Table of Contents

INTRODUCTION

It has been more than 50 years since any attempt has been made to compile a history of the Department of Mechanical Engineering (ME) at Colorado State University. Hence, on the occasion of my retirement I felt that I could provide a useful service to the department by updating the history and including more statistical data than had been previously compiled. Also, with the advent of word processors, by providing an electronic version of the history it will be much easier for people to update the history in the future. This activity is not entirely unselfish, as it keeps me occupied.

If one reads this material then one will recognize that there are five areas in which the ME Department has played a significant role on facilities and academic programs of the institution. The first is in buildings. Faculty of the department designed and supervised construction of many of the early buildings around the oval, including Ammons Hall, the chemistry building, the library building, the administration building, the men's old gymnasium, and the industrial sciences building. The second area is in computing. ME faculty members have served as director and associate director of the university computer center, have founded engineering network services, and have served as director of academic computing and network services. The third area is with respect to academic programs. Departmental faculty started the electrical engineering department and the computer sciences department. The fourth is in distance education. Departmental faculty members were prominent in starting the SURGE program at Colorado State University. Finally, the fifth area is in energy conservation on campus. Graduates of the department have headed the conservation efforts by facilities management.

A search of the departmental archives revealed a condensed history prepared by J. Harry Scofield, associate professor of ME, dated March 16, 1944 and another, covering the period from 1909 to 1923, prepared by George F. Henry, associate professor of ME, dated June 1, 1944.

These two documents were among the papers that were in the department office and were contaminated and had to be removed. The library has very little material on the ME department, other than what is included

The Brass Furnace

in general catalogs. Most material concerning the department was either lost in the flood of July, 1997, or destroyed due to the contamination of the engineering building.

Material that was located makes for very interesting reading. For example, the following material was found in the State Agricultural College Handbook from 1901.

> *"All college Departments open to both sexes. Tuition Free. No fees of any kind."*

> *"Prior to 1887, but one course of study was pursued by students. Since that date the course has been differentiated. The courses, from which the students can make choice are: Agricultural Course, Mechanical Engineering Course, Civil and Irrigation Engineering Course, Ladies' Course, Veterinary Course, Architectural Course and Commercial Course."*

Brief descriptions of the courses of study were provided. For example, for ME the description is as follows:

"Mechanical Engineering—The studies and practice of this department prepare students for the practice of mechanical engineering. The instruction, theoretical and practical, covers a wide field. The special studies of this course are as follows: Drawing; carpentry and joinery, also wood-working machinery; pattern making and foundry work; forge work; machine advise work in metals; principles of mechanism; strength of materials; boilers; the steam engine; and machine design, machinery and mill work."

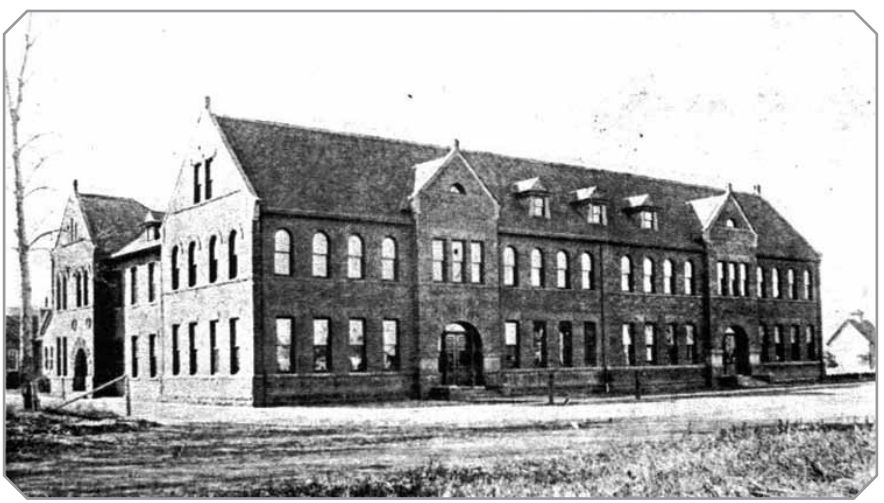
The department had its own building at that time, as seen in the photograph shown below. More discussion about the building will be provided later.

