ENGINEERING EDUCATION

Olin Puts Up $500 Million For 'No-Excuses' College

A small college under construction outside Boston aims to fix what's wrong with U.S. engineering education—and cost is no obstacle

NEEDHAM, MASSACHUSETTS—Diana Dabby wants to create Renaissance engineers. A concert pianist and composer as well as a Massachusetts Institute of Technology (MIT)–trained electrical engineer, Dabby has developed a course on Leonardo da Vinci's scientific and artistic achievements that she thinks is just right for students at the not-yet-ready-for-prime-time Olin College of Engineering. "I want them to be fluent in several languages—science, mathematics, the creative arts, and entrepreneurship," says Dabby, a member of the initial group of 10 faculty hires, adding that her technical expertise informs her music and vice versa. "And I think I can do that at Olin."

Such a course would be music to the ears of Olin's president, Richard Miller. As head of the first freestanding undergraduate engineering college in the United States in nearly a century, Miller hopes to shake up an educational system that he and many others believe is not keeping up with today's fast-paced, high-tech economy. It's a system crammed with traditional courses and little room for burgeoning areas such as computer and bioengineering—or the communications and business skills that most students will need to succeed outside academia. It also has a poor record of attracting women and minorities, even though these groups comprise a rising share of the college-age population.

"Most engineers end up being trained rather than educated," says John Slaughter, the former president of Occidental College in Los Angeles who now heads the National Action Council for Minorities in Engineering. Adds William Wulf, president of the National Academy of Engineering (NAE), "When we deprive students of a liberal arts education, we make them poorer engineers." Olin College intends to provide an alternative.

Miller doesn't seem fazed by the challenge, nor by the target opening date of September 2002: "Our goal is to produce graduates [about 150 a year] with the ability to predict, create, and manage the technology that will shape the future." That education may include courses on da Vinci and starting a dot-com, as well as bread-and-butter subjects such as fluid mechanics and thermodynamics. There will be no academic departments and no tenure for faculty members, who instead will be given 5-year renewable contracts.

Olin wouldn't be able to test these ideas—indeed, it wouldn't exist at all—without a benefactor. Fortunately, it's got a very generous one: the Franklin W. Olin Foundation, formed in 1938 by a New England entrepreneur who made a fortune manufacturing ammunition and small arms. It has made available its entire endowment of more than $500 million to get the college up and running. Olin will also benefit from a close relationship with its next-door neighbor, Babson College in Wellesley, which has a top-rated entrepreneurship program for business majors. With these resources, Olin aims to have a big impact. "We will be disappointed if we create something that is not applicable to other engineering schools," Miller says.

Building big. Olin's president, Richard Miller, has high hopes for the successful launch of this experiment in engineering education.

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Although the college's self-funding and small scale so far have kept it off the radar screens of the mainstream engineering community, some university administrators are starting to take notice—and to raise concerns. Last fall, participants at a National Science Foundation–sponsored workshop for women academic engineers expressed fears that Olin's emphasis on precollege achievements would simply replicate the "white, bright, and male-dominated" culture at most engineering schools. And some educators have questioned whether its approach is really all that new, or is capable of being scaled up if successful.

"A lot of people are doing these things—more electives, an emphasis on entrepreneurship, and so on, although Olin is doing this formally, and all at once," says Al Soyster, dean of engineering at Northeastern University in Boston. Still, there's a touch of envy in his voice when he thinks about the possibilities. "My hat's off to them," Soyster adds. "And if they are successful, I think that others will follow."

No-excuses zone

The new college is taking shape on 28 hectares of land off a two-lane road that winds through the prosperous Boston suburb of Needham. Construction crews are rushing to complete four buildings in time to admit a small, prefreshman class in the fall. This part is old hat for the Olin Foundation, which for 2 decades ran a competitive grants program that built 72 labs at 57 small colleges around the country. However, in 1997, the foundation terminated the program and announced it would instead pour money into its own creation. "We had looked at the buildings program as a way to energize those schools and raise their sights by giving them the necessary facilities," says Lawrence Milas, a New York lawyer who is president of the foundation. "A new college would be the ultimate development grant, as well as a tremendous memorial to Mr. Olin, who was trained as an engineer."

The foundation's largess will allow Olin to cover the full cost of tuition and room for all students. That amounts to a scholarship estimated at $165,000 for the 25 to 30 "partners" who will spend their first year as beta testers of the curriculum. College officials hope that the idea of a free ride to a new engineering school with lofty ambitions will attract a highly accomplished student body (see sidebar).

