

# Social and Academic Synergies in MIT's Mechanical Engineering Department for Empowering Twentieth-Century Chinese Leaders

by

Joshua Charles Woodard

Submitted to the  
Department of Mechanical Engineering  
in Partial Fulfillment of the Requirements for the Degree of

Bachelor of Science in Mechanical Engineering

at the

Massachusetts Institute of Technology

June 2018

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## ***ABSTRACT***

Between 1854 and 1954, MIT awarded 734 degrees to students studying abroad from China, which is the third largest number among all American universities during this time period. Within the MIT Mechanical Engineering department, the number of students is well within the hundreds. While these students studied engineering topics uniquely influenced by the developments and needs of twentieth-century China, their courses of study were furthermore influenced by the tutelage they received from a small set of MIT professors willing to cross cultural gaps. These students also had support through affinity groups and made notable impacts on MIT's social landscape during their time at the Institute. Finally, they went on to play significant roles in the subsequent industrialization of China. What, then, were the academic and social environments in the twentieth-century MIT Mechanical Engineering department that led to the successful graduation of students studying abroad from China, and what lessons can be applied to present-day MIT? Based on information from the 1931 *MIT Chinese Students' Directory*, which provides data on Chinese students from 1877 to 1930, Chinese students' social and academic presence at MIT was quantified, and efforts were made to identify their research advisors and academic mentors, and also to delineate what interpersonal relationships and connections existed between the faculty and the students. In the first decades of the twentieth century, several Mechanical Engineering professors took on more Chinese students than others, most notably, George B. Haven. From the analysis of 20+ theses written by these students between 1877 and 1931, the Mechanical Engineering faculty certainly rallied to support these students as they faced linguistic, cultural, and other challenges during their courses of study. This cohort of Chinese mechanical engineering students was responsible for inventing the first Chinese typewriter, doing the earliest mechanical tests on China-native materials such as ramie and bamboo, and was fundamental to the development of the Mechanical Engineering department at MIT's sister school, Tsinghua University in Beijing.

Thesis Supervisors:

Dawn Wendell Ph.D.; Senior Lecturer in Mechanical Engineering

Emma J. Teng, Ph.D.; Professor and Head of Global Studies & Languages



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## *ACKNOWLEDGEMENTS*

I would like to extend my sincerest thanks to Dr. Dawn Wendell and Professor Emma Teng for their assistance in drafting and doing research for this thesis. Dr. Wendell provided invaluable guidance in creating the thesis outline and providing insightful direction in delving into MIT's academic history. Professor Teng, with her wealth of knowledge on early Chinese students immigrating to MIT, and of China in general, was indispensable in providing contextualization of their Chinese students' experiences at MIT and directing topics of historic research to elaborate further on.

None of this work would have been possible without the extensive archives and collections of the MIT Institute Archives, and the generous library staff working there routinely.

For the "MIT'S CHINESE GRADUATES AND THEIR IMPACT ON THE DEVELOPMENT OF TWENTIETH CENTURY CHINA" section of this thesis, all of the biographical information on the Chinese graduates comes from the book "Bridge of Education: From Tsinghua to MIT." Special thanks to the Marjorie Yang and the Esquirol Group for their work in creating this compilation; without this book, the "IMPACT" section of the thesis would not be possible.

## 1. INTRODUCTION

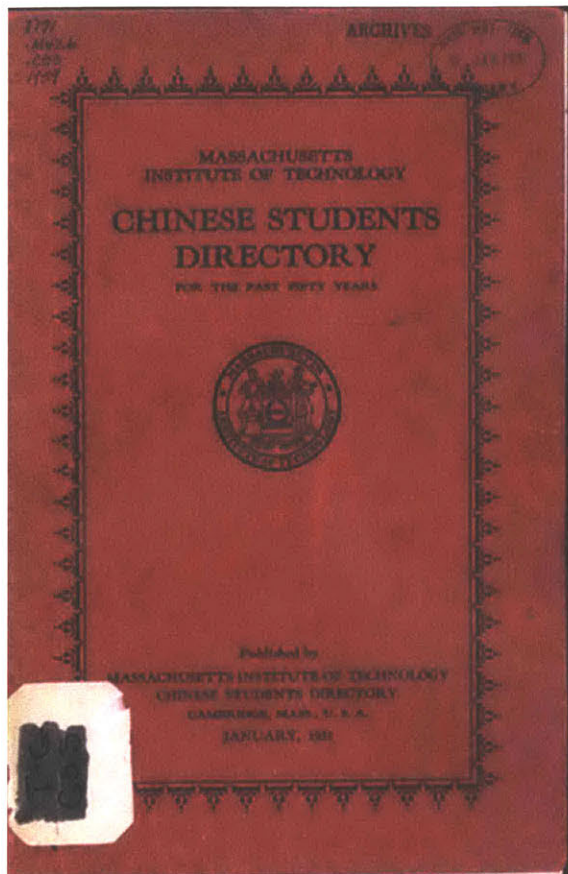
“工程,”romanized<sup>[1]</sup> as *gongcheng*, is the Chinese word for the act of engineering, and appears in accounts of civil engineering projects during periods as early as the Northern Qi Dynasty, nearly 1,500 years ago (Wang, 2015). Although the term 工程 initially referred to large-scale construction projects, it became an umbrella term for the disciplines, proficiencies, and general body of knowledge necessary to create engineering feats in modern China.

Beginning in the early 1870s, China began sending a sizeable wave of students abroad to learn Western sciences and technology and bring their newfound expertise back to China in order to facilitate its own modernization. In 1877, twelve years after its founding on April 10<sup>th</sup>, 1861, the Massachusetts Institute of Technology registered its first Chinese student in 1877, who had to travel for weeks on end from overseas to reach the Institute (Koo, 1931). This first student studied mechanical engineering. In the 1870s, the Chinese Educational Mission, a program that encouraged Chinese students to study-abroad in American colleges and universities, was slated to send roughly 120 students to America, but it was cut short due to pervasive anti-Chinese sentiment in America, culminating in the Chinese Exclusion Act of 1882 (Teng, 2018a). From that point, the enrollment of Chinese students at MIT has fluctuated with the political and social climate of China, falling around the Sino-Japanese War and Boxer Uprising of the early 1900s, reaching peaks in the early 1920s, and falling to a slow trickle during the Communist Revolution of 1949. That is where the number stayed, until Chinese Premier Deng Xiaoping’s *Gǎigé kāifàng* (“reform and opening-up”) policy in 1978. As of 2018, there are roughly 1,740 students from Asia currently enrolled at MIT, with China being the most well represented at a count of 947 (MIT, 2018a).

Between 1854 and 1954, MIT awarded 734 degrees to students studying abroad from China, which is the third largest number among all American universities during this time. Within the MIT Mechanical Engineering department, the number of students is well within the hundreds. While these students studied engineering topics uniquely influenced by the developments and needs of twentieth-century China, their courses of study were furthermore influenced by the tutelage they received from a small set of MIT professors willing to cross cultural gaps. These students also had support through affinity groups and made notable impacts on MIT’s social landscape during their time at the Institute. Finally, they went on to play significant roles in the subsequent industrialization of China.

[1] The process of converting Chinese characters into phonetic pronunciations based on the alphabet is called romanization. One character may be Romanized a number of different ways as the result of different romanization styles, but the official conversion system is the Pinyin romanization. In the early twentieth century though, the Wade-Giles system was heavily used (“Pinyin romanization,” n.d.)





**COURSE AND THESIS DIRECTORY**

**COURSE I  
CIVIL ENGINEERING**

Chang, Jen	M.S. 1929	Discharge Side Weir with and without Baffles.	Loo, Clarence C. T.	B.S. 1929	An Investigation of the Stresses in a Continuous Two-span Highway Bridge.
Cheng, Chung Wu	B.S. 1922	A Design for a Pin-Connected Truss Double Track, through Railroad Bridge.	Miao, En Chao	B.S. 1918	A Study of the Development of the Steel Freight Cars.
Chen, Shao Chung	B.S. 1914	A Design for a Single-Track Pin-Connected through Railroad Bridge.	Shih, Kailan	M.S. 1922	Slope Deflection Method and its Application to Rigidly Framed Structures.
Chow, Z. Y.	B.S. 1914	Design of Water System for Duxbury, Mass.	Shi, Tse Sing	B.S. 1918	Water Supply and Sewage Disposal in Various United States Cantonnments.
Hsiao, Tsin	B.S. 1926	A Study of the Hydrostatic Pressure Acting against Cellular Floors and Similar Structures.	Sun, Arthur Kwang I	B.S. 1926	Effect of Steaming upon Setting of Cement Mortar.
Hsia, Wen Chi	B.S. 1926	A Study of Methods of Control Used in Aerial Mapping.	Tan, Chen	M.S. 1919	Test of Gardner Falls Hydroelectric Plant of the Greenfield Electric and Power Company.
M.S. 1926	Plan for the Establishment of a Geodetic Survey in a Country not yet Systematically Surveyed.	Tao, Pao Kai	B.S. 1929	A Study of the Economy of Locomotives of Various Types.	
Hsu, Chuan Yuan	B.S. 1918	A Study of Locomotive Superheaters.	Tong, Pao Tung	B.S. 1915	An Investigation of Theory and Practice in the Design and Construction of Light-houses.
Hsieh, Cho Pin	M.S. 1919	Test of Gardner Falls Hydroelectric Plant of the Greenfield Electric and Power Company.	Tow, King	B.S. 1920	Comparative Design for a Steel Arch Bridge with Both Cantilever and Simple Span Truss Approaches (with R. L. Barret, Jr.).
Huang, Chi Yen	B.S. 1918	Design for a Reinforced Concrete Dam Tainter Gates Crest.	Tsai, Fang Ying	M.S. 1928	Physical Properties of Shanghai Silt Deposits.
Huang, Shen Heng	B.S. 1917	Tests upon Bamboo as a Concrete Reinforcement.	Tsu, Hsueh Yu	B.S. 1922	Proposal for Relief of Traffic Congestion on Revere Beach Parkway in Everett, Mass.
Kuo, Tien Pang	B.S. 1924	Tests upon Bamboo as a Concrete Reinforcement.	Tu, Yu Chung	B.S. 1918	Review of Methods of Flood Protection.
Kuo, Y. M.	B.S. 1919	General Survey of Municipal Refuse Disposal.	M.S. 1918	Study and Design of a surge Tank.	
Lew, Shoh Young	B.S. 1924	A Comparison of the Relative Economy of a Steel Girder Bridge and a Cut-Stone Arch Bridge with Reference to Conditions in China.	Wu, Liu Sheng	B.S. 1930	A Method of Determining Influence Data for the Reactions of a Continuous Beam.
Li, Sze Mien	B.S. 1926	A Study of Recent Developments in Aerial Surveying.	Young, Joe Wah (Joe, Young Wah)	B.S. 1924	Tests upon Bamboo as a Concrete Reinforcement.
Lin, Gue Call	B.S. 1918				

**COURSE II  
MECHANICAL ENGINEERING**

Chan, F. C.	B.S. 1925	Efficiency Determination of the Motorbike Heat.	Chang, K. C.	B.S. 1921	Effect of Cooling and Annealing on Micro-structure of Cast Iron.
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Figure 1: The *Chinese Students' Directory*, written in 1931 by the MIT Chinese Students Club, and primarily compiled by Eugene Chen Koo. This reference book was written to foster connections between successful Chinese graduates of the Institute. The photo on the left is the front cover of the *Chinese Students' Directory*, and the photo on the right is a capture of the directory listing that organized Chinese students alphabetically, while listing their graduation year and thesis titles.

