# The George W. Woodruff School of Mechanical Engineering

At the Georgia Institute of Technology



An ASME Historical Mechanical Engineering Heritage Site

The American Society of Mechanical Engineers

# THE HISTORY AND HERITAGE PROGRAM OF ASME INTERNATIONAL

The History and Heritage Landmarks Program of ASME International (the American Society of Mechanical Engineers) began in 1971. To implement and achieve its goals, ASME formed a History and Heritage Committee initially composed of mechanical engineers, historians of technology, and the curator (now emeritus) of mechanical engineering at the Smithsonian Institution, Washington, D.C. The History and Heritage Committee provides a public service by examining, noting, recording, and acknowledging mechanical engineering achievements of particular significance. This Committee is part of ASME's Council on Public Affairs and Board on Public Information. For further information, please contact Public Information at ASME International, Three Park Avenue, New York, N.Y. 10016-5990, phone: 1-212-591-7740.

#### Designation

Since the History and Heritage Program began in 1971, 212 landmarks have been designated as historic mechanical engineering landmarks, heritage collections, or heritage sites. Each represents a progressive step in the evolution of mechanical engineering and its significance to society in general. Site designations note an event or development of clear historic importance to mechanical engineers. Collections mark the contributions of a number of objects with special significance to the historical development of mechanical engineering.

The Landmarks Program illuminates our technological heritage and encourages the preservation of the physical remains of historically important works. It provides an annotated roster for engineers, students, educators, historians, and travelers. It helps establish persistent reminders of where we have been and where we are going along the divergent paths of discovery.

The 125,000-member ASME International is a worldwide engineering society focused on technical, educational, and research issues. ASME conducts one of the world's largest Publishing operations, holds some 30 technical conferences and 200 professional development courses each year, and sets many industrial and manufacturing standards.

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#### Preface

The story that follows highlights Georgia Tech's early role in the transformation of engineering education from a vocational to a professional curriculum. The American Society of Mechanical Engineers (ASME) was founded in 1880 to professionalize the trade of mechanical engineering in the United States. John Saylor Coon was a charter member of the ASME. He came to Georgia Tech in 1888 and spent the next 35 years teaching mechanical engineering. Dr. Coon shaped the curriculum, broadening it from a vocational (practical) approach to a rigorous academic model that used the shops as laboratories. These changes mirrored the ASME's vision to replace the pervasive shop culture with a professional engineering education. Under the guidance of J. S. Coon, Georgia Tech became an engineering school that had a significant impact on its region and gained a national and international reputation for producing high quality and successful engineers.

The purpose of a course in engineering is not so much in the line of imparting facts and information as it is to enable the student to form the habit of logical reasoning, to depend upon his own resources, to draw correct conclusions from given premises—in short, to think.

John Saylor Coon on Ethics and Engineering

owhere was the need for industry more acute than in the South. Following the Civil War and Reconstruction, southern leaders sought to improve the fortunes of their devastated region by developing an industrial economy similar to that of the North. These leaders, loosely called New South boosters [1], became evangelists of the need for education and industrialization. In newspapers and political forums, New South boosters, such as Samuel Inman, Oliver Porter, Edward Hodgson, and Judge Columbus Heard, argued that northern capital, combined with the natural bounty of the South and with an educated southern workforce, would create enormous regional prosperity. Perhaps the best known New South booster was Atlanta journalist Henry Grady who, speaking at the 1877 Cotton States Exposition in Atlanta, told of a funeral in rural Georgia as a way of describing the industrial poverty of his state: He said, "... The South didn't furnish a thing on earth for that funeral but the corpse and the hole in the ground."[2]



Mr. Grady emphasized the limitations of an economy built primarily on trade. The photograph of the City of Atlanta before the Georgia School of Technology opened shows the small retail stores that were the focus of Atlanta's economy. Apart from railroads, which themselves represented a mere shadow of those in the North, Georgia had