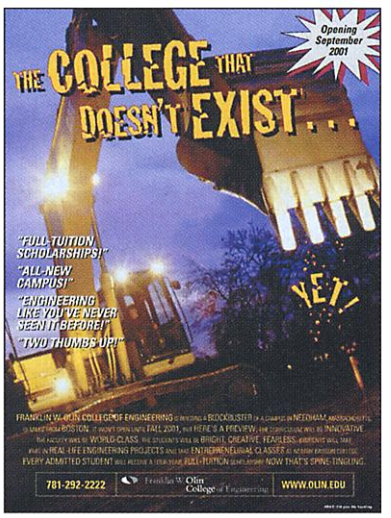
The standards for faculty members are equally challenging. Miller and his administrative team want risk-takers who are willing to forgo tenure. They must support a curriculum, designed in part by students, that fosters entrepreneurship along with academic excellence. The package has already lured a dozen faculty members, including tenured professors from other top-rated engineering programs and a Harvard-trained immunologist who wanted to move from basic cancer

Academic Excellence Is Just a Start for Prospective Students at Olin

Julianna Connelly would be a catch for any science-oriented college. Besides having earned a perfect 1600 score on her SATs and nothing but A's at the highly selective Thomas Jefferson High School for Science and Technology in Fairfax, Virginia, the senior says that music is "a big part of [her] life" and that chemical engineering "sounds really cool as a career." She's already been accepted by the University of Michigan's top-tier engineering school, which is wooing her with a scholarship offer. Yet her heart is set on Olin College of Engineering, a school that doesn't even exist. "I want to get more out of college than mixing chemicals and building things," she says.

Connelly's scholastic record, broad interests, and self-confidence are exactly what Olin College officials are looking for. Her sex also pleases school officials, who stress that they want to avoid the male-dominated "geek" culture that pervades many engineering programs. "Our goal is to be the first engineering school to have a 50-50 balance of men and women," says Sherra Kearns, vice president for innovation and research and a former professor of electrical and computer engineering at Vanderbilt University. Kearns points proudly to a near-balance among the first 10 faculty hires as an indication of Olin's commitment. "It makes the culture different and very enjoyable," she told a group last fall at a National Science Foundation–sponsored conference on women in academic engineering. She says Olin is also committed to attracting more minorities into engineering.

Can it succeed? The conferees were skeptical. They noted the implied high testosterone levels in one recruiting brochure showing a bungee jumper in midair with the caption, "Fearless?" They predicted that a brochure picturing a huge earth mover taking a bite out of the ground would appeal more to boys than girls. They and others have also warned Olin officials that an emphasis on precollegiate success will exclude many promising minority candidates. "If Olin uses the conventional SAT and GPA profiles, then forget it, they won't do much to increase diversity," says John Slaughter, president of the National Action Council for Minorities in Engineering. "Creativity comes in many forms, including someone who has overcome adversity and has the motivation to achieve, who's figured out a way to finish school despite [having] a steady job and other responsibilities."



Heavy metal. Will heavy machinery in recruitment brochures derail a drive for balance between the sexes?

Kearns shares some of those concerns. "It will be hard for us to attract minorities," she acknowledges. Yet she says that poor grades and low test scores in high school "are an indication that [students] may have trouble doing the work" at Olin, even if they have shown "a passion" about the subject matter.

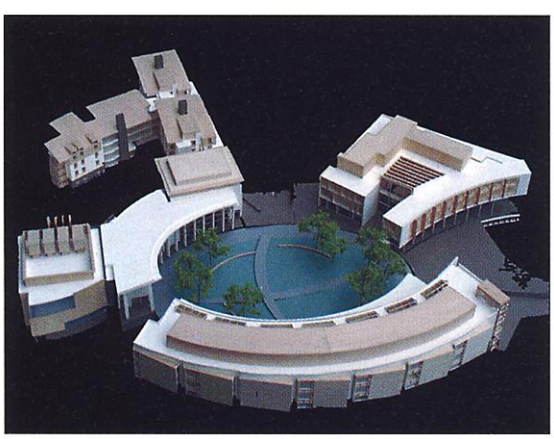
At the same time, Kearns is more confident in the school's ability to appeal to high-achieving women like Connelly, who says that she wouldn't want to attend a school that made special accommodations for one sex. "I'd be disappointed if they accepted poorer students just to meet a quota," says Connelly. "I want to be the best in math, not the best girl."