Of the 65 Chinese study-abroad students who studied at MIT's Mechanical Engineering Department between 1877 and 1931, 52 of those students successfully graduated with a Bachelor of Science or a Master of Science in Mechanical Engineering, a success rate of 80%. Given this success, what were the academic and social conditions in the twentieth century MIT Mechanical Engineering department in particular, that led to the successful graduation of students studying abroad from China, and what lessons can be applied to present-day MIT? Of the 20 courses of study available at the MIT between 1877 and 1931, Mechanical Engineering and Electrical Engineering were the two most popular among Chinese study-abroad students, which reflects the priority that both the Chinese government, and the students themselves, placed on learning those fields. Moreover, Mechanical Engineering included the study of textiles, which was the top export from America to China (and vice versa) in the early twentieth century. Of the 381 graduates in the 1931 *MIT Chinese Students' Directory* (see Fig. 1), the graduates of the Mechanical Engineering department constitute 15% of total graduates between 1877 and 1931, second only to Electrical Engineering's 19%. Based on information from the *Chinese Students' Directory*, Chinese students' social and academic presence at MIT was observed, and efforts were made to identify

their research advisors and academic mentors, and delineate what impacts they had on the development of these study-abroad students. Several Mechanical Engineering professors took on more Chinese students than others, most notably, George B. Haven. From the analysis of 20+ theses written by these students between 1877 and 1931, the Mechanical Engineering faculty certainly rallied to support these students as they faced linguistic, cultural, and other challenges during their courses of study. This cohort of Chinese mechanical engineering students was responsible for inventing the first Chinese typewriter, doing the earliest mechanical tests on China-native materials such as ramie and bamboo, and was fundamental to the development of the Mechanical Engineering department at MIT's sister school, Tsinghua University in Beijing.

## 2. METHODOLOGY

A crucial starting point for the research in this thesis was *The MIT Chinese Students' Directory*. The *Chinese Students' Directory* was a document created through a collaboration with MIT then-president Karl T. Compton, and Eugene Chen Koo (Chemical Engineering B.S., Class of 1929) and was published by MIT in January 1931. Described by President Karl T. Compton as “a valuable aid in maintaining those personal and professional relations which should be valuable and lasting by-products,” the Directory sent out surveys to hundreds of Chinese graduates and compiled information about their majors, theses, and graduation years. By the time of the Directory's publication, MIT had overseen the education of 400+ Chinese students studying abroad (Koo, 1931). This directory was crucial in ascertaining the identities of the earliest Chinese Mechanical Engineering majors, and was consulted regularly throughout the composition of this work (Koo, 1931).

Using the 1931 *Chinese Students' Directory* as a starting point and a reference, the names, graduation years, and thesis topics of all Chinese study-abroad students between 1877 and 1931 was tabulated in an Excel sheet. Then, the thesis titles were cross-referenced with the MIT Institute Archives database to identify overlapping academic advisors and subject breakdowns. Academic advisors who had mentored high volumes of Chinese study-abroad students were paid special attention to, in addition to students who had an outstanding extracurricular or academic performance while attending the Institute. Efforts were made to trace interactions between faculty and Chinese study-abroad students in historical yearbooks, *The Tech* Newspaper articles, *The Technology Review* magazine, reading the publications of faculty members (with high numbers of Chinese mentees) and by analyzing the theses of the study-abroad students themselves. The MIT Institute Archives was heavily consulted while doing this research. In sum, the Bachelor of Science and Master of Science thesis papers of 21 study-abroad students were read, prioritized by whether they worked with a “high-volume” faculty member, or had another notable academic or social achievements.

The reports to follow are the most interesting notes arising from this exploration, supplemented with contextual information about the social and economic conditions of China in the late nineteenth and early twentieth century, and contextual information about MIT and the Mechanical Engineering department during the same period of time. Through an understanding of

the environmental contexts these Chinese study-abroad students hailed from, societal influence and pressures on those students can be inferred.

To determine where the career trajectories of the study-abroad students of interest, *Bridge of Education*, a compilation by Marjorie Yang and the Esquirol Group, was consulted, almost exclusively.

### 3. HISTORICAL BACKGROUND

#### 3.1 MIT Mechanical Engineering in the Early Twentieth Century

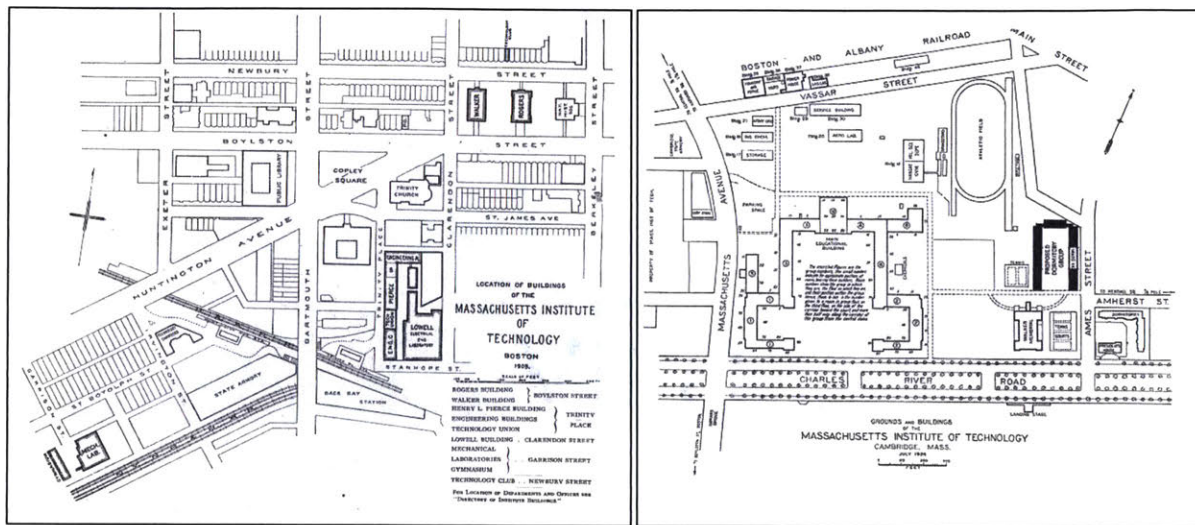


Figure 2: Maps of MIT in the Early Twentieth Century. The leftmost map represents MIT as it looked in 1905, primarily located in the Rogers Building in Boston. The rightmost figure represents how MIT looked in 1924, at its new location on the Cambridge side of the Boston River (“Early Maps of the Massachusetts Institute of Technology Boston, 1905 | Cambridge, 1916 | Cambridge, 1924,” n.d.).

MIT was in a period of significant growth and development during the early twentieth century, characterized by the consolidation of subjects of study, shifting popular majors, comparatively higher rates of presidential turnover, and most significantly, the completion of MIT’s transition from its Boston campus location to its extant Cambridge-side location. The MIT experienced by Chinese students travelling from abroad looked very different, depending on when they studied between 1877 and 1933.

During the move to Cambridge in 1916, the size of the campus saw a significant increase: at the cost of \$ 6.7 million dollars (\$160 million dollars today), MIT acquired 12 acres for educational buildings, 13 acres for future developments, and 25 acres for athletic fields, Walker Memorial, dormitories, and other student spaces (“Statistics of New Tech Building,” n.d.).

The MIT Department of Mechanical Engineering (Mech E.) has been around since MIT’s inception in 1865. The first Mechanical Engineering laboratory was built in 1874, several blocks away from the main Rogers campus in Boston (see Fig. 2). After MIT’s move to Cambridge, all

of the important laboratory and teaching spaces were consolidated into a single eight-acre main campus space (as seen in Figure 3) (Koo, 1931).

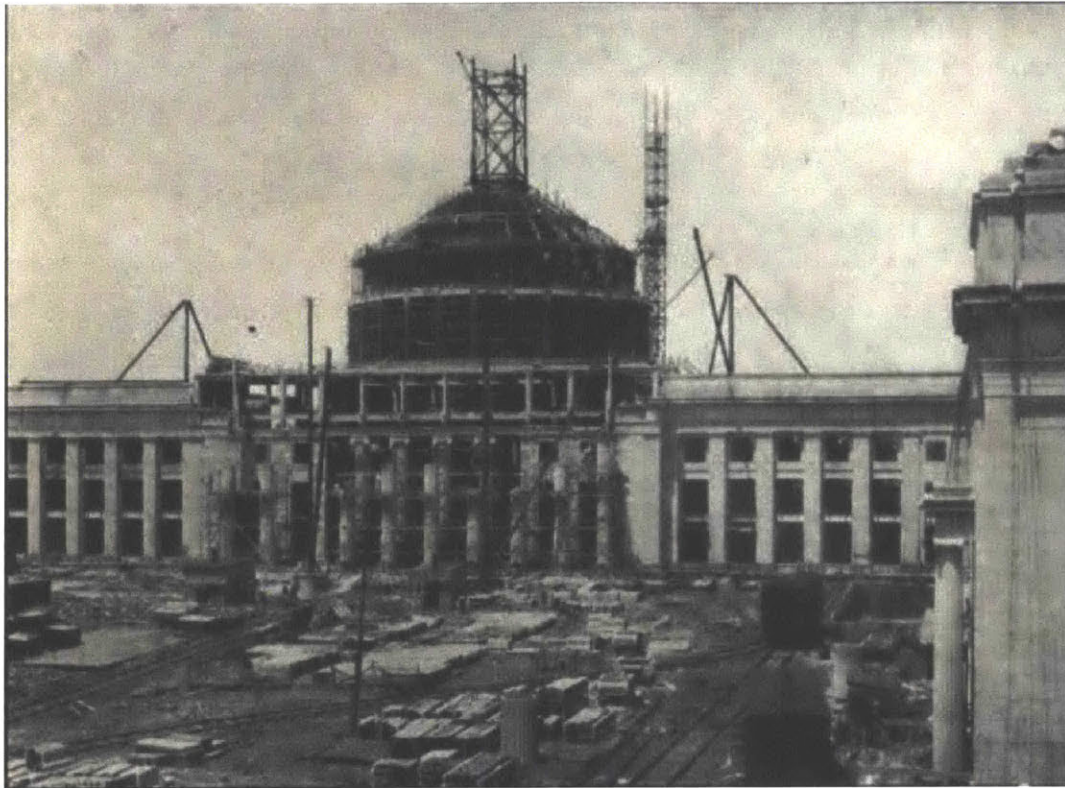


Figure 4: A photograph of the iconic MIT Dome, still under construction, and overlooking an unfinished main court (today, referred to as Killian Court). This photo dates back to 1915, but was taken from the 1917 edition of the MIT Technique, the school yearbook.

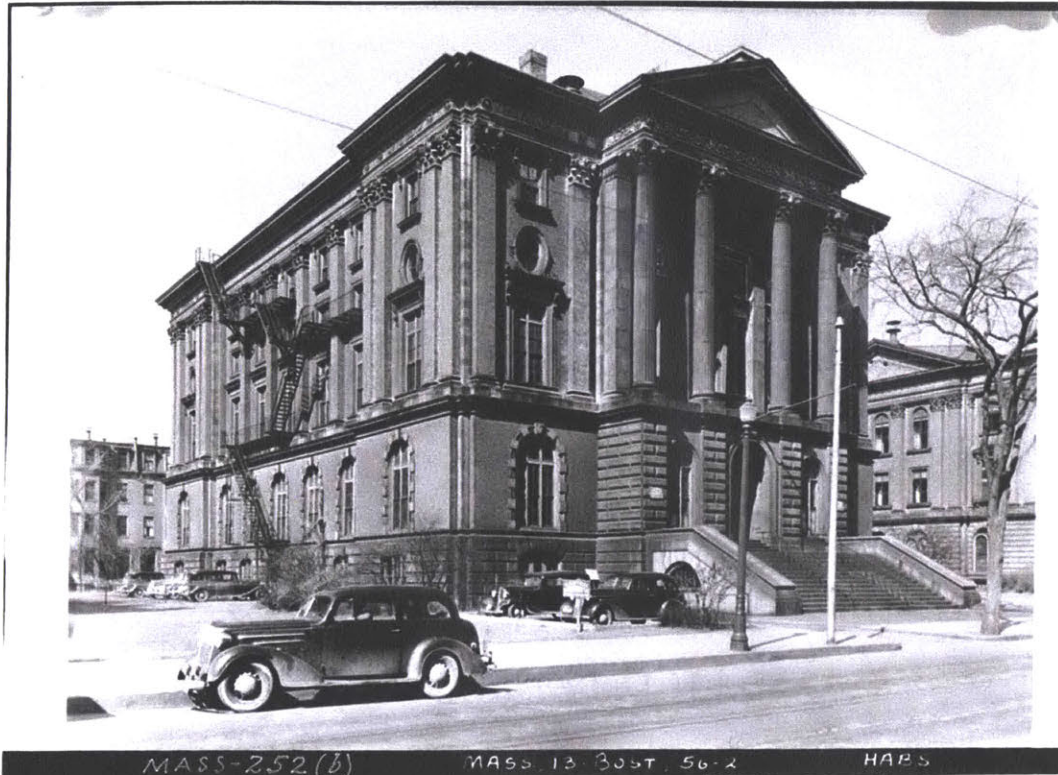


Figure 5: The Rogers Building, at MIT's Boston Campus, taken in 1939 (Historic American Buildings Survey, Creator, and William G Preston, 1933).