ATLANTA'S CHIEF RETAIL AND SHOPPING DISTRICT IN 1882, SIX YEARS BEFORE THE GEORGIA SCHOOL OF TECHNOLOGY WAS OPENED.

little industry. While Atlanta was a railway hub, only about ten percent of U.S. manufacturing took place in the South. The shops necessary to familiarize youth with mechanical devices, and the industry to provide examples for study and jobs for graduates were sparse during the early years of the Georgia School of Technology. Men like Henry Grady argued that southern industry, processing available raw materials with local labor and with the guidance of native technical skill, would provide the key to social stability and economic recovery. The key to this plan for regional salvation was education to develop the hands of industry and the trained technical minds necessary for manufacture.



GEORGIA TECH'S FIRST TWO BUILDINGS, THE SHOP BUILDING (LEFT) AND THE ACADEMIC BUILDING (RIGHT), OPENED IN 1888.



THE FOUNDRY IN 1898.



The Woodshop in 1897.

During America's tremendous growth after the Civil War, this nation's industrialists recognized that continued industrial expansion would depend heavily on shops that were managed by professional engineers, not by machinists. These engineers would need to have a strong working knowledge of shops and machines, augmented by a rational, orderly education in mathematics and science as they applied to the problems of industrial machines and processes [3]. The American Society of Mechanical Engineers was founded in 1880 as part of this great movement toward professionalism. The Georgia School of Technology, also known as Georgia Tech, was founded in 1885 to address the same set of concerns as the ASME - the need for technically-trained professional engineers who would promote industrial expansion. In fact, Georgia Tech's founding and early development largely mirrored the early development of the ASME.

As if to provide an example of the difficulties faced by the ASME in its advocacy of engineering professionalism, Southern technical school advocates met enormous resistance from those who misunderstood the role of the engineering professional. When the enabling legislation for the establishment of a technical school was passed in 1885, the Georgia legislators suggested that the school could be best funded if it adopted the commercial 'contract shop' format of the Worchester Polytechnic Institute. Under Worchester's 'contract shop' system, shops supported the school by producing furniture and metal goods for commercial sale; this contract shop system appealed to a Georgia legislature accustomed to the fiscal challenges of an agrarian economy and reluctant to think of engineers as scientists rather than millwrights.

Consequently, the original format of the Georgia School of Technology resembled, in many ways, the school shop model then used at the Worcester Polytechnic Institute. Indeed, when Georgia Tech began classes in 1888, the campus consisted of two similar towers, one housing classrooms and the other shops, indicating that

nearly equal weight was to be given to both the "practical" education and the academic courses. Under the contract shop arrangement "practical" engineering skills were cultivated in four shops: the foundry, the woodworking shop, the machine shop, and the blacksmith shop. Students produced products, including furniture, andirons, and small tools, to support the school. These products were advertised for sale and had to pass inspection by both the shop

foreman and the buyer. After the contract system ended in 1896, Georgia Tech's shop products were used to furnish offices and dormitories on campus.

Because the South urgently needed qualified technical personnel, mechanical engineering was the sole degree program of the new school. The decision to adopt mechanical engineering as the sole path of study, a decision made even as the role of the mechanical engineer was being debated within the ASME [4], would have a profound impact on the new Georgia School of Technology The ASME's efforts to develop a new basis for professionalism, moving from a system grounded in school-based technical practice toward a system grounded in school-based knowledge, would be mirrored by developments in Georgia Tech's curriculum. Under the stewardship of John Saylor Coon, a founding member of the ASME and the first president of the Atlanta section, Georgia Tech's curriculum developed as an implementation of the national engineering society's concerns.



Some of the latters in the  $M\,{\rm Achine}$  Shop in 1895.



Some of the products made in the Wood Shop.

The Smith Shop in 1898.