Some additional quotes from the handbook are:

"There is a genuine democracy throughout the college. It is the democracy of work and worth."

"The new method is not always the best. But the method of education which develops intellect, hand, and character at the same time is sure to become permanent."

"The military drill is not for the purpose of making soldiers, primarily. Strong bodies, erect carriage, promptness and



Mechanical Engineering Building

The Forge, Foundry, and Shop Era (1882–1914)

It must have become practicable quite soon, as the college name was changed to the Colorado School of Agriculture and the Mechanic Arts in 1882. The curriculum was revised and enlarged and the Department of Mechanics and Drawing was added. Frank H. Williams was hired as professor of mechanics and drawing. Mr. Williams served as department head for less than one year and was replaced by James W. Lawrence in March, 1883. At that time Mr. Lawrence had not yet received his BS degree; this was conferred on him by the college in 1891, eight years after being hired as professor of mechanics and drawing and one year after serving as acting president of the college. The college also conferred the ME degree on him in 1902, in recognition of his outstanding contributions to the college. Mr. Lawrence was clearly a remarkable man. In addition to serving as professor and head of mechanical engineering from 1895 to 1915, and dean of the faculty from 1906 to 1912, he designed and supervised the construction of the college heating plant. The heating plant remained under the direct supervision of the mechanical engineering department head until 1949; it was used by mechanical engineering students in their studies involving steam and heat. The stack for the plant remained standing until 1989 when it was determined that it needed major maintenance in order not to become a potential hazard. Rather than spend the necessary funds the decision was made to remove it. Some attempt was made by the mechanical engineering students at that time to save it and have it declared a historic monument but the costs of stabilizing it were too high and the resources were not available. Mr. Lawrence also directed the construction of the 4040 square foot Mechanic Arts Hall in 1883. Another interesting anecdote is that he married the first woman (Elizabeth Cox) to graduate from the college.

The Mechanic Arts Hall was one of the earliest buildings on campus and resulted from an authorization from the State Board of Agriculture of $7500 for the erection of a mechanic shop in 1882 [SBOA, 1882]. The building was initially named the Mechanic Shop but the name was changed to the Mechanic Arts Hall in 1891 [Thirteenth Annual Register]. However, it seems that

some students continued to refer to it by its original name as indicated by the following statement: "The Mechanic Shop is now one of the most elegant buildings on the college grounds." The red brick building consisted of a two-story 25 by 56 foot front section facing east (the long axis was north-south) and a single-story tee 20 feet wide by 62 feet long (east-west). A photo from the 1889–90 catalog is shown below. The first floor housed a machine shop for iron working and the second floor housed a wood shop. The tee section housed the boiler and coal room. The boiler provided steam for heating the building and for running a 12 hp steam engine that was used to drive the shafts for the machine shop and wood shop. Professor Lawrence requested $10,000 for an addition to the Mechanic Shop in 1891. His request was initially denied but later approved and reported on in the initial edition of the Rocky Mountain Collegian. One factor leading to the approval was probably the extensive use of the facility, as indicated by the following quotation: "Owing to the large number of students taking shop work, Professor Lawrence has been compelled to make two divisions, each section working two hours each afternoon." Professor Lawrence had an interest in manufacturing. He prepared detailed catalog descriptions of course work indicating that the purpose was to train students for work in the manufacturing industries. Manufacturing companies were tending to hire machinists who were specialists in only one type of operation and Professor Lawrence wanted his students to be knowledgeable in the principles of all machines and processes. Hence, when supervisory positions became available the mechanical engineering students would be selected. The catalog description of 1882–83 contains the first references to manufacturing. Professor Lawrence wrote the following description for the Practical Mechanics course:

Mechanic Shop

> *"The old system of apprenticeship is rapidly becoming a thing of the past, and it is now almost impossible for a boy to learn a trade in any modern shop or factory. This is owing, largely, to the introduction of special machinery, necessitating special workmen to manage it, and the workman who has learned to run a machine of this kind is kept at that work, as being most*

Mechanic Shop (1883)

Machine Room

profitable to his employer; his practical knowledge of other methods and machines is, therefore, confined to narrow limits, and, should a vacancy occur in a superior position, he is not the man for the place, from the fact of his being unacquainted with other practical parts connected with his trade, the manipulations and principles involved in which he has not had an opportunity to learn."

(Author's note: Mr. Lawrence and William Faulkner must have learned to write from the same teacher.) Mr. Lawrence continued with:

"Should his surroundings be such that he enters manufacturing, his ideas having been broadened by this training, he will the more rapidly grasp anything new that may come up in his business, or if he takes up farming, he will with greater ease, be able to understand the mechanical principles and workings of his machinery, and also how to keep them and his buildings in proper repair."

The Evolutionary Period (1964–1981)

In the mid-1960s, Dr. Marschner began a program of hiring new faculty in order to start a doctoral program in the department. He hired Dr. Sanford Thayer, Dr. Fred Smith, Dr. Byron Winn, Dr. Harry Edwards, and Dr. Hilding Olson, all in 1965 and 1966. These faculty members had different specialties in order to broaden the scope of the department and help the department qualify for granting doctoral degrees. A proposal for granting PhD degrees was submitted to the university administration in October of 1966. It was stated in the proposal that the following areas would be emphasized: energy conversion, heat transfer, propulsion, environmental engineering, and mechanics. It was also stated:

> *"Mechanical Engineering represents the foundation of the industrial growth in the United States and is necessary for the continuing industrial growth of the state of Colorado."*

The administration approved the proposal and the program started immediately, pending accreditation by the North Central Association. NCE examiners visited the university in 1967 and the program was accredited in March 1968. The examiners stated in their report

> *"At first glance, the Department of Mechanical Engineering gives the impression that it might be too widely diversified to give proper substance to a PhD program. Recent additions to the staff have background in chemistry, aeronautics, nuclear engineeing and thermodynamics. Two of the major research programs are being conducted in association with other departments—atmospheric science and electrical engineering. One begins to wonder if the resources of the department are being spread so thin that study in depth would be impossible. Actually these seemingly divergent skills and activities do have a common denominator. The Department has been building its strength in a relatively narrow portion of the mechanical engineering spectrum—namely, energy conversion. The recent moves which (sic) have been taken*

are all directed toward this ultimate goal. It is hoped that the existence of this variety in background of the staff will actually lead to new insights as they work together on the basic problem of energy conversion and its closely related adjuncts. The plan has considerable merit and promises to form an ideal base for PhD instruction."