From 1911 to 1933, Professor Edward Furber Miller was the department head of Mechanical Engineering department. Professor Miller, a Class of 1886 Mechanical Engineering graduate, was attributed with significantly influencing the development of all mechanical Engineering Department laboratories, overseeing the transition of the department “from the modest beginnings in the basement of the Rogers Building (Fig. 5) to the [then-present] extensive equipment in ten or more laboratory divisions now under the department” (Fig. 4) (Anon., 1933). Due to the timing of Professor Miller’s tenure as Mechanical Engineering department head, he also oversaw the exploding popularity of the Mechanical Engineering Department within the Institute, as well as the peak period of Chinese students studying abroad at MIT between 1910 and 1925 (Koo, 1931; MIT Institute Archives, n.d.; *Technique 1917*, n.d.). Empirical studies and hand-on learning experiences have been fundamental to the Mechanical Engineering department since it took its current form as “Course 2.” During the time of the greatest influx of Chinese students “Mens et manus,” or “mind and hand” was an influential ideology that flowed throughout the spirit of MIT, encouraging the active application of MIT’s theoretical teachings to tangible solutions to real-world problems.

During the period between 1877 and 1931, the time of the first recorded Chinese study-abroad student at MIT and the publication of the *Chinese Students’ Directory*, the Institute had a total of 12 different presidents; in other words, 58% of MIT’s 19 presidents served during a period that constitutes only 35% of the Institute’s entire history (MIT, 2018b). As the result of the post-war industry demands on the Institute, 1920s inflation, and the full onset of the Great Depression on American society, MIT as an entity was in a rough position, which surely weighed heavy on

those presidents (Stratton, 1954). It is unclear which of these presidents were particularly supportive of the influx of Chinese study-abroad students during their tenure, but one president who demonstrated commitment to supporting the Chinese students was Karl T. Compton.



Figure 6: A photograph of MIT President Karl T. Compton surrounded by a group of excited students. Dr. Compton is the left-most figure sitting on the couch, while his wife, Mrs. Compton, is closely situated next to him, second farthest to the left.

At 19 years, Dr. Karl T. Compton's tenure as President of MIT is the longest in the Institute's history, during which he is credited with increasing the institute budget by an order of magnitude (from \$3.7M to \$46.1M), creating the American Institute of Physics, and, according to his Medal of Merit, shortening the duration of the Second World War through his scientific contributions to the effort (Bush, Killian Jr., Loomis, & Swope, 1954). Dr. Compton was known through the States for his technical proficiency and leadership gifts, publishing 379 research papers during his time, while also refining the graduate study experiences, reprioritizing Humanities studies, and establishing the School of Science (Bartlett, 1954; Killian, Jr., 1954; Stratton, 1954). Moreover, even though Dr. Compton's tenure as president only has three years of overlap with the period of interest of this thesis, his influence was integral to the creation of the *Chinese Students' Directory*, which is the foundation on which the historical experiences of Chinese students was constructed. In the *Chinese Students' Directory*, Dr. Compton was listed on the first page as an Honorary Advisor, and has his Message printed in the book even before the Governor of Massachusetts (Koo, 1931); clearly, the Chinese students at the time thought his role in the preservation of their legacy was crucial as well.

During the early twentieth century, the Mechanical Engineering department was of a size that it was easy to build a rapport with most of the members of the department. The department

would hold official “smokers,” a defunct term for a social gathering of men (Merriam-Webster, 2018), and other social events to encourage intradepartmental camaraderie (MIT Tech Club, 1913).

The changes MIT was undergoing could be gleaned through the interests of the students, at different time points in the early twentieth century. Between 1912 (when the MIT campus was still situated in Boston), 1917 (the year after the campus move), and 1921 (the year when the population of Chinese studying abroad students reached its maximum at sixty), certain numerical trends emerge (Koo, 1931). In 1912, Civil Engineering is the largest department, with 220 students enrolled in total, followed by Electrical Engineering with 210, and Mechanical Engineering in 3<sup>rd</sup> place with 198 students (*Technique 1912*, n.d.). By 1917, the trend has flipped on itself: Mechanical Engineering is the new largest department, with an enrollment of 279 students, followed by Electrical Engineering at 235, and 188 students enrolled in Civil Engineering (*Technique 1917*, n.d.). From analyzing the numbers themselves, there was a shifting interest towards the pursuit of Mechanical Engineering, and this trend can also be observed in what Chinese students chose to get Bachelors’ degrees in. According to the *Chinese Students’ Directory*, of the 381 Chinese study-abroad students who are recorded as receiving degrees between 1877 and 1933, Electrical Engineering and Mechanical Engineering are the most popular majors, with graduation numbers of 71 and 59<sup>[2]</sup> students (19% and 15%), respectively (Koo, 1931). Along with the increase of student enrollment in the Mechanical Engineering department, the department faculty also increased from 13 full time professors (in 1912) to 17 full-time professors and 30+ staff assistants by 1921 (*Technique 1922*, 1922). Chinese students made up the largest group of minority students at MIT since 1910, up to today (Yang, 2016).

Chinese Students Graduating with a MechE Degree by Year

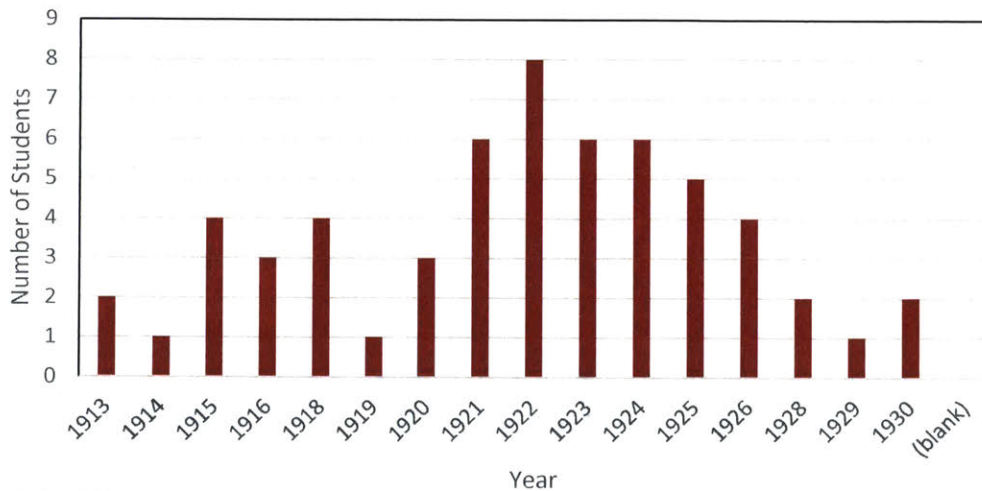


Figure 7: A histogram of the number of Chinese Students graduating from MIT with a Bachelor of Science or Master of Science degree in Mechanical Engineering,

[2] In the Chinese Students Directory, there is a discrepancy between the quantity of Chinese study abroad students given as being in Mechanical Engineering, and the number of study abroad students listed as having studied Mechanical Engineering. 59 is the quantity given for total students in Mechanical Engineering between 1877 and 1931, but 65 is the number of students in Mechanical Engineering based on hand count (13 of which never received degrees).

between 1913 and 1930. During this period, the peak number of Chinese students at MIT was in 1920, and between 1920 and 1924, the most Chinese students graduated.

### *3.2 China in the Early Twentieth Century*

In the early twentieth century, China was in a period of rapid industrialization and educational reform, but in the first decade of the century, China was grappling with the decline of the Qing dynasty (China's last dynasty), the impact of foreign imperialism, the failure of the self-strengthening movement in the mid 1890s, and the Boxer Uprising at the turn of the century.

The 1842 defeat of China by Britain in the Opium War and the resulting seizure of Hong Kong and other territorial concessions to Western powers greatly shaped Chinese elites' perception of themselves in the world, and redoubled their motivation to want to change it (Ogden, 2013). Initiated by several individuals, including Feng Guifen and Prince Gong, the Self-Strengthening Movement from 1891 to 1895 was the Chinese response to the ballooning threat that foreign influence posed to its autonomy. The creation of China's first modern navy, several modern military arsenals, and a foreign relations office were some of the most notable changes from the Self-Strengthening Movement, which essentially looked to adopt Western-style military and civil institutions in order to strengthen China against foreign imperialism (Wright, 2015). The subsequent defeat of China in the Sino-Japanese War of 1895 signaled a failure of the movement to effectively insulate and protect China. By the late 1890s, China saw semi-regular uprisings led by frustrated groups of people, of which, the largest and most intimidating movement was the Boxer Uprising.



Figure 8: Printed photograph of a foreign troop walking alongside Chinese executioners, a image taken near Shanghai's international settlement, presumably



captured during China's Boxer Uprising in the early twentieth century (Bickers, 2000).

The employment landscape and economy of China in this decade was highly disrupted by modernization through the form of Western-built railroads and telegraphs, and the rural parts of the country especially felt the sting (Silbey, 2012). The Boxers, or "fists united in righteousness," is a reference to a rural martial arts practice, but their beliefs hinged upon blaming foreign missionaries and Christian converts for the drought rural China was facing at the time. Placards and pamphlets allowed this set of beliefs to propagate like wildfire, aided in how the Boxers offered an easily understandable world view with a solution to all of China's ills, that resonated with the common people's frustrations (Silbey, 2012). With the slogan "exterminate the foreigner; support the Qing Dynasty," the Boxer Uprising garnered significant following of anywhere from 500 thousand to 1 million people and most notably, the implicit support of the Qing Dynasty. Boxer Uprising supporters, over the course of two weeks, mobilized to slaughter foreign railroad engineers, telegraph workers, and missionaries (Silbey, 2012). This carried on for months until the Boxers suddenly disbanded, leaving the Qing Dynasty exposed to the wrath of Western powers (Bickers, 2000).

In line with the other Western countries demanding financial compensation from China for the loss of life and property, America also demanded monies, but it overcharged China. By 1911, instead of directly returning the excess charged funds to China, America created the Boxer Indemnity Fund, which financially supported Chinese students to study-abroad in America. This funding was also used to establish the Tsinghua School in Beijing (discussed in detail below).

Due to country-wide economic crises, and mounting frustrations of the working classes towards the government's failure to resist Western influence, the Xinhai Revolution was staged, overthrowing the Qing Dynasty (Ogden, 2013).