Arriving late in 1888, John Saylor Coon's work at the Georgia School of Technology began just as the ASME's internal debate over the virtues of scientific theory versus manual shop training in the course of technical education began to heat up. Dr. Coon brought to Georgia Tech not only his skills as an engineer and as an instructor, but also an intense interest in the professional discussions ongoing at the ASME [5]. His participation in these discussions would shape Georgia Tech's curriculum directly for 35 years, and would have a lasting impact on mechanical engineering and Georgia Tech to this day.

Dr. Coon had a strong sense of applied mechanical engineering practice rooted in the traditionally strong engineering shops of the northeast [6]. As a disciple of John Edson Sweet, head instructor at Cornell's Sibley College of Engineering and a vocal advocate of the virtues of the so-called shop-based approach to mechanical engineering, Dr. Coon was an eminently capable master technician. As a result of Dr. Coon's shop-based education and his years of practice as a consulting mining engineer and a steam engine efficiency expert, he had a keen sense of the growing role of scientific rigor in engineering.

Dr. Coon was well trained, well practiced, and well connected within engineering circles; he was also the youngest founding member of the ASME. Within the conference halls of that burgeoning organization, and within the pages of its Transactions, a debate raged over the practical shop-based curriculum versus more theoretical science-based curriculum [7]. Because of Dr. Coon's lively interest in this debate, Georgia Tech would implement the



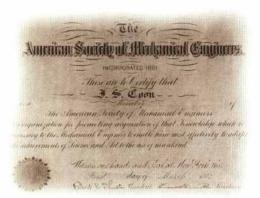
JOHN SAYLOR COON IN 1888.

developing model of science-based engineering education. Dr. Coon set his path by merging personal practice with articles, speeches, and editorials from the ASME [8].

J. S. Coon's emphasis on the theoretical in the Georgia Tech curriculum shows that the ASME's internal discussions over the role of shop and school practice in the engineering curriculum were being played out at Georgia Tech. After all, Dr. Coon was a man well studied in the traditions of shop culture. His insistence that the theoretical be reinforced with scientific tests in the mechanical laboratories, with comprehensive courses in mechanical drawing, and with extensive courses in wood and metal shop practice applied all the methods of technical education then under discussion in the United States. Dr. Coon acted on the notion that theoretical understanding was of fundamental significance, but practical experience was also necessary to produce an exceptional engineer [9].



AN EARIY ADVERTISEMENT (CIRCA 1889) FOR ITEMS MADE IN THE SHOPS.



J. S. COON'S ASME CHARTER MEMBERSHIP DATED MARCH 1882 AND SIGNED BY ASME FOUNDER ROBERT THURSTON.

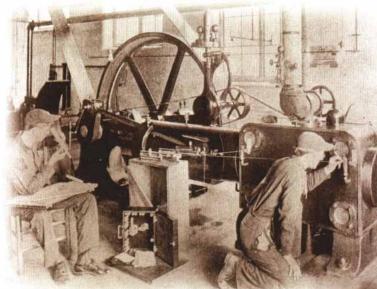


TESTING THE STRENGTH OF MATERIALS IN 1895.

A 1906 class working in the Machine Shop.

Dr. Coon's belief in practical experience is shown in the introduction of the apprentice system in the fall of 1888. Essentially a preparatory year for the Georgia School of Technology, the apprentice year featured a heavy shop emphasis and advanced high school classes, particularly in mathematics and science. The apprentice system helped acclimatize prospective freshmen to the rigors of Mechanical Engineering at Georgia Tech, introducing them to machines and tools they may never have seen before, such as slide rules and planimeters.

Working with a slide rule and planimeter in 1902 to indicate a textile engine.



After Dr. Coon became superintendent of the shops in 1896, the commercial production that characterized the contract system was phased out. Though the shops would continue to produce goods at the insistence of buyers until 1901, pressure from local businesses and a desire to develop the curriculum apace with changes in the engineering profession prompted a reevaluation of the shops' appropriate place and use in the school.