–J.D.M.

research into teaching. All express their devotion to teaching, although most say they also plan to remain active as researchers.

Miller, the leader of this assault on the engineering establishment, is a round-faced, earnestly friendly 51-year-old aerospace engineer. Hired 2 years ago as Olin's first employee, Miller came from the University of Iowa, Iowa City, where he revamped the engineering curriculum and created one of the nation's first engineering entrepreneurship programs. Miller is radiantly optimistic about his chances at Olin. "This is a no-excuses zone," he says, echoing a favorite phrase of his tight-knit clan of academic pioneers. "If we can't make this work, it's our own fault."

Reformers generally agree about what needs to be done to improve engineering education: more hands-on learning, more collaborations within and outside academe, more attention to instruction rather than research, more outreach to underrepresented groups. But consensus isn't enough. It's hard to budge a system that includes 325,000 undergraduates in more than 2300 engineering programs at 500 institutions across the United States. Reformers say that earlier attempts to set up model programs and disseminate "best practices" have barely made a dent in the established order.



CREDITS: OLIN COLLEGE

Tight-knit group. The college's first buildings will include dormitories, classrooms, offices, and lab space arrayed around a green.

"It's inertia," says NAE's Wulf, a member of the college's advisory board. "Engineering schools have been very successful since the end of World War II" at producing graduates who have helped make the U.S. economy the undisputed world leader, notes Wulf, a former professor of computer engineering at the University of Virginia, Charlottesville. "So even if you agree we must do better, it's hard to make a change."

But change is imperative, say Wulf and others, because the demographic trend lines are disturbing. The number of bachelor's degrees awarded in engineering has declined 19% since a 1986 peak, and funding for engineering research is falling far behind other fields, while the share of advanced degrees going to foreign students continues to rise. Non-Asian minorities, the fastest growing segment of the undergraduate population, are badly underrepresented, registering barely 11% of the total. The sex imbalance is even worse, comparatively, with women making up just 18% of enrollments.

Different rules

Olin's ideas may be radical, but its image and approach—a small New England college seeking an elite group of students—could hardly be more traditional. While other schools are scrambling to reach new audiences—midcareer professionals or stay-at-home students taking courses on the Internet—Olin plans to focus entirely on its resident population of fledgling engineers. Attempting to reach nontraditional populations is "outside our mission," says John

Bourne, a professor of electrical and computer engineering who established the Sloan Foundation's Asynchronous Learning Network web while at Vanderbilt University in Nashville, Tennessee. He's brought the grant to Olin, where he'll help the school participate in a 40-school consortium for online education. "That would have been a much riskier experiment," agrees Milas. "I don't think we would have felt comfortable doing it."

Initially Olin will offer 4-year degrees in only three areas—mechanical, computing and electrical, and general engineering. The length of the program was stipulated by the trustees, Miller told a recent gathering at NAE. "We're not entirely at peace with it," he adds, referring to ongoing discussions about a fifth year, "but industry seems to like it." He also expects to expand the number of programs to meet demand, noting as examples the growing popularity of bioinformatics and bioengineering. The faculty structure also sets Olin apart: It will have no departments. Miller says that maintaining a unified faculty will help prevent the school from becoming captive to an outdated curriculum structured around narrow subdisciplines. "The allegiance to tradition is strong," he says. "Many courses haven't changed in decades because the faculty took them, and they assume that their students should, too."

The use of 5-year, renewable contracts instead of tenure is similarly aimed at ensuring what Miller calls a "culture of continuous improvement." "Olin College isn't staking its future on the absence of tenure," says Miller, "but I suspect that it plays a role in the lack of innovation at other schools." Faculty members say they had few qualms about coming to an institution that doesn't offer tenure, and that engineers don't require the same sort of protection from the vagaries of politics as do liberal arts professors. "Those who are most successful don't need it, and those who need it shouldn't have it," says Daniel Frey, an assistant professor of aerospace engineering and another MIT émigré.

The big attraction for most Olin faculty members is the opportunity to write on a blank slate, with talented students and sufficient resources. "Universities are built for homeostasis," says Lynn Stein, a former MIT assistant professor who hopes to integrate computer science into systems engineering and design courses in a way that she says wasn't possible at MIT. "The research is constantly changing, but the educational system stays the same."