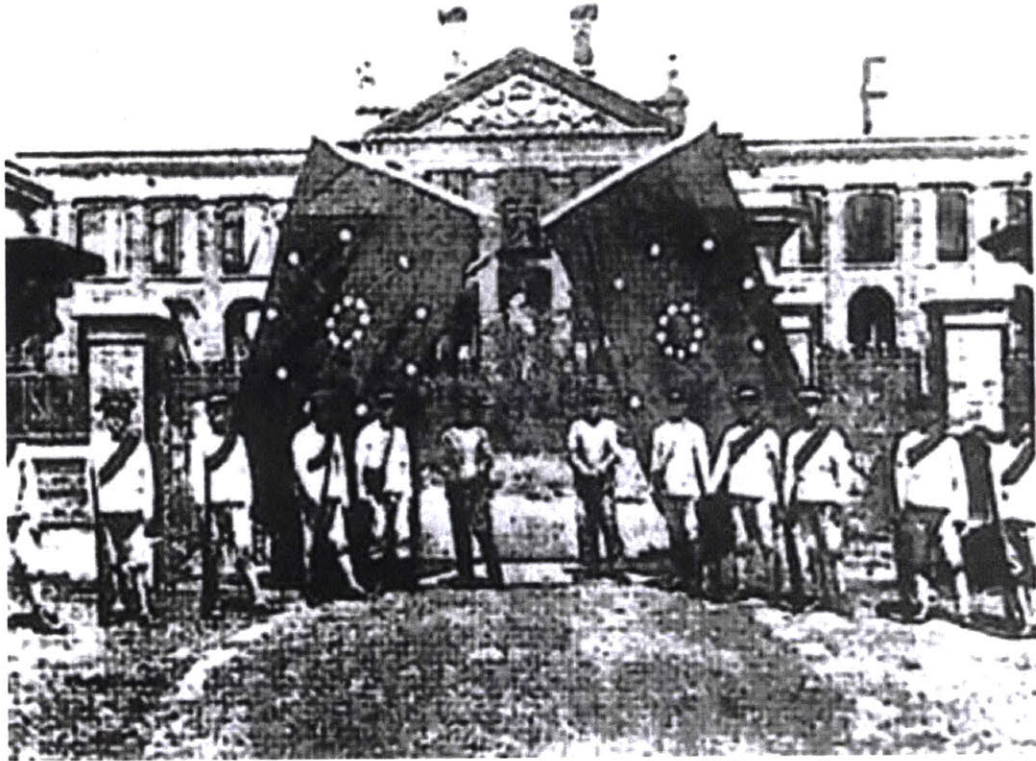


Figure 9: A photograph of the founding of the Hubei Military Government of the Republic of China, taken after the successful overthrowing of the Qing Dynasty (during the Xinhai Revolution). This photo is in Wu Chang, on October 11, 1911 (S. Li & Yuan, 2015).

Following the Xinhai revolution, Sun Yatsen, the leader of the Nationalist Party and President of China's new Republic, had a vision for new China that placed modernization and industrialization at the forefront of the government's objectives. His Industrial Plan was the first of its kind, setting a model for the 5-year or 10-year development plans that have become ubiquitous in the Peoples' Republic today (Kirby, 2000). In line with Sun Yatsen's vision, by 1912, the National Government instituted “认字癸丑” or *renzi guichou*, a policy intended to encourage higher education through a new degree system, a professor council, undergraduate and graduate degrees, and most notably, a renewed effort to study modern Western science courses (Wang, 2015).

As early as 1914, in issue of the *Chinese Students' Monthly*, a journal written and edited by Chinese students in the US, there was a clear acknowledgement of the pursuit of engineering as a trend amongst students studying abroad in America from the Tsinghua preparatory school (Chinese Students' Monthly, n.d.):

*“Of the seventy-five new students who entered college, fifty-one are taking some kind of technical study, while there are only twenty-four enrolled in non-engineering courses, such as liberal arts...”*

More important is what that Industrial Plan stipulated: development of China's resources and consolidation of control under a centralized government (Kirby, 2000). By 1919, Sun Yatsen was calling for a national Chinese-owned rail, the creation of a dam on the Yangtze River, light and heavy industry, oil and coal prospecting, and other elements of modernization, even creating the

Ministry of Industry to carry out the encouragement and management of these efforts (Kirby, 2000; Wang, 2015). In fact, Sun Yatsen is quoted as defining the early twentieth century as the “age of electricity,” and had been a proponent of the electrification of China since 1893, but the government had to create a pipeline of engineers, scientists, and technical minds to usher China into the modernity of Sun’s dreams (Kirby, 2000). Interestingly enough, Electrical Engineering was the most popular choice of major for Chinese students pursuing Engineering degrees at MIT in this era (Koo, 1931).

### ***3.3 Tsinghua University***

Founded on Boxer Indemnity funds in 1911, Tsinghua College was created by the Qing government as a preparatory school for students heading to America to pursue higher education at MIT and other high-ranking colleges. 1914 was the year of the earliest students from Tsinghua successfully graduating from MIT: “The May 1914 edition of MIT Alumni Magazine reported on the ceremonious response of the Chinese media to the graduation of seventeen Chinese students” (Yang, 2016). Before Tsinghua School was abolished in 1928, it graduated a total of 112 students from MIT (12 percent of all students trained at Tsinghua) (Yang, 2016). 220 graduates of Tsinghua also graduated from MIT between 1910 and 1928, 33 of them earning doctoral degrees, and 92 of them earning master’s degrees. The current president of Tsinghua University, Binglin Gu, in 2016, enthusiastically recounts the MIT-Tsinghua relationship:

“Tsinghua became a place where American educational ideals interacted and mingled with Chinese society. In this way, Tsinghua became a window to the outside world for the Chinese people as well as a place which valued the interaction between Chinese and western cultures. More importantly, it set a good example for Chinese people pursuing ‘academic independence’ and developing the country with knowledge” (Yang, 2016).

## ***4. MIT’S ROLE IN NURTURING CHINA’S TWENTIETH CENTURY MECHANICAL ENGINEERING LEADERS***

### ***4.1 Chinese Students in MIT’s Mechanical Engineering Dept.***

For Chinese students to attend the Massachusetts Institute of Technology during the early 1900s was seen as mutually beneficial, not only for the Chinese students studying abroad, but also for the Institute itself. The opportunities for cultural exchange were multivariate, but ethnic prejudices were not wholly absent from the Chinese study-abroad students’ American experience.

Some of the earliest Chinese students were sent abroad during the post-Opium War self-strengthening movement of the late 19<sup>th</sup> century. The earliest Chinese student to graduate from an American university, Yung Wing (Yale Class of 1854) was brought to the states by Christian missionaries, after which, he returned to China in order to found the Chinese Educational Mission (Teng, 2018a). The students from these early initiatives clearly would return to their homeland to be highly influential in the early stages of Chinese modernization (Wang, 2015). It makes sense that resultingly, China continued to emphasize educating students in Western sciences and

technologies, through the twentieth century. As important as educational mission was to China, the journey to MIT from China was a significant endeavor and investment of time and energy. In the mid-19<sup>th</sup> century, the journey to America via ships along the Atlantic could take an upwards of 98 days, but by the mid-1920s, MIT students like Yu Hsiu Ku (B.S. 1925 in Electrical Engineering) were recorded completing the journey from China to Boston in 24 days (Teng, 2018b).

Many Chinese study-abroad students spent time at Tsinghua School in between their high school and MIT experience, and would enter MIT with sophomore or junior status (Esquiél Group, 2016). When they would arrive, the needs of a developing and industrializing China played a significant role in the way Chinese students studying abroad would select their course of study at the Institute (Esquiél Group, 2016).

MIT was excited to welcome Chinese study-abroad students in their midst, seeing this as a worthwhile endeavor. The MIT Alumni Association, in fact, is on record discussing the importance of attracting more talent from China, to be educated in western sciences and sent back, as early as 1914 (MIT Tech Club, 1914). That is not to say that everyone whole-heartedly shared in the sentiment of welcoming Chinese to the Institute. Nationalistic pride and ethnic prejudice was not an uncommon obstacle for the early Chinese to face.

In a 1917 issue of *The Technology Monthly Engineering Journal* (a syndicated journal written by MIT to keep its constituents informed of technological advances), Chemical Engineering graduate and Chinese study-abroad student Lee Ting Chen discusses the shortcomings of the typical American college student disposition:

*[The ordinary American student] has had a little history of the world and certainly a course in American History which has carefully eliminated the dark side of the past and emphatically eulogizes the cases of success in the life of the republic. ... [H]e turns a sympathetic smile on his Chinese friend, quietly commiserating him for the hard lot that befalls his people. Occasionally, in an attempt to relieve his friend of the probably embarrassing situation to which he is subjected, he might wind up the conversation by saying, "The Chinese however are an intelligent race; their people are intelligent looking" (Chen, 1917).*

Cultural clashes aside, the Institute did put forth a strong foot to support Chinese study-abroad students. The president of the Institute, Karl T. Compton himself, made efforts to support the development and matriculation of Chinese students studying abroad at MIT, as evidenced by the praise he received in the *Chinese Students' Directory*, in addition to various references to his involvement in facilitating healthy relationships between Chinese students and the Institute (Koo, 1931).

Few Chinese study-abroad students are more exemplary of the positive potential relationship between the Institute and themselves than Ping Yok Loo. In 1916, Ping Yok Loo, hailing from the Guangdong Province of China received his Bachelors of Science in Mechanical Engineering upon the completion of the thesis "The effect of heat-treatment upon the physical properties of wrought iron," while under the tutelage of Professor Henry Fay (Koo, 1931; Wang Ziyu, 2015). As important as academics are to the MIT student experience, Loo's interactions with the MIT community were not strictly confined to the mechanical engineering space. Loo served on the Class Day Committee, which was a group responsible for organizing a large class-wide social event. Moreover, Loo was voted "best athlete" of the MIT Wrestling team in 1916, captain of that same team in 1917, making him the first Chinese athlete to become head of a varsity group

(*Technique 1917*, n.d.; Teng, 2018a). In that same year, Loo was appointed Vice Chair of the Mechanical Engineering society (*Technique 1917*, n.d.). For his social interactions, Loo was in the Flip Flap (FF) fraternity, which was the oldest Chinese fraternity in the US (founded in 1910), and the most popular fraternity for Chinese students on the east Coast (Teng, 2018a). Loo is a great example of how Chinese students not only attended MIT, but also wove themselves into the threads of the student life and made significant contributions to campus culture. Moreover, things like participating in athletic activities was a deviation from what was expected of Chinese students at the time, which demonstrates how Loo's peers influenced him as well (Teng, 2018a).



MORSE            GILES            TODD            WIRT            HOFFMAN            SACHE  
 STEBBINS, *Manager*    LOO, *Captain*    BONE    ROUNDS

Figure 10: A photo of P. Y. Loo on the MIT Wrestling Team, taken from the 1917 MIT *Technique* Yearbook. He is in the bottom row, sitting second from the left most player. Note his team designation “*captain*” written next to his name. (*Technique 1917*, n.d.).

Ping Yok Loo, as seen in Fig. 10, served in leadership capacities in extant groups around campus, but certain groups of Chinese students created their own social clubs. The Chinese Students’ Club (CSC), during its inception in the early 1910s, was a club that went about “promoting mutual fellowship and friendship among the members and of exchanging good fellowship with other Chinese students clubs as well as various other organizations” (Koo, 1931). Kuo Chou Li, a Class of 1921 Mechanical Engineering graduate from Beijing, served as president of the Chinese Students’ Club in 1921 (*Technique 1922*, 1922). His fellow Mech E. Class of 1921

graduates, Jung An Lo, Kuang Tsu Tu, and Ku Cheng Ku, the same year, served as the Vice President, Chinese Secretary, and English Secretary for the CSC, respectively. In pursuit of its goal to provide a supportive structure for students thousands of miles away from their homeland, the Chinese Students' Club would network with other CSCs at colleges along the East Coast, in addition to hosting regular social meetings, and celebrating traditional Chinese holidays as a community (Teng, 2018a). As seen in the case of Tu and Ku, the social relationships formed outside of the lab directly led to productivity inside of it: for their senior year thesis, Ku and Tu collaborated on writing "Moisture effect on light cotton fabrics," under the tutelage of George B. Haven (discussed in detail further below).

Outside of the Chinese Students' Club, Chinese students studying abroad at MIT engaged in a myriad of other clubs and sports activities. Tech Show, an annual production done by MIT students, attracted a handful of talented Chinese actors; moreover, Chinese students would find themselves engaging with the communities of local Chinese, through organizations like the Chinese YMCA or the Chinese Student of Greater Boston club (Teng, 2018a). The Chinese Students founded their own soccer team two years in advance of the general MIT community creating their own (Teng, 2018a).