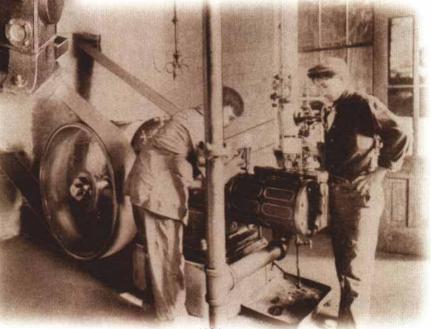
Free from the need to render a profit on instructional time, Dr. Coon implemented an educational format which placed increasing stress on the emerging tenets of quantification and analysis. The revised course of study devised by

The development of science in the last hundred years has been the salvation of man.

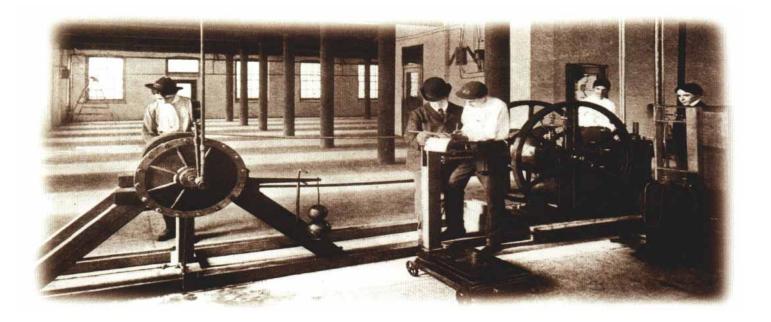
When an engineering structure fails, a man's head should be cut off.

Engineering is common sense first, and mathematics, next.

John Saylor Coon on Ethics and Engineering

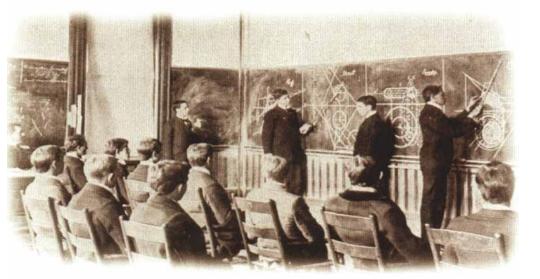


INDICATING AN ENGINE BUILT IN THE SHOPS IN 1904.



Dr. Coon included a new curriculum, a set of revised course descriptions, and a revised catalog statement describing a Mechanical Engineering program that emphasized design, mathematics, and problem solving. Prominent in the new curriculum was a senior thesis, which was an experimental laboratory project emphasizing design and testing. This experimental project requirement survives today as a capstone experimental engineering project course. This new emphasis on quantification and experimentation kept Georgia Tech graduates and the developing industrial practice in the region in step with the latest changes in the profession.

Dr. Coon stressed a continuum between the classroom and the shop floor to prepare his students for the increasing importance of quantification. In the shops, rather than focusing on specific aspects of design or construction in applied engineering, Dr. Coon insisted that students focus on three areas of study so that they were well versed in the abstract process of tackling engineering problems, an orderly advance over the expensive and dangerous method

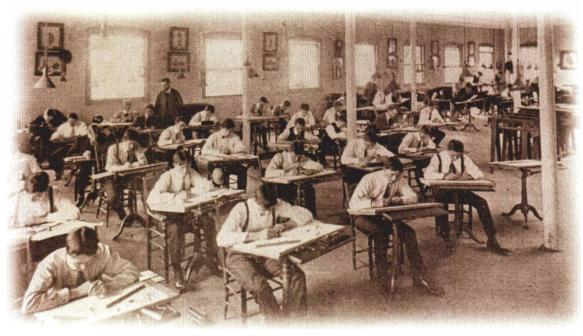


Testing a gas engine for horsepower in 1904.