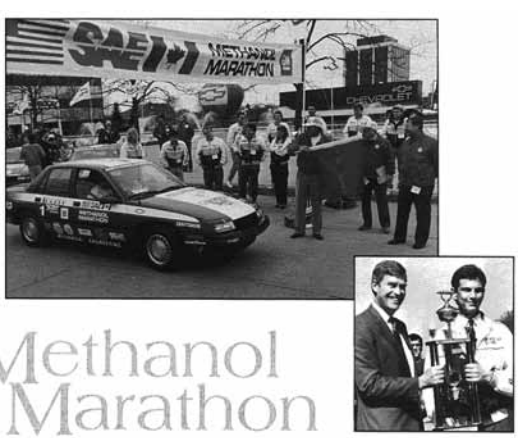
Energy conversion has remained a major thrust of the department through the present (2003). Members of the department (Professors Duff, Burns, Winn) have been actively involved in the Solar Energy Applications Laboratory since it began in 1973 and Professor Hittle of the department has directed the laboratory since 1989. The Energy Analysis and Diagnostic Center (later to become the Industrial Assessment Center) was started by Dr. Winn in 1984 and has provided technical assistance to more than five hundred manufacturers, resulting in energy savings of more than fifty million Giga-joules. The Engines and Energy Conversion Laboratory was started by Dr. Bryan Willson in 1991 and has a national reputation for research in engines and alternative fuels conducted at the laboratory. The ME students have won numerous national awards for their work on alternative fuel and hybrid vehicles. Several of the faculty members have worked extensively with researchers at the National Renewable Energy Laboratory (NREL) for many years. Several of the ME graduates have gone on to high level positions in organizations involved in energy conversion. Some of these are: Robert Thresher and Susan Hock, director and assistant director, respectively, of the wind energy program at NREL; Tom Mancini, manager in the Solar Power Tower research at Sandia National Laboratory; Kelly Beniga, manager of the Solar Power Group at SAIC; William Kramer, former director of hybrid vehicle research at Idaho National Engineering Laboratory; John Bleem, manager at Platte River Power Authority, John Morris, Steve Hultin and Carol Dollard at CSU facilities services and Pieter van der Mersch at CU facilities services.

When Dr. Millsaps became department head in 1968 he attempted to start a biomedical engineering program and hired a number of faculty to staff it. The program proved to be unsuccessful and all but one of the faculty members hired for it had left by the mid 1970's. Dr. Histand has remained and continues to teach two courses in biomedical engineering on a bien-

nial basis. The accompanying photo shows Dr. Histand anaesthetizing a dog. In 1991 Dr. Susan James joined the department and is currently involved in developing a biomedical engineering program within the department. Dr. James was the first full-time tenure-track woman to join the department.

Dr. Histand (1969)

During the 1980's the department became involved in large-scale student competitions. The department founded the Walking Machine Decathlon in 1986, with sponsorship from the Society of Automotive Engineers. This is an international student competition that, as the name suggests, is comprised of ten events of increasing complexity. The competition is held at schools from Canada to Mexico and from east to west coasts of the U. S.. Since its inception, the CSU students have almost always placed within the top three competitors, finishing first in eight of eleven times. The team has also participated in an international robotics competition held in France on two occasions. In addition to the walking machine and robotics projects the mechanical engineering students have participated successfully in several vehicle competitions, starting with the STAB I vehicle in 1979. This was followed by the Methanol Marathon in 1988. This involved converting a Chevrolet Corsica, donated by General Motors, to run on methanol. The team finished second to the University of Tennessee students overall, but won the prize for the best design. Dr. Bryan Willson was the faculty advisor. The next year the students entered the GM Sunrayce USA competition and placed in the top



Methanol Marathon

quarter. The project leader was Dr. Don Radford. One of the sponsors of the team, Asahi Solar of Japan, invited the CSU and Arizona State teams to participate in a Japanese solar car race held in Kobe, Japan in October of 1990. The company paid all of the expenses for the trip. This was a marvelous experience for the students, some of whom had never been out of the state of Colorado. Photos taken at this event are shown to the left.

Dr. Willson directed the students in the Natural Gas Vehicle Challenge in the years 1990–91, 1991–92 and 1992–93. These design competitions involved converting stock vehicles to run on natural gas and our students fared quite well in these national competitions. Also, in 1992–93, Dr. Willson and Dr. Winn served as faculty advisors on the Hybrid Electric Vehicle Challenge. This project involved converting a Ford vehicle to run on a small internal combustion engine and an electric motor. The students placed eighth of fifteen entries in their category. Our students entered another GM Sunrayce competition in 1992–93, under the guidance of Dr. Radford. These three large-scale design events, in addition to the Walking Machine Decathlon, placed a significant burden on fund-raising in the department. Our department was, to the best of my knowledge, the only department in the United States to be involved in four major student design competitions in that year. As a result, the only major competition that was entered in the next two years was the Walking Machine Decathlon. Dr. Peterson served as the faculty advisor. Then, starting in 1995–96 the students entered both the Walking Machine and the Formula SAE design competitions under the direction of Dr. Peterson and Dr. Willson, respectively. However,

Dr. Fred Smith is currently (1998–2000) advising the students on the Walking Machine. Also, in 1997–98 and 1998–99, the students entered the Human Powered Vehicle (HPV) competition and won first place. The department also entered a competition to design a clean (low noise and low pollution) snowmobile in 2000. Photos of the event are shown on the following page.