## ***4.2 Zhou Houkun and the First Chinese Typewriter***

On September 11, 1910, Zhou Houkun (also written HK Chow), at the age of 20, embarked on a journey from Shanghai, to Honolulu, San Francisco, and then to Chicago, before he ended up in Boston. Born in Wuxi, Jiangsu province, Zhou attended the Shanghai Industrial College Preparatory Program before testing and qualifying for the Boxer's Uprising Indemnity Scholarship in July of 1910. After a year-long stint at the University of Illinois, Zhou transferred to MIT's Department of Mechanical Engineering and the Department of Naval Engineering in 1911 (Yang, 2016). For his undergraduate thesis, Zhou collaborated with S. S. Keh to create an analysis of the changes in set and elongation of copper and composition wires over time (Keh & Chow, 1913). The other thesis he wrote on his own was "Bamboo as Reinforcing Material for Concrete," during which, he imported half a ton of bamboo from China in order to characterize its material properties for the engineering world (Teng, 2018a). Zhou was in the inaugural class of Master degree recipients from MIT's Aeronautical Engineering department, receiving his degree "with distinction" (Esquiél Group, 2016). Afterwards, Zhou went on to become the first person in the Dept. of Aeronautics and Astronautics to receive a Master's degree in 1915; moreover, his Masters' thesis on calculating aeroplane stability damping coefficients earned him an award from the American Institute of Aeronautics and Astronautics (Esquiél Group, 2016).

In between his Bachelors and Masters degrees, Zhou completed his first prototype of his Chinese typewriter in May 1914, got it patented in the U.S., China, and Japan, and received a feature on the front page of the *New York Times*: "Chinaman Invents Chinese Typewriter Using 4,000 Characters" (Esquiél Group, 2016; Mullaney, 2017). According to the *New York Times* archival article, the creation of the typewriter was inspired by Zhou's exposure to American typewriters while studying at MIT. Inspired by a girl he observed typing in the Mechanics Building of MIT's old Boston Campus, Zhou set out to create an equivalent machine that would facilitate

the modernization of China through efficient text production, as seen in his thoughts recorded below:

*“My thoughts at once turned back to China and brought before me vividly the scene in a Chinese press room—where typesetters, little trays in hand, travelled to and fro seeking for a particular type in a maze of thousands. The process was slow, tedious, inefficient, and has constituted one of the great obstacles to the advancement of the general education in China” (Mullaney, 2017).*

Zhou’s design was unique for its time because it hinged upon a rotating cylinder to give a user access to most of the characters required for Chinese publications, as seen in Figure 11 (“Chinaman Invents Chinese Typewriter Using 4,000 Characters,” 1916). During a demonstration in his home province, Jiangsu, Zhou was praised for “creating a machine that would print 2,000 characters each hour, rather than the 3,000 per day achievable by hand” (Mullaney, 2017). By 1916, Zhou was in talks with Shanghai’s Commercial Press company over commercializing and mass-producing his prototype typewriter, but the company was hesitant to move forward most likely due to the fixed, unremovable nature of the individual character tiles on the device (Mullaney, 2017).

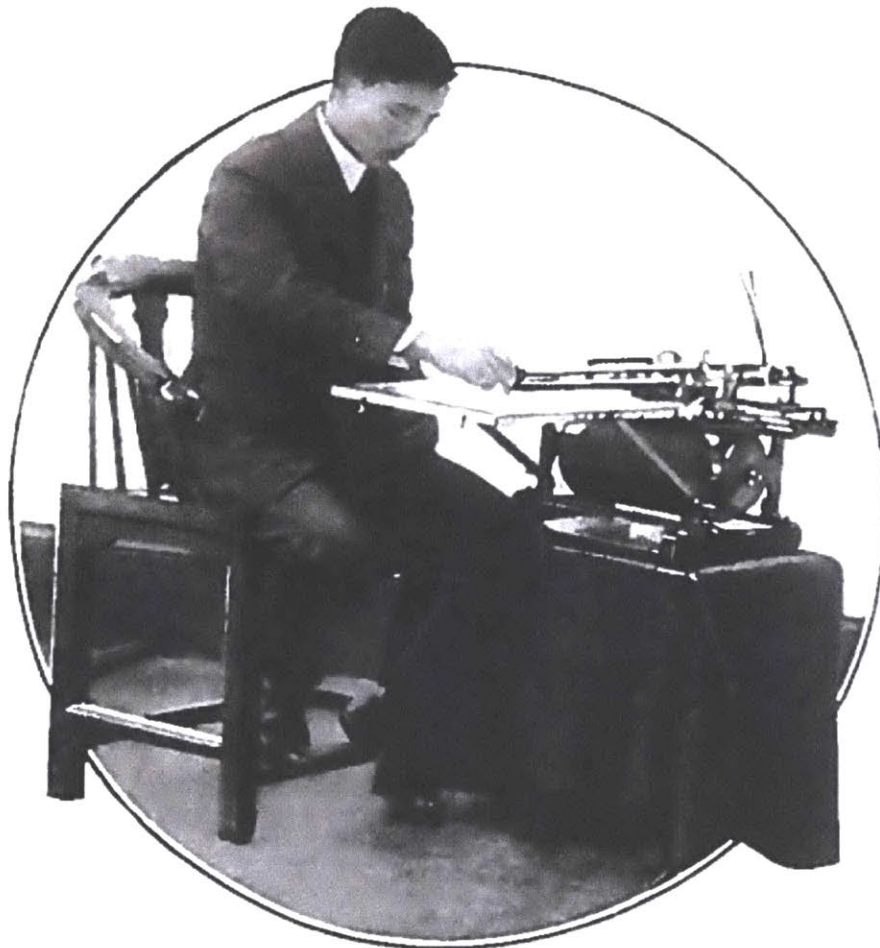


Figure 11: This stylized photograph is one of the only known extant photographs of inventor Hou Kun Zhou with his typewriter. This photo was initially published in Popular Science Monthly (Mullaney, 2017).

Zhou's work as a student at MIT was not limited to his academic successes in the Mechanical Engineering and Aeronautics and Astronautics departments—he served as an informal cultural ambassador of China to the broader MIT community. As a member of the Cosmopolitan Club, a group formed to promote and support international students and their unique cultural experiences, H. K. Zhou presided over the annual MIT “Chinese Night.” This event was a cultural showcase of Chinese music, entertainment, and a forum for discussing the current state of Chinese affairs that would attract nearly 300 attendees during its height in the mid-1910s (Teng, 2018a). In addition, Zhou also had the spirit of a performer: during a theatrical reinterpretation of the classic Chinese novel *Journey to the West*, Zhou played the role of Ox Demon to a crowd of hundreds of individuals from the greater Boston community (Teng, 2018a).

### ***4.3 George B. Haven, Textile Aficionado***

In the 8<sup>th</sup> issue of *The Tech*, MIT's local newspaper, in 1933, MIT Professor George Bartholomew Haven conducted a six week seminar on the technical developments in the field of textile fibers, taught at the Institute for a limited group of “laboratory men, mill agents, and overseers” from the textile industry community (MIT Tech Club, 1933). This was the eleventh seminar of this kind conducted by him, since its inception in 1929 (MIT Tech Club, 1933). Clearly, Professor Haven was the expert on textiles during this period, and his research supports that claim. His book “Mechanical fabrics” was a comprehensive treatise on the mechanical properties of various textile fabrics, detailing their manufacturing process, moisture absorption, the ultimate tensile strength, flexibility and toughness, appropriate testing methods, and numerous other mechanical properties for a number of standard Western fabrics: cotton, linen, rayon, wool, and silk, amongst many others (Haven, 1932). One fabric that sticks out from the rest is “ramie.” Ramie, as described by Professor Haven, is a fabric from Asia (particularly China and India) that has excellent tensile strength and durability, but is laborious to harvest (Haven, 1932). This note would be mostly uninteresting if it were not for the fact that Haven, as a faculty of the Mechanical Engineering Department, oversaw the completion a significant quantity of textile-related undergraduate theses, mostly written by Chinese students studying abroad.

Of the 58 Chinese students who matriculated from MIT's Mechanical Engineering Department between 1913 and 1930, at least 20% of them (11 students) were directly under the tutelage of Professor George B. Haven, based on advisor citations from the MIT Libraries catalogue. “Moisture Effect on light cotton” was K. C. Ku and K. T. Tu's 1921 Mech E. thesis, followed by C. T. Chien and H. Kao's “Relative Strength of Staple Cotton in Comparison with Mixed Long and Short Staple” in 1922, and then C. Y. Chou and T. K. Hsueh's “A Study of Chu-Ma as a Textile Fibre” in 1924 (“Chu-ma” 苧麻 is an older romanization of the Chinese characters for ramie) (Chien & Kao, 1922; Chou & Hsueh, 1924; Ku & Tu, 1921). There are very insightful details in each of these theses that not only portray the relationship between Professor Haven and his mentees, but also depict a general state of affairs in the Mechanical Engineering department in the early twentieth century.



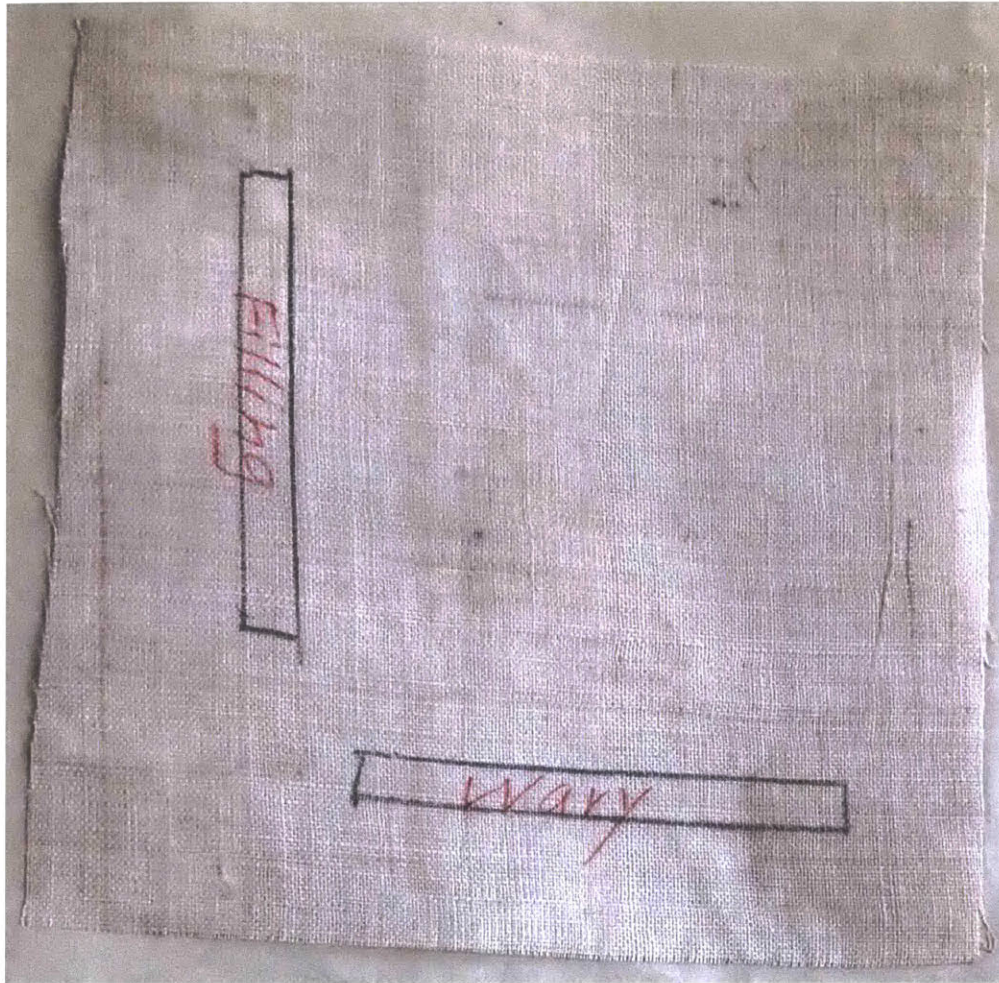


Figure 12: A photograph of a page from the thesis paper “A Study of Chu-Ma as a Textile Fibre”, featuring a sample of “Chu-Ma” used in the research. The numerical values that follow ( Sample Dimensions 4” x 4”; Thread per inch Warp: 63 threads; Threads per inch Filling: 69 threads) serve to quantitatively characterize this sample’s properties (the implication being that, the material and the construction of the textile both matter in the textile’s final material properties) (Chou & Hsueh, 1924).