Much of the advanced instruction at Georgia Tech should be of university grade. This requires wide freedom of action on the part of the instructor. He should not be in the least hampered by any limiting vision of those about him. He should feel perfectly free to present what, to him, is truth based on evidence. Truth, which is based on evidence, comes into sharp collision with the traditions that have come down to us from the intellectually dark past. In the recent past, when there was very little knowledge, man busied himself devising schemes about himself that will not stand the rigid tests we apply now to truth. In Engineering we know, or we don't know, and we cannot except any field of thought from this rigid and fair criterion. Truth never was and never will be discovered by psycbologic introspection, or looking under the bed for spooks. The man who has, by diligence, by hard work, acquired a fair knowledge of some of the sciences knows how, and how only, truth is to be attained. All else is bumbug, some of it interesting, most of it silly slush.

John Saylor Coon on Ethics and Engineering

 $\label{eq:metrical} \begin{array}{l} M \text{ echanical engineering students in a} \\ \text{descriptive geometry class in 1895.} \end{array}$ 



The drawing room for apprentice, junior, and middle classes in  $1902. \label{eq:classes}$ 

This is a room for the discussion of scientific knowledge and truth. When you enter that door you will please leave all myth, superstition, doubt, tradition and opinions on the outside... we will have no guessing here. Either you know or you don't.

John Saylor Coon on Ethics and Engineering

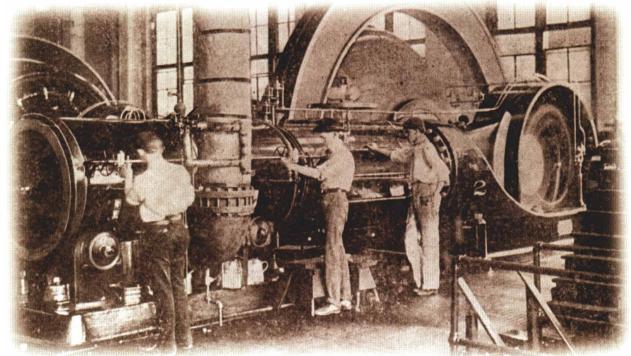
of trial and error. First, students were taught to conceptualize engineering problems in mathematical terms, applying them to evolving bodies of engineering referente information, to design, and to operational problems.

Second, Dr. Coon stressed the importance of mechanical drawing, of mastering the language of technical communication, and precise construction. All students were required to take four years of mechanical drawing, where proficiency was considered almost as important as skills in the shops. Students progressed from freehand drawing in the first year to drawing various

machine parts, and to detailed machine design drawings in the senior year.

Above all, Dr. Coon stressed the importance of hands-on practice in the shop and engineering laboratory to gain an understanding of how machines were built and tested without the pressures and deadlines of a contract shop. It was thought that teaching the fundamentals of engineering from conception to execution first, and the exigencies of business second would produce talented engineers capable of meeting the demands of industry. So great was the need for skilled engineers that Georgia Tech students began to work at jobs in the city of Atlanta while still adhering to the now quite rigorous academic curriculum implemented by Dr. Coon.

This work program to gain practical experience was formalized in 1912 as the Cooperative Education Program. It survives today as the largest optional cooperative program in the country. Students gain valuable work experience in industries throughout the United States as well as on international assignments. Dr. Coon's other two fundamental tenets of mathematics and drawing are also mainstays of today's mechanical engineering curriculum at Georgia Tech. Mathematics continues to be an important component of the bachelor's degree



INDICATING AN ENGINE AT THE GEORGIA RAILWAY AND ELECTRIC LIGHT STATION IN ATLANTA IN 1902.

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program. Mechanical drawing and design remain central elements of the mechanical engineering curriculum although in different manifestations from Dr. Coon's time at Georgia Tech. Today, there are required courses on Engineering Graphics and Visualization, Creative Decisions and Design, and Capstone Design, which are part of a course sequence in design.