Olin officials say they're still searching for the right balance between specialized training and a broad undergraduate education. "I hope that Olin will be sufficiently radical," says Henry Riggs, president of the new Keck Graduate Institute for the Applied Life Sciences, a member of the Claremont (California) Colleges consortium. "For instance, why specialize in the same few majors that engineering has been stuck with for years?" says Riggs, an engineer and past president of Claremont's Harvey Mudd College, whose rapid rise to academic excellence since its founding in 1955 Olin officials hope to emulate. "Why not provide a more well-rounded education in the arts and sciences and leave specialization to graduate school?"

Olin will explore those and many other issues during the next academic year, as its student-partners combine on-campus seminars with two monthlong experiences abroad. Miller says he doesn't expect to get it right the first time, but he's counting on the faculty and students to keep Olin from becoming "just another engineering school."

"It's a brave and courageous experiment," says Wulf. "I'm not sure how big an impact one small school will have. But they are asking a lot of the right questions."

–JEFFREY MERVIS

PORTUGAL

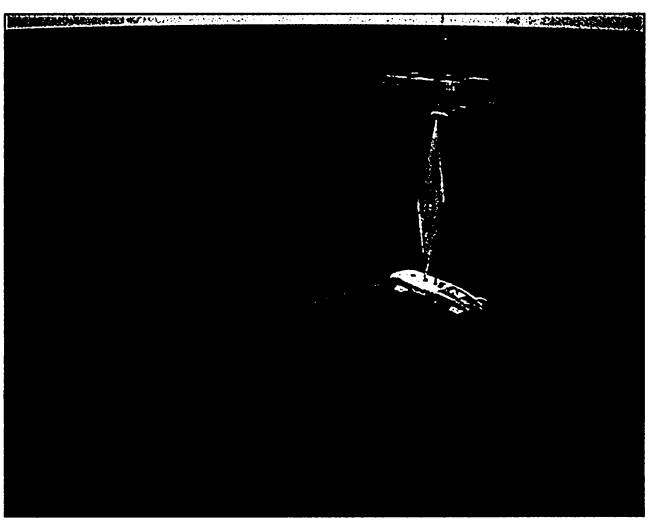
Money and Charisma Help The Science Tide Come In

New funds from the central government and the E.U., in the hands of an activist science minister, are helping revive a once-proud scientific tradition

LISBON—Five centuries after Vasco da Gama sailed around the Cape of Good Hope, pioneering a trade route between Western Europe and India, Portugal is again making waves in ocean science. Based in this renowned port city, the Institute of Systems and Robotics (ISR) is a leader in underwater robotics, working jointly with top-tier labs from California to Vladivostok. ISR's latest project—a novel master-slave pair in which a robotic catamaran controls an autonomous underwater vehicle (AUV)—is winning praise from foreign experts. The Portuguese AUV team is "world class," says Samuel Smith, director of the Advanced Marine Systems Lab at Florida Atlantic University in Dania.

ISR's success is one facet of Portugal's speedy transformation from a scientific backwater to a force to be reckoned with. "Twenty years ago, science virtually didn't exist in Portugal," says Cecília Leão, research vice rector at the University of Minho (UM) in Braga. But steady cash infusions from the European Union (E.U.), which Portugal joined in 1986, and reforms initiated by Science Minister José Mariano Gago, a physicist who took office in 1995, have pulled Portuguese science up by its bootstraps. The number of Ph.D. scientists in Portugal has swelled from 1700 in 1987 to 8000 in 1999, and funds for peer-reviewed grants have doubled in the last 4 years. Public research spending as a percentage of gross domestic product has nearly tripled since 1986, to 0.63%—still low compared with the research superpowers, but higher than that of Ireland, Italy, and Spain.

More help is on the way: The government is about to launch a pair of 6-year science and technology (S&T) programs, totaling $1.4 billion, that will upgrade scientific equipment and Internet connections and spur research commercialization. And even though E.U. funding for capacity-building projects will dry up in 2006, government officials feel that the country is finally on the right track. "The opportunity for Portugal to become a scientifically advanced country is within reach," says Luis Magalhães, president of the Portuguese Science and Technology Foundation (FCT), the country's main granting agency.



CREDIT: ISR

Leading the way. A unique master-slave catamaran and autonomous underwater vehicle, both remotely operated, will be tested off the Azores this spring.