In 1921, Professor G. B. Haven supervised the direction of “Moisture Effect on light cotton,” a characterization the mechanical properties (tensile strength) of cotton fabrics under differing moisture conditions, written by Chinese study-abroad students K. C. Ku and K. T. Tu. Within the first few pages of the document, Ku and Tu reference Professor Haven as someone who has done pioneering work in understanding relationship between moisture and fabrics, which gives credibility to Haven, as he is also mentioned as giving step-by-step guidelines in how to proceed with the research. The students then go on to state outright how their thesis work would contribute directly into Professor Haven’s research, which as we’ve seen, heavily focuses on the characterization of all types of fabrics over the course of the ten years following Tu and Ku’s thesis (Ku & Tu, 1921). Interestingly enough, through the use of library checkout cards, we see that Professor Haven returns to Ku and Tu’s thesis, four years later, presumably as a reference for his upcoming work.

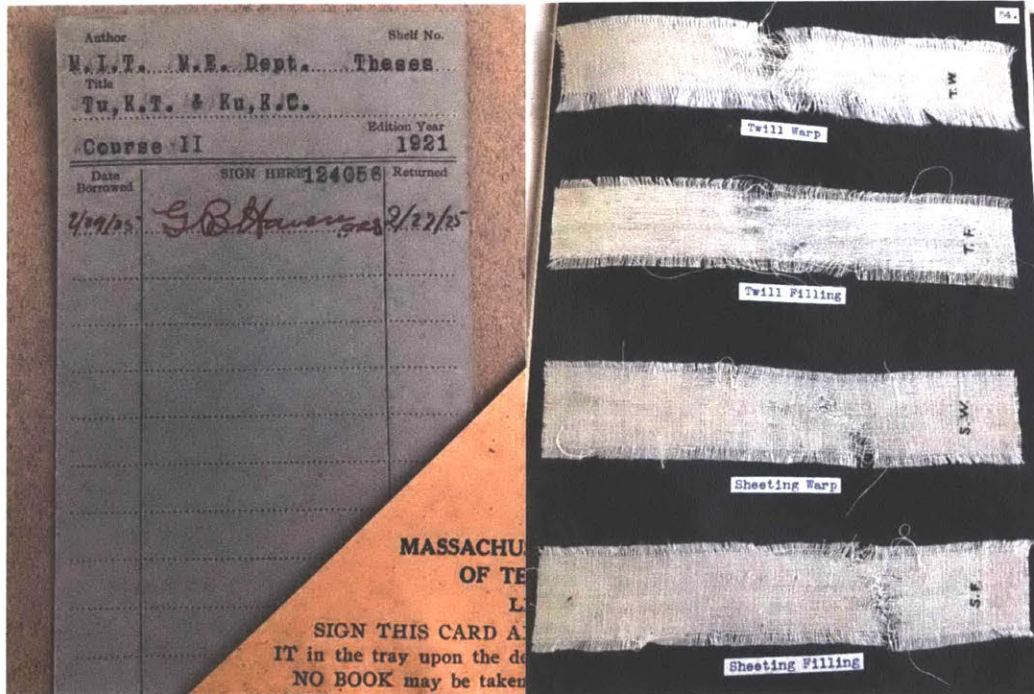


Figure 13 (a & b): The photograph of the book checkout slip the left (a) was taken from the back-binding page of K. C. Ku and K. T. Tu's graduating thesis "Moisture Effect on light cotton." Prof. G. B. Haven's signature on the document indicates that he checked out his own students' thesis in 1925. The photograph of the fabrics on the right (b) are various threading of cotton used in the same thesis written by Ku and Tu.

In 1922, C. T. Chien and H. Kao's completed their Bachelor of Science thesis "Relative Strength of Staple Cotton in Comparison with Mixed Long and Short Staple," which was a characterization of tensile strength of cotton strands, varied between short staple and long staple (types of cotton). Professor G. B. Haven is thanked outright for procuring mission critical materials from Firestone Tire and Company, but Chien and Kao ultimately imply that their work merely preliminary, and that they believe Haven is more than qualified to finish the job:

*"With this test as a prelude it is hoped and expected that additional light will be thrown on the subject by further tests ... it can be justly anticipated that with better cooperation from producers to be accorded to the testers in the future this somewhat knotty question will be readily settled by a corps of textile students in M.I.T. under the able leadership and direction of Professor Haven."*

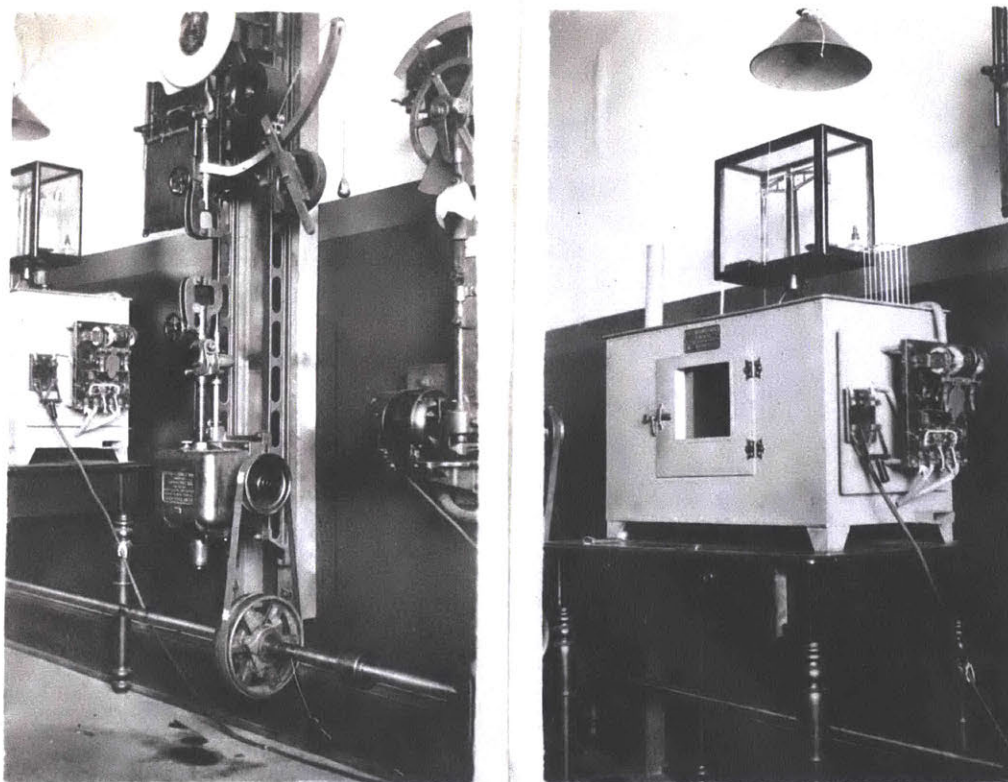


Figure 14 (a & b): The photograph on the left(a) is of the Scott Testing Machine, a device used for tension-based testing of relatively small items. The photograph on the right is of an Emerson Conditioning Oven, used to modulate moisture-based factors for fabrics. These devices were used by most of Professor Haven's students on their thesis work, including Ku & Tu; and Chien & Kao (Ku & Tu, 1921).

"A Study of Chu-Ma as a Textile Fibre" was written by C. Y. Chou and T. K. Hsueh for the completion of their Bachelor of Science thesis in 1924, also under the guidance of Professor G. B. Haven. An interesting note present in this thesis, and not others, is a section where the Mechanical Engineering Department assigned Professor Haven to oversee the research of these students, which may imply that the inspiration to study this fiber may have come from the students themselves. If this course of study was Chou and Hsueh's own idea, it also makes sense that they went through the effort of importing Chu-ma fabric from their homes in China, especially considering Western discrepancies around whether Chu-ma and Ramie genuinely referred to the same plant. Based on their introduction, Chu-ma was particularly popular in China as a lightweight, strong clothing fabric for the past 3,000 years. Chou and Hsueh were able to complete their theses in a little over a month.

Four years prior to C. Y. Chou and T. K. Hsueh's "A Study of Chu-Ma as a Textile Fibre," a pair of local American students collaborated on a project that would characterize "ramie": Frank L. Bradley and Joel A. Goldthwait wrote "Moisture effect on ramie, silk and wool fabrics" for their Bachelor of Science thesis in 1920, and they benefited greatly from the "invaluable assistance" of Professor G. B. Haven. As evidenced by library checkout cards, Professor Haven, over the course of the next decade, references this thesis twice, once in 1921 and again in 1928. Clearly, the extensive numerical quantifications present in their thesis proved to be of value.

Upon closer examination of Professor George B. Haven's "Mechanical Fabrics," we see how he credits the thesis of Goldthwait and Bradley as a footnote, under the characterization of the moisture regain vs. tensile strength graph for ramie. More curiously, are the pairs of Chinese students who do not receive credit for doing work along similar lines of chapter subheadings in his treatise. For example: Ku and Tu's thesis dealing with the moisture properties of cotton could fit well into Chapter VIII of Professor Haven's book that details "Moisture Effects in Cotton," yet, despite having revisited their thesis, their work went uncredited.

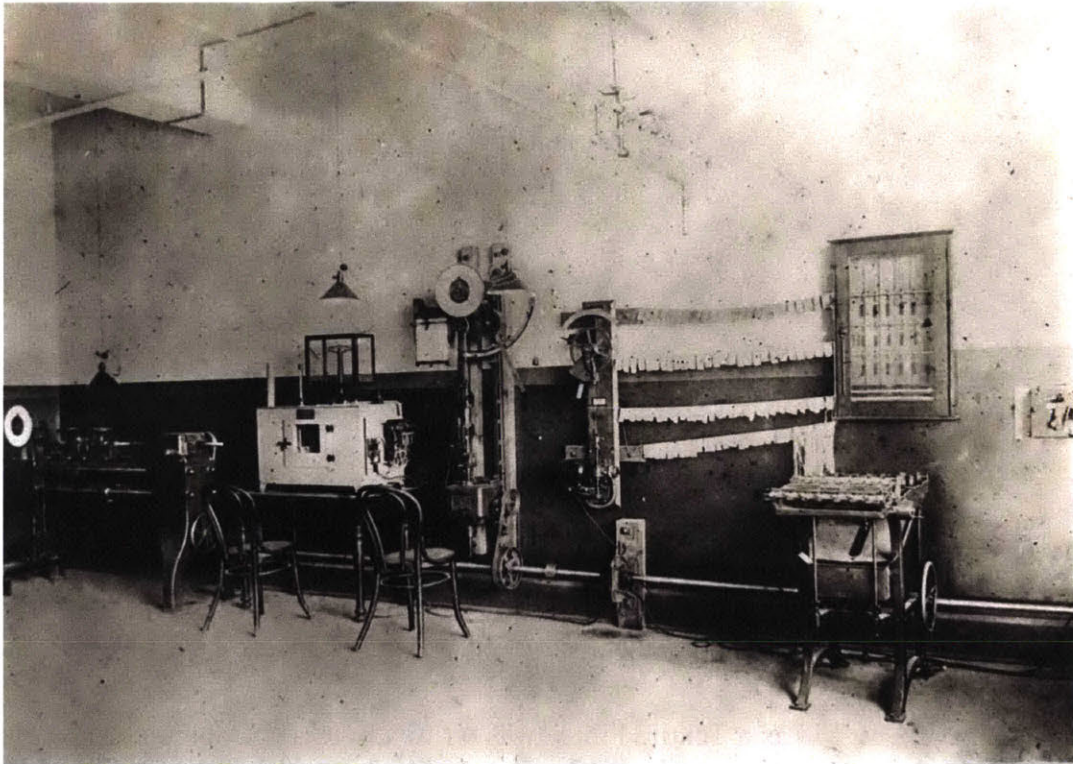


Figure 15: A photograph of the MIT Mechanical Engineering Department's Textile Laboratory. From left to right, one can observe the Scott Horizontal Tester, Emerson Conditioning Oven, Scott Testing Machine, and different material samples hung on a rack. Most of Professor G. B. Haven's thesis advisees would have used this space heavily, especially if their work was textile-related (Bradley & Goldthwait, 1920).