Another strong influence that Dr. Coon had on his "boys," as he referred to his students, was the importance of learning ethics. Dr. Coon explained in the Georgia Tech Bulletin:

It will be conceded that it is not sufficient for a course in engineering to turn out technical experts, if it can hope to do even this. But it must do much more; it must turn out men. While the schedule of subjects in this course does not indicate it, it is the prime object to send out young men to engage in the commercial work of the world with high ideals, and a keen sense of moral responsibility. Good character is of more importance to the young engineer than engineering ability [10].

His philosophy set a precedent for today's high standards at Georgia Tech, where students are required to take ethics in engineering courses.

Graduates from the Georgia School of Technology helped build industry in the New South. Historians James Brittain and Robert McMath reached a similar conclusion in their 1977 article "Engineers and the New South Creed." They demonstrate the key role played by the Georgia School of Technology, showing that 70 percent of the Georgia Techtrained engineers who graduated from 1890 through 1898 held technical positions in the fifth year after graduation, and 73 percent held technical jobs ten years after graduation [11]. Furthermore, most of these technical jobs directly influenced Southern development. These Georgia Tech graduates had an enormous impact on Atlanta's emergence as a dynamic industrial and manufacturing hub. In 1899, over 85 percent of these same engineers were still at work in the South. These findings bear out the words of 1891 Tech graduate J. B. McCrary,

owner of McCrary Engineering Corporation, who wrote in Dr. Coon's ASME obituary [12]:

He was a very rigid and exacting professor, but his practical experience and forcefulness of character made a strong impression on the young men who later went out into the engineering world. When Dr. Coon years ago at the beginning of Georgia Tech, became a pioneer engineering educator of the youths of Georgia, he began an education new to the South and one that has since become a tremendous asset to the industrial development of this state, as well as this nation.

Though the New South advocates' vision of Atlanta as a southern version of Pittsburgh or Cleveland was never fully realized, the vital industry, which helped build the South of today, owes its foundations to the efforts of men like John Saylor Coon and the well-trained engineers he produced. Georgia Tech played an important role in the region's development. a swing that was not large enough for a man to lie down in - they now have to submit a sketch of what they want to build, before going into the shop - no swing should be built that is not large enough to support three stout women. John Saylor Coon on Ethics and Engineering

The students were formerly permitted to

go into the wood shops and do work for

though the shop, I noticed a boy building

themselves. One day while walking

Knowledge comes from reflection.

STUDENTS TEST BOILERS AT THE ATLANTA WATER WORKS IN 1904.

Learning comes from books.

Man has been most insistent about things he could not prove.

John Saylor Coon on Ethics and Engineering



THE GEORGIA TECH CAMPUS IN 1912.



ATLANTA IN 1922.

I'm an engineer on the Pennsylvania Railroad. I lower a boot down in a track tank while the train is traveling at 45 miles an hour. How should the mass of water be started? I want a technical answer to that question! If you don't know that instinctively, just write the folks back home and tell them as soon as the ground is right you are coming back and help them plant corn.

John Saylor Coon on Ethics and Engineering

During his thirty-five year tenure, Dr. Coon brought the professionalization of engineering to Georgia Tech, shaped by his belief that engineers with theoretical training and practical experience were best suited to the needs of the South. In keeping pace with the changing nature of mechanical engineering, Dr. Coon brought the fruits of the best industrial method to a region, which, though impoverished, recognized the need for technological innovation. By applying theoretical rigor, practical ingenuity, and a sense of the latest professional developments to technical education in Georgia, Dr. John Saylor Coon helped Georgia Tech evolve as a uniquely southern institution that worked to forge the foundations of the New South.

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John Saylor Coon before his retirement from Georgia Tech in 1923.

ohn Saylor Coon was born on November 22, 1854 in Burdett, New York, where he was educated in the public schools. He attended Cornell University, twenty miles from his home, and received a B.S. in three years and an M.S. (1877), both in mechanical engineering. As a display of his strong mechanical abilities, he built the first dynamo electric machine in the United States, which was exhibited at the Philadelphia Centennial Exhibition in 1876. He remained at Cornell until 1878 as an instructor of mechanical engineering, when he took a position in the mechanical and consulting engineering office of E. D. Leavitt in New York. Later, he worked for Calumet & Hecla Mining Co. in Boston, where he tested

and inspected mining and pumping equipment.

