.

"It goes a long way toward giving

the student a realistic picture of what the company is doing," says Dr. Peter D. Hansen, vice presidential assistant at the Foxboro Company, Foxboro, Mass. "It also gives us a clear idea where we want the new man. Our experience has shown that all the Dartmouth students we have hired have very successfully fitted into our operation."

An intangible benefit to the company is that it gets access to college resources and information and is privy to current research on campus. Another is that conferences can be held on campus, and company personnel can attend special courses on such subjects as reverse osmosis or crystallography.

But not is all automatically smooth between Thayer and industry, as is to be expected in that difficult interface. "Our hope was," says Wilbur A. Spraker Jr., manager of advanced development at the technology center at Scott Paper Co., "that we could make an input of industrial problems and in return we could get stimulation and new ideas and points of view to counter the parochial type of thinking associated with industrial concerns. We have not been completely successful in either case, but we may not be putting enough time and thought into the program."

Spraker says there is no thought of Scott pulling out. "In general, it has been very fruitful in enough spots to encourage us to continue," he says of the relationship.

The problem may be one of communications. "It's hard to get a dialogue going between university and industry people," says Spraker, despite the fact that a large number of the Thayer faculty comes from industry.

The reasons they pick Thayer over some other school are varied.

Dr. Robert G. Wolfson, who teaches materials science, joined because "most schools have no educational philosophy. Here, they have one, and it's eminently sound."

But for Dr. John W. Strohbehn it was more personal. " I wanted to teach and keep up with my research interests. I came here for a balance, and it's balance I get."

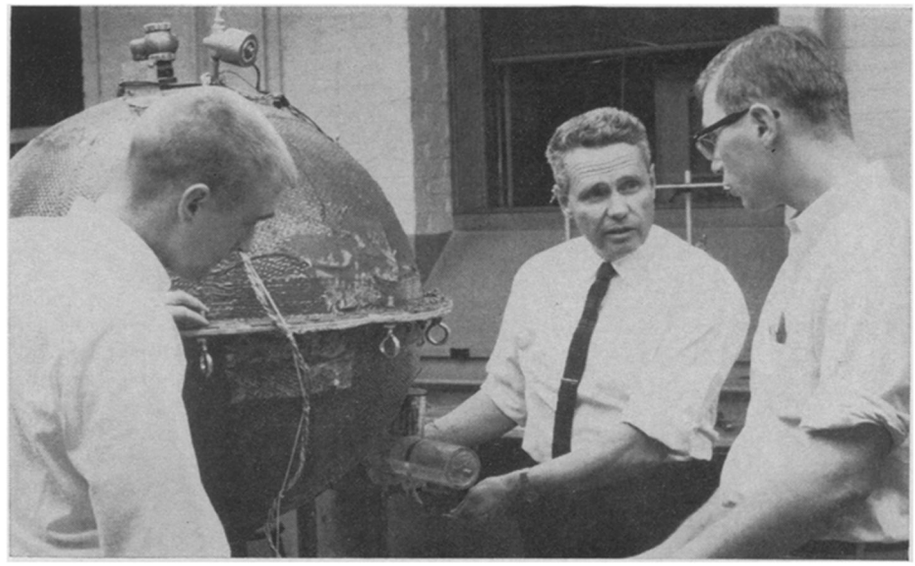
Dr. Piatkowski finds several features attractive. He cites the freedom to move around in the curriculum in the absence of formal departments, and the real-world nature of the courses. "There is no publish-or-perish syndrome as in many schools where a professor's worth is based on the string of publications trailing behind him," he says.

The one advantage a large school has, concedes Dr. Piatkowski, is in equipment. "We don't have large laboratories to handle many specific problems," he admits. However, he feels that this is not a total disadvantage, pointing out that lack of equipment has compelled metallurgy students to go to a steel mill, an experience they might otherwise have missed.

According to Dr. Strohbehn, a Thayer graduate class contains 9 or 10 students at most; at other schools, the figure can reach more than triple that size.

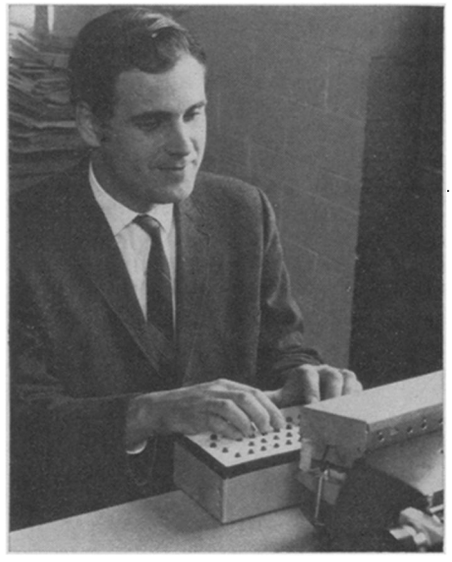
Because of their large size and rigidity, Dr. Colligan thinks the mega-universities are unlikely to pick up the Thayer program. "As far as large schools adopting the program goes, it doesn't look promising," he comments.

But Thayer's high priests haven't given up proselytizing. "We've brought in visiting faculty members," recounts Dr. Strohbehn. "We've got to do this more. The influence of Thayer is definitely growing, but we can't sit back." □

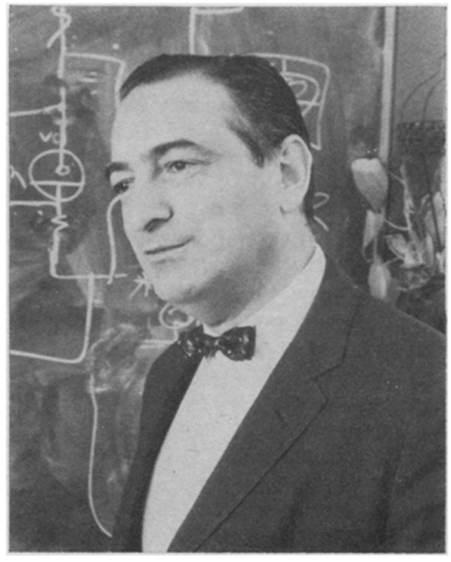


Photos: Adrian N. Bouchard

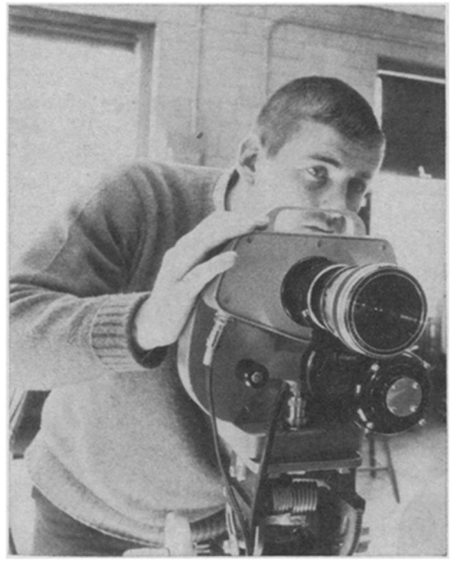
Stearns with underwater communications project: Economics is important.



Newly developed portable teletype.



Tribus: Less science in engineering.



High-speed camera traps an instant.