Whereas the aforementioned works and theses were focused in material property characterization, William Moy Ding and Ki Kee Chun's Bachelor of Science thesis "The properties of ramie fabric as covering for airplane wings" concentrated on the direct applications of this Asia-native fabric in novel use cases. Though Professor A. L. Townsend advised the direction of the thesis, Professor G. B. Haven's name still arises, not only as an acknowledgement of giving advice and instruction, but also as a bibliographical reference to works he produced for the American Society of Testing Materials. Through drying out and doping (adding a protective coating to the fabric to make it weather resistant and airproof) ramie, Moy Ding concluded that ramie as a wing material was more than sufficiently viable to use in fabric-based airplane wings, as long as the fabric was under no torsion. William Moy Ding and Ki Kee Chun were only two of

the Chinese students at MIT who contributed to research relevant to the development of aviation in China.

Before writing his treatise on mechanical engineering fabrics and providing tutelage to Chinese students studying abroad in MIT's Mechanical Engineering department, Professor George B. Haven was a student himself at MIT. George B. Haven is attributed as being integral to the transition of MIT from its location in Boston to its new position off the banks of Cambridge (MIT Tech Club, 1915b). Long before his taking on of Chinese students, Haven is cited as being "one of the most active progressives at the Institute," playing an active role in hosting smokers and recruiting new minds for the Progressive Club of MIT (MIT Tech Club, 1915a). He is sighted as being a Republican and a Congregationalist in the Decennial Catalog for the Class of 1894 (Haven, 1904). As an active faculty in the Mechanical Engineering Department, he also did his fair share of promoting his ideals and values among the department (MIT Tech Club, 1915). Haven particularly valued honesty, preparedness, and courage as the most important values of students leaving the Institute (MIT Tech Club, 1913).



GEORGE BARTHOLOMEW HAVEN, S.B., *Assistant Professor of Mechanical Engineering.*—S.B., M. I. T. 1894, II.

Assistant in Mechanical Engineering Drawing, Massachusetts Institute of Technology, 1894-96; Instructor in Mechanical Engineering Laboratory, 1896-99; Instructor in Machine Design and Mill Engineering, 1899-1905; Assistant Professor of Mechanical Engineering from 1905.

Residence, Webster Street, Needham.

Figure 16: The professor biography of George B. Haven, excerpted from the 1912 Technique Yearbook.

#### ***4.4 Engineering for the Community and the Homeland***

"This power plant ... is intended to replace an old plant at Sha-Shih, a city in China" (Peng, 1925). In 1925, for his Bachelor of Science thesis, Kai Hsu Peng designed an outline for a power generating facility to be placed in his hometown. "Due to incompetent design and mismanagement, the old plant has never enjoyed a day of prosperity. At present the engines and equipment[] rapidly become worn out and the output is less sufficient to meet the city demand, so a new plant to replace the old is quite necessary" (Peng, 1925). In accordance with Sun Yatsen's vision of the twentieth century as the "age of electricity," Peng, upon matriculating to MIT, engaged in a course of study that would directly facilitate the advancement of China, according to the desires of the Chinese leadership at that time.

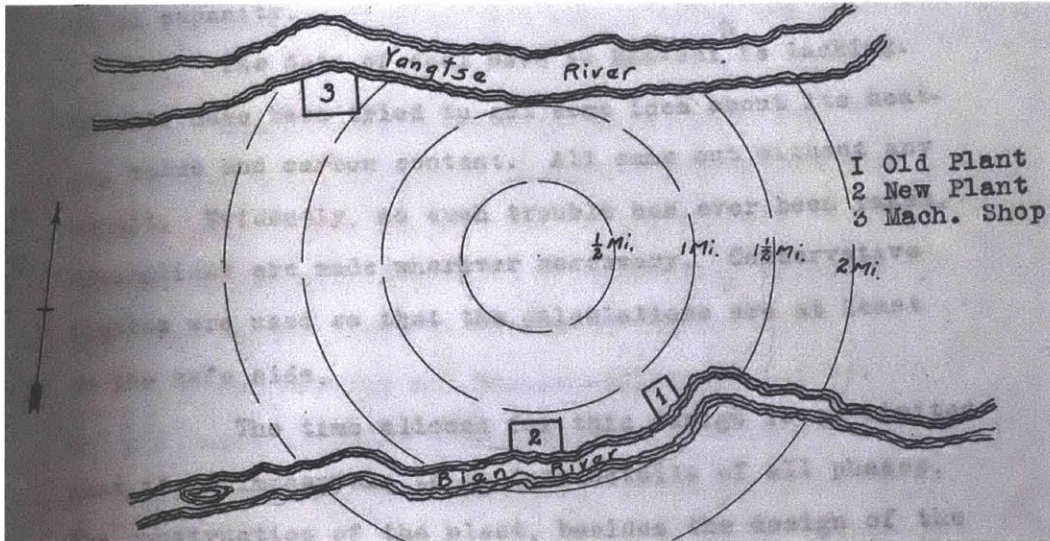


Figure 17: A diagram of the proposed new location for the power plant designed in Peng's 1925 undergraduate thesis. The machine shop (labeled "3") would have been more than sufficiently supported by the proposed new power plant, making it a bonus to the technological capability of the Sha-Shih locale.

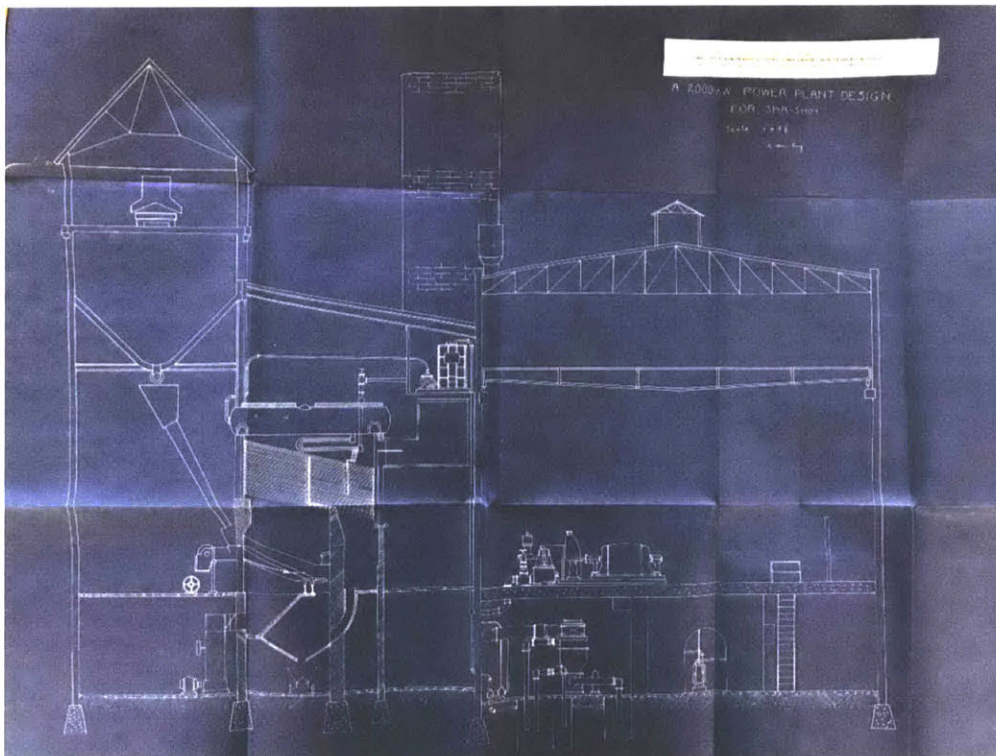


Figure 18: A blueprint schematic for a 2000MW power plant, designed by Peng.

It was not uncommon for Chinese students during this time to pick theses that have direct practical application to the development and modernization of China. As seen with Peng's thesis, and as will see with H. C. Ling and M. C. Chou's theses, Chinese Mechanical Engineers fully utilized the resources and connections of MIT to create extensive reference documents of Western

technologies, which would be invaluable documents to have on the hand during the period of a rapidly modernizing China.

In 1918, Homer C. Ling completed his Bachelor of Science degree with the thesis “A study of movable crests for dams and a design of an automatic rolling counterweight crest gate.” His thesis advisor was Department Head E. F. Miller, which makes sense, considering how Professor Miller’s research expertise was in the design and operation of power plants (Anon., 1933). Also, interestingly, Ling was the only Chinese study-abroad student to ever fall under Professor Miller’s advisory. Crest gates, which are a technology for harvesting hydro power, are a highly topical course of study for a Chinese student, especially considering Sun Yatsen’s push for the creation of dams and other forms of energy in lieu of coal.

His thesis is listed both as his B.S. and M.S., as this comprehensive characterization of crest gates is 184 pages long. Ling’s work is extensive, describing mechanically operated crest gates (poiree needle, boule, stationary flashboards, camera curtain, chanoine wicket, sliding, tainter, rolling), and then semi-automatic and automatic varieties, with blueprint descriptions of their underlying mechanics to supplement.

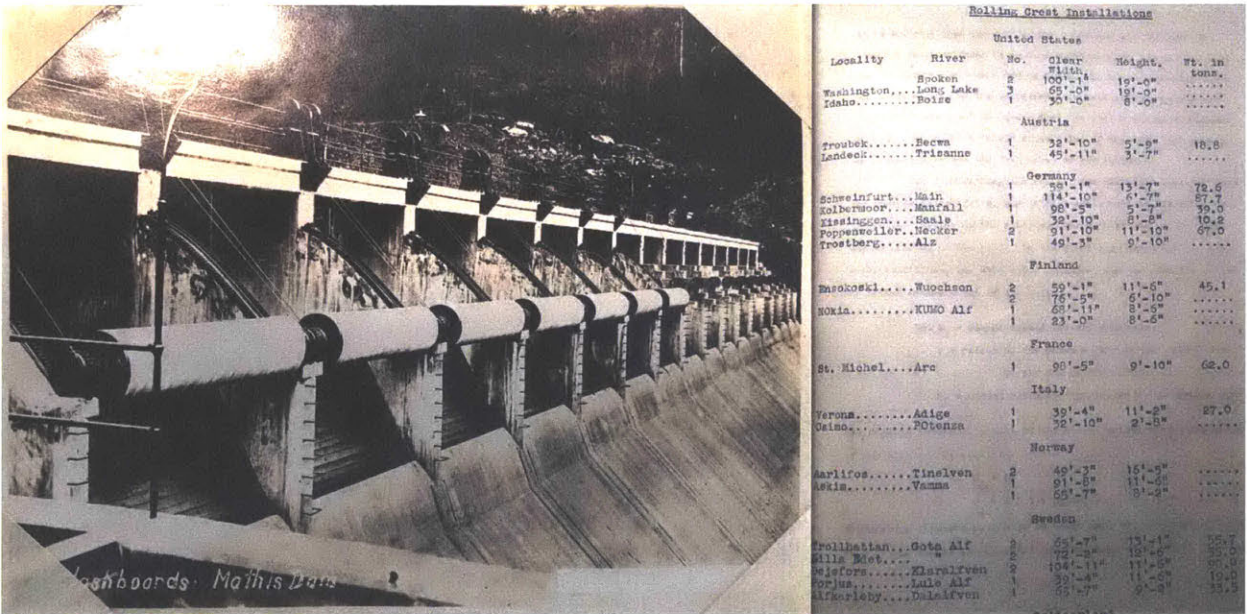


Figure 19 (a & b): (a, on the left) A photograph of an automated rolling counterweight flashboard, which is a type of movable dam that H. C. Ling was studying for his Master thesis. (b, on the right) A photograph of the author’s thesis citing instances of rolling crest use in places around the world, with precise dimensions such as width, height, and weight.

