

A Century of Engineering

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The Charter Class of 1905 at the Carnegie Technical Schools founded by industrialist Andrew Carnegie

Andrew Carnegie understood the importance of education and its ability to improve the lives of the working class. Carnegie, the son of a master weaver in Dunfermline, Scotland saw his boyhood paradise torn asunder when his father's skills were rendered obsolete by the power loom. He emigrated to Pittsburgh at age 12. Quick-witted, shrewd and resilient, he survived a Dickensian adolescence to become one of the Gilded Age's wealthiest industrialists.

"Put all your eggs in one basket," Carnegie once advised, "and then watch that basket." For him, that basket brimmed with steel. Fiercely competitive, obsessed with innovation and efficiency – he would unhesitatingly scrap a relatively new plant to erect a more modern one. Carnegie imported the Bessemer forced-air steel process to America. Such innovation permitted him to reduce the price of rails – the product that initially drove the industry – from \$160 a ton in 1875 to \$17 by 1900. His steel furnished the growth of America's burgeoning towns and factories. His philanthropy built the Carnegie Technical Schools.

The 120 members of the charter class of 1905 at the Carnegie

Technical Schools enrolled in programs of study leading to three-year diplomas in the fields of architectural practice, chemical engineering practice, civil engineering practice, electrical engineering practice, mechanical engineering practice, and metallurgical engineering practice. (Those disciplines would map directly into the engineering disciplines a century later in the engineering college.)

In 1912, the technical schools became a four-year degree-granting institution offering bachelor's and master's degrees and in 1922, the School of Applied Science was recognized as the College of Engineer-

ing, (Carnegie Tech). The early engineering curriculum was characterized as hands-on technical training in courses taught by faculty who were often practitioners. By 1928 engineering students faced a daunt-

ing array of technical course requirements that crowded out classes in science, humanities and social science. Carnegie Tech was training technologists rather than educating engineers, and by 1929 engineers who were so narrowly trained often failed to find employment outside their fields.

Early on, concern arose in the college about the process by which students became engineers. Carnegie Tech President Robert Doherty, having observed engineers while employed at General Electric, felt that colleges and universities were failing students by not educating them in problem-solving

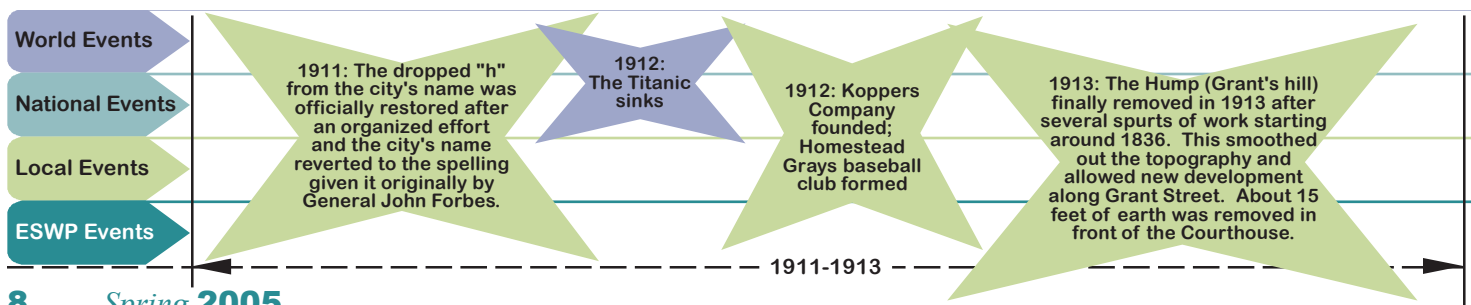
result, new courses in humanities and social leadership were added to the engineering curriculum. Engineers were educated to develop creative and analytical abilities.

As historian Edwin Fenton states, "To achieve his goals, Doherty divided the curriculum into two stems: the scientific stem and the humanistic-social. The scientific stem would teach problem solving by laying a foundation in fundamental scientific courses... The humanistic-social stem would give students social knowledge... Doherty argued that this curriculum should educate students to become engineers, not to train them to be engineers."