Dr. Gearold R. Johnson

A rather amusing anecdote concerning the Methanol Marathon is as follows. Mechanical engineering students, faculty, and university administrators were gathered in the old field house for the purpose of taking a publicity photo. Just as the photo was about to be taken, one of the students turned to President Philip Austin and said "Are you with the university, Sir?"

The department has played a major role in computing at Colorado State University. Beginning in 1968, the University Computer Center was under the direction of Dr. Marschner and Dr. Winn. Dr. Johnson joined the computer center staff in 1972 and replaced Dr. Winn as associate director in 1973. Dr. Johnson later joined the mechanical engineering faculty and, in 1983, established the Center for Computer Assisted Engineering in the college. He also directed the development of Engineering Network Services and served as the first George T. Abell Professor of Computer Assisted Engineering. Dr. Patrick Burns was appointed as head of Academic Computing and Networking Services for the university in 1998.

Dr. Sakurai and HPV Team

Dr. Johnson retired from CSU in 1995 to become academic vice president of the National Technological University.

Dr. Budak, Dr. Willson, and Dr. Smith

CSU Snowmobile Team

The department has been involved in providing support to manufacturing companies for many years. As indicated earlier, Mr. Lawrence had a strong interest in manufacturing and designed early courses in the department oriented toward manufacturing. The department also had a faculty member assigned to the agricultural extension service in the early days to work in the development of farming equipment. In 1986, Dr. Wade Troxell was hired to work with Dr. Winn in developing the Manufacturing Excellence Center (MEC). The goal of MEC was to provide technical assistance to manufacturers in order to help them become more profitable. The center grew rapidly and soon involved faculty and students from four colleges (engineering, natural sciences, applied human sciences and business). Some comments from the business community regarding MEC are as follows: "If you want to employ leading-edge technology, that's where I see MEC fitting in. Going to MEC is like going to a healthy business environment with a strong chamber of commerce—it can give you a lot of things you need." [Allan Wilson, president of Plastec]. "I think it's phenomenal that a group of us was able to get together for the first time, and three months later develop something that apparently no one has done before. It was an unusual synergism. Cross-fertilization is the key to success." [David Carson, president of CBW Automation]. In 1993, MEC became a part of the Mid-America Manufacturing Technology Center

(MAMTC), funded by the National Institute of Standards and Technology. Field engineers were appointed as staff in the mechanical engineering department; these field engineers met with manufacturers throughout Colorado and helped to connect the manufacturers with CSU faculty who could help solve problems for the manufacturers. Dr. Troxell directed the program until 1998, when he resigned in order to spend more time on teaching and research. A photograph of Drs. Troxell and Winn in the robotics laboratory is shown below.

Dr. Troxell and Dr. Winn

The mechanical engineering department has played a strong role in the development of distance education at Colorado State University. The SURGE program (State University Resources in Graduate Education) was started in 1968 by former dean Lionel Baldwin. Dr. Baldwin perceived a need for practicing engineers to be able to continue their education while working at a full-time job. Also, as these engineers often traveled a great deal it would not be feasible for them to attend regular classes on campus. Dr. Baldwin's solution was to videotape regularly scheduled classes and send the videotapes to the working engineers. Thus the engineers could view the tapes at their convenience while completing the identical course work as the students on campus. The first four faculty members to teach on SURGE were Drs Winn