This work by Ling is not only notable for its comprehensiveness, but also for how it accounts movable crests that come from all over the world, some European (French particularly) and others American, with precise dimensions for width, heights, and weights. Such a wide survey of types of crests makes for an invaluable resource for dam construction in China, with a myriad of crest types to be used in all types of environments and climates. As a conclusion, Homer C.

Ling details how to go about designing his own crest dam, with the demonstrative body of water being in Blackwater river at Webster, New Hampshire.

The 1920s Bachelor of Science Thesis “International Standardization of Screw Threads” was written by Ming Cheng Chou, under the guidance of Professor George B. Haven and R. H. Smith. Fitting into the trend established by Homer C. Ling, this thesis serves as a reference guide to different types of screw threads, their countries of origin, and the conditions of their use. In line with previously discussed theses, Chou’s work would be a great resource during the development of China, during that period of the early 1920s. Moreover, there is a record of MIT professors themselves referencing the work: Professor Irving H. Cowdrey, an Assistant Professor of Testing Materials in the Mechanical Engineering Department, is on record as having withdrawn Chou’s thesis, demonstrating how the works produced were of direct interest to the academic community involved.

Ming Cheng Chou’s thesis was not the only thesis referenced by professors. In Sing Dji Li’s 1915 thesis “An investigation of the strength of bamboo under cracked and weathered conditions,” Li makes an explicit reference to Houkun Zhou in his introduction, referring to tests Zhou did on bamboo during his 1913-1914 academic year at MIT (S. D. Li, 1915). In the expository section of Li’s thesis, he acknowledges assistance from George B. Haven, who gave Li the value for the ultimate tensile strength of pine, a piece of information that was used to for a basis for comparison. On the library checkout card for Li’s thesis, two years later, Professor I. H. Cowdrey is again recorded checking out the thesis for a period. Li’s thesis provides another great example of the fluid sharing of knowledge between faculty and students that was fundamental to the successes of MIT’s earliest researchers.

#### ***4.5 Irving H. Cowdrey and the Materials Testing Laboratory***

By the time of his passing in 1965, Professor Emeritus Irving Henry Cowdrey had taught and conducted research at MIT for 44 years, after receiving his own degree from the Institute in 1905 (The Technology Review, 1965). He was a lifelong resident of Massachusetts, living in different towns, and was survived by two daughters. Professor Cowdrey was the author of numerous works during his time, including papers in the American Society of Mechanical Engineers’ publications, and of his own book in 1935, called “Materials Testing—Theory and Practice.” Professor Cowdrey is of interest due to the frequency that his name comes up in the written by Chinese students studying abroad, not only cited as having referenced different works, but also as a direct advisor to several Chinese mentees of his own. Between 1922 and 1926, Professor Cowdrey advised Shih Ming Chu, Ching Fan Lo, Yuan Lun Ta, P. L. Tsang, and I. Kwei Young on their Mechanical Engineering theses, all in the pursuit of a Bachelor of Science degree (Koo, 1931).

P. L. Tsang’s 1923 thesis “Investigation of the effect on tensile strength of a hole drilled in round machine member” explicitly acknowledges Professor Irving H. Cowdrey’s contributions to his thesis completion. Tsang thanks the professor explicitly in the acknowledgements section for all his help, including suggesting three methods for tensile strength testing. In the same year, I. Kwei Young thesis “To investigate the effect of different shapes of grooves on tensile strength of low carbon steel, having constant cross-section area” was also completed, and advised by Professor



Cowdrey. In both Young and Tsang's thesis, the reference using the same types of machinery (Riehlie testing machine of 20,000# capacity and Berry's strain gauge to measure elongation), which leads to the conclusion that these experiments are happening in the same physical space, at the same time. The laboratory used for the work, moreover, was the Testing Material Laboratory, which is a space that Professor Cowdrey would have directly oversaw. Interestingly, the book checkout card on Young's thesis has Professor Cowdrey's signature on it, leaving a record that Cowdrey withdrew it on April 25th, three years later. With respect to timing, it is notable that Shih Ming Chu's 1926 thesis "Bolt failure on Account of a 'Poor Fit'" would have been in the early ideation stage around the moment when Professor Cowdrey withdrew the document. This leads to the question: did Professor Cowdrey reference theses written by earlier Chinese graduates to guide the mentorship of incoming students on their academic work?

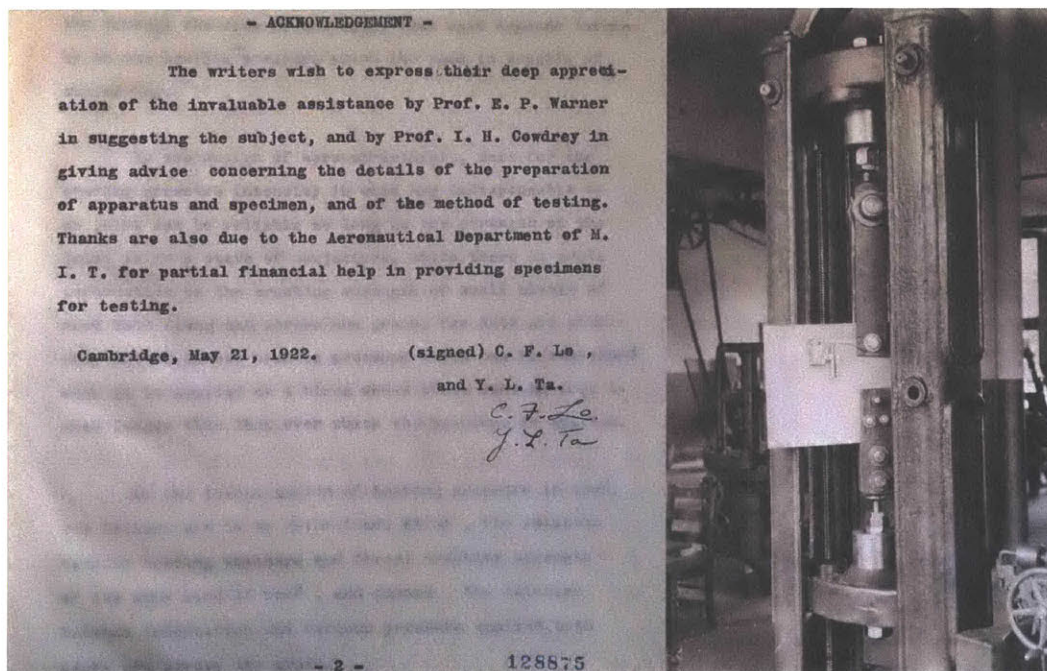


Figure 20 (a & b): (a, on the left) Photograph of the acknowledgement page of Yuan Lun Ta and Ching Fan Lo's 1922 thesis "Bearing Pressure in Wood." This is of interest because they received supplemental financial support from the Aeronautical Department. (b, on the right) Photograph of Ta and Lo's experimental setup, putting tension on the bearing and wood slab "across the grain" of the wood slab.

"Bearing pressure in wood," written by Yuan Lun Ta and Ching Fan Lo for their 1922 Bachelor of Science thesis, was heavily guided by Professor Irving H. Cowdrey. According to the acknowledgements, Professor Cowdrey is recorded as providing advice on preparation of the apparatus for testing wood, and the wooden specimen themselves. Another note that is unique about Ta's work is how Professor E.P Warner, in the aeronautical department of MIT, provided "partial financial help in providing specimens for testing." Faculty members appeared to go out of their way to provide resources to students when called upon, which is an important note, when thinking about the role of faculty in facilitating the development of students studying under them.

Professor Irving H. Cowdrey's enthusiasm for his course of study was evident in the way he discussed his work amongst his peers:

“The work here at the Institute is very interesting particularly at present in the laboratory for testing materials, which I believe is about to develop greatly in the next few years. The men who the various evening schools have brought to me have proved a set well worth studying. They are on the whole more purposeful than Tech students though the general ability must of course average lower” (*Ayer & Green, 1917*).

From that quote, more important notes can be gleaned about then-Instructor Cowdrey: he has an interesting sense of humor, a bit of an elitist (or regular Boston folk are quite less inclined to producing high quality work than MIT students), and most importantly, would give his time to helping facilitate the research and studies of the local Boston community in Mechanical Engineering during the evenings. It is unclear whether he was given a choice in the matter of teaching “evening schools,” but this implies that Cowdrey has a penchant for stepping out of the MIT bubble to teach people. This may explain why Professor Cowdrey was more inclined to take on Chinese students than his peers may have been.

## ***5. MIT’S CHINESE GRADUATES AND THEIR IMPACT ON THE DEVELOPMENT OF TWENTIETH CENTURY CHINA***

### ***5.1 Houkun Zhou, after the Typewriter***

After Houkun Zhou received his Bachelor of Science in Mechanical Engineering and his Master of Science in Aeronautical Engineering, he returned to China to work for Commercial Press as an engineer. Initially, this company was planning on commercializing his typewriter invention, but due to concerns around the flexibility of the device, they decided not to move forward with Zhou’s design, encouraging him to pursue other inventions. After this, Zhou was appointed as Chief Engineer and Manager of Daye Ore Mine of Hanyeping Company. Following this, he patented another creation, the “impact-proof ship,” for China Merchants Group, worked for Mobil and Texaco, and with a group of other MIT graduates, founded Shanghai Industrial Junior College.

### ***5.2 George B. Haven’s Mentees***

Ku Cheng Ku and Kuang Tsu Tu, the two MIT Mechanical Engineering graduates who wrote “Moisture Effect on light cotton” to complete their Bachelor of Science in 1918, led quite successful lives in China, but they knew each other long before being partners at MIT. Ku and Tu, born in 1898 and 1899 respectively, hail from the same city, Wuxi, in the Jiangsu province. Moreover, they both attended the Tsinghua School around the same time: Separated only by a year, Tu graduated from Tsinghua in 1918 and Ku graduated in 1919. These two not only researched together but served in complimentary roles on Chinese Students Club Executive Board as the Chinese and English secretaries. The year difference between their age ultimately meant they graduated at different times; Tu completed his degree in 1921, and Ku completed his a year later.

In 1898, Kuang Tsu Tu was born in Wuxi, a city in Jiangsu province, and matriculated from the Shanghai Industrial College to the Tsinghua School in Beijing. Upon graduating from Tsinghua to 1918, he came to MIT, where he spent 3 years pursuing his bachelor's degree. Following his stint in Boston, he returned to Jiangsu via an invitation to teach science at Southeast University. He would do several educational roles throughout his career, including teaching at Nanyang University, Zhejiang University, and even received a teaching invitation from his alma mater Tsinghua. Afterwards, he occupied various administrative, managerial, and directorial roles, including Director of the Mechanical Group, Research Committee for the Chinese Engineering Society, Director of Resources for the Ministry of Economy in 1937. He played a significant role in the restoration of Shanghai Jiao Tong University and spent the latter half of his life doing production management at Wahson Electric, before passing away in 1982.

Of the Tu and Ku duo, it was much harder to find information on Ku Cheng Ku, but it is known that after graduating from MIT in 1922, he went on to serve as Director of Engineering and Head of Material Division at Peiking-Tiensin Region Railway, under the Ministry of Transportation and Commerce.

Chang Tsu Chien and H. Kao, like the Tu and Ku duo, both hailed from the Jiangsu Province of China. Kao was a polyglot from a young age, speaking fluent German and translating a Rudolf Baumbach work before even entering Tsinghua School. After completing his degree, Kao went on to become an accomplished historian, publishing a book called "Third Reich Before and After the War." After matriculating through the Tsinghua School and MIT, with both Mechanical Engineering and