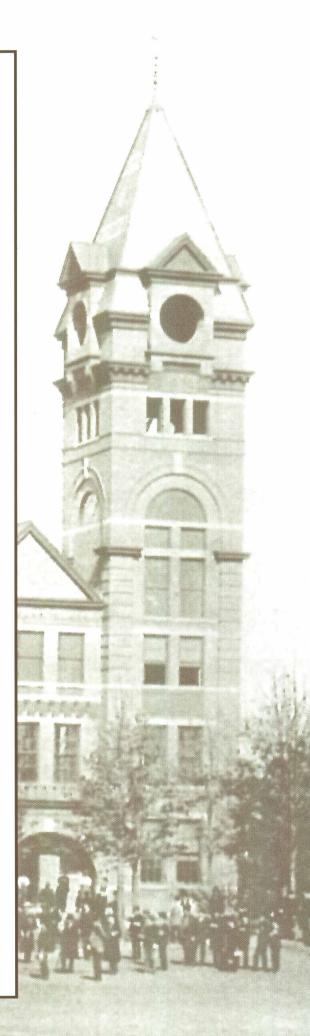
In 1886 he worked in mines and stamp mills for Anaconda Copper Co. in Montana. When the mines closed, he worked as an expert, performing efficiency tests on locomotives and pumps. In 1882 and 1888 he published papers on pumping engines and upright boilers in the *ASME Transactions*.

In 1888, Coon went to the University of Tennessee as the chair of mechanical engineering, and less than a year later he was offered a position at Georgia Tech as professor and head of mechanical engineering and professor of drawing. In 1896 he added superintendent of shops to his list of titles. He received an honorary doctorate from the University of Georgia.

Dr. Coon stayed at Georgia Tech for thirty-five years, and the School's growth and reputation is attributed to him. He retired from Georgia Tech in 1923 and returned to Cannandaigua, New York, where he died on May 16, 1938 [13].

Dr. Coon was a founding member of the ASME, served as the first chair of the Atlanta section, and was a member of Sigma Xi and Phi Kappa Phi. He loved nature, music, fishing, football, and especially, baseball.

Dr. W. H. Emerson wrote in the *Georgia Tech Alumnus* on the retirement of Dr. Coon from Georgia Tech: "His memory will doubtless live at Tech as long as the school endures." This designation from the ASME is testament to the credibility and vitality of that statement.



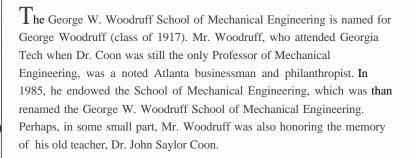
## MECHANICAL ENGINEERING HERITAGE SITE GEORGE W. WOODRUFF SCHOOL OF MECHANICAL ENGINEERING GEORGIA INSTITUTE OF TECHNOLOGY

1888

BETWEEN ITS OPENING IN 1888 AND THE MID-1920S, GEORGIA TECH TOOK A LEADING ROLE IN TRANSFORMING MECHANICAL ENGINEERING EDUCATION FROM A SHOP-BASED, VOCATIONAL PROGRAM TO A PROFESSIONAL ONE BUILT ON RIGOROUS ACADEMIC AND ANALYTICAL METHODS. LED BY JOHN SAYLOR COON (1854-1938), A FOUNDING MEMBER OF ASME, THIS CURRICULUM MERGED THEORETICAL UNDERSTANDING WITH PRACTICAL EXPERIENCE. THE SCHOOL OF MECHANICAL ENGINEERING WAS NAMED FOR ALUMNUS AND BENEFACTOR GEORGE W. WOODRUFF (CLASS OF 1917) IN 1985.



THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS - 2000



### Georgialnstitute of Technology

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