The Carnegie Plan was significant not just because it emphasized problem solving, but because it emphasized the need for engineering students to possess problem-solving skills in the context of larger social issues and to understand the impact of technology on society. In 1940, all first-year students at Tech were required to take a common curriculum that included humanities courses. By 1945, Tech faculty were writing papers on the new curriculum and their assessment of its impact, and in 1948, faculty volunteered to evaluate their

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skills. His "Carnegie Plan for Professional Education" emphasized an understanding of the fundamentals of science and engineering, creative problem solving, and an appreciation of the humanities. As a





Engineering students during the spring of 1959 surveying a portion of the campus off Frew Street near where the university now features Hunt Library.

strengths and weaknesses in the classroom by having students fill out rating sheets, a precursor of present day course evaluations.

After World War II, the economy surged and technology advanced, creating a need for engineers. The college of engineering experienced growth in its research and enrollments during this period. In the 1950's, computing first entered the engineering curriculum. In 1958, the Computing Center pioneered a course in programming for first year students, and within two years, half of the firstyear engineering and science

recognized worldwide for its robust interdisciplinary culture, evident in its academic objectives and especially in research endeavors. Engineering's interdisciplinary culture took root back in 1923, when the Metals Lab opened. In this lab, physics and chemistry were applied to metallurgical research. The lab was supported by industry and foundations and provided fellowships for graduate students. Decades later in 1967, Mellon Institute, the prototype of private applied research institutes in this country, merged with Tech to become Carnegie Mellon University.

“...with the pace of technological innovation, students must be prepared to become life-long learners.”

students were taking computing courses. Nearly 50 years later it is hard to imagine engineering before computer and information systems like the Internet. (Carnegie Mellon was one of the original sites that comprised the first electronic network, which preceded the Internet.)

The College of Engineering is

The purpose of this union was to develop a greater partnership between industry and science in the hope that academic research results could be shared with the public.

“Being an engineering student at Carnegie Mellon means being part of a century-old tradition—a tradition that combines a techni-

cal and liberal education,” said Pradeep K. Khosla, dean of Carnegie Mellon’s College of Engineering. “Our students experience a broad mix of engineering challenges via project classes and student research projects.”

In 1990, the College of Engineering evaluated its undergraduate curriculum, recognizing that as the world becomes at once smaller and more complex, demands are placed on engineers to meet the increasing needs of society. Engineers enter a profession that cuts across international cultures and markets. Important questions that helped shape the new curriculum included what kind of education allows engineers to contribute to the advancement of technol-

ogy, while deriving personal career rewards; what kind of undergraduate education would provide the best background for graduates who wish to enter other professions, such as medicine, business or law?

Faculty recognized that it is impossible to teach everything about each discipline, and with the pace of technological innovation, stu-



Carnegie Mellon civil engineering students work to complete a concrete canoe for competition at the 2004 American Society of Civil Engineers' concrete Canoe competition.



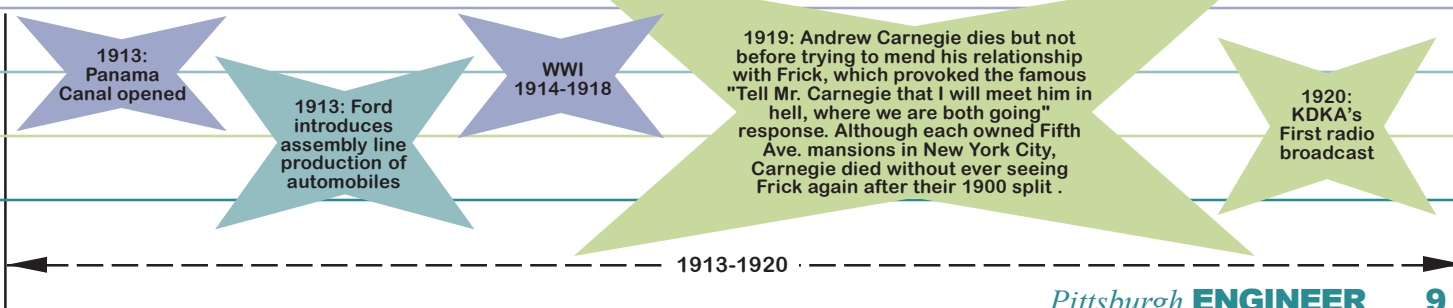
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A Century of Engineering Continued

dents must be prepared to become life-long learners. A new, more flexible curriculum was designed which increases breadth of knowledge while reducing class overloads and yet imparts students with skills that foster self education.

A priority of the new curriculum was to introduce students to engineering in their first semester at Carnegie Mellon. Each discipline developed an Introduction to Engineering course that is offered with a science or math co-requisite. In the intro courses, lectures on fundamentals and theories are combined with hands-on engineering projects. True to the Carnegie Plan,

engineering students had 20% of their courses in the humanities and 80% in engineering, math and science. In the revamped curriculum 65-70% of a student's courses are engineering, math and science related, leaving room to pursue other interests, or double majors or minors, many outside of engineering.

Two double majors within engineering are Engineering and Public Policy (EPP) and Biomedical Engineering (BME). These programs are integrated into traditional majors in such a manner that students can graduate in 4 years with majors in related but distinct fields. Students in these programs have



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career interests that transcend traditional engineering. Many BME undergraduates are interested in medical-related careers, while EPP

students explore technology-based policy options in government, foundations or other non-profit organizations.

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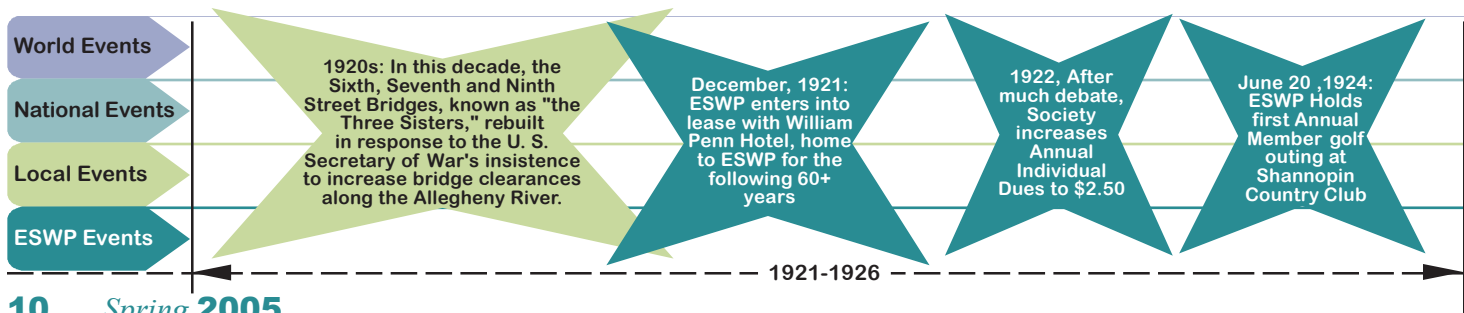
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Engineering continues to organize interdisciplinary teams to tackle challenging research into new processes, materials and technologies through dozens of research centers. The Institute for Complex Engineered Systems (ICES), for example, delves into research involving multiple disciplines and technologies. ICES initiated a number of interdisciplinary design courses that bring together faculty and students from all of engineering, other colleges, and industrial sponsors to explore engineering product design projects.

The Biomedical Imaging Center

was recently founded to advance the development of advanced computer systems that assist in the interpretation and analysis of biomedical images. This center involves faculty and graduate students from Biomedical Engineering, Electrical and Computer Engineering, Computer Science and Biology.

A final example, the Information Networking Institute (INI) began as an interdisciplinary program of the computer science, engineering and the management schools to conduct research and to provide a master's degree in information networking. Close ties with industrial sponsors

drove the original research and educational program. Today, the INI offers a master's program on campus, and via distance learning opportunities, also awards degrees in Greece. Next year, the program will expand to include Japan and Korea. As the challenges of society and technology become more global, engineers will be needed to innovate and manage technology overseas and in virtual locations.

Andrew Carnegie's philanthropy, rooted in part from his recognition of the limitations of narrow training, enabled the rise of an internationally prominent univer-

sity, where engineers are educated to be innovative and creative as they pursue a variety of careers. Throughout the College of Engineering the mission is clear and consistent: develop and implement the fundamental and essential elements of an enduring education and identify and solve the most challenging technological problems for the enrichment of humankind.

This work relies heavily on *Carnegie Mellon 1900-2000 A Centennial History*, written by Edwin Fenton, published by Carnegie Mellon University Press.

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Herr's Island (Before)



Washington's Landing Development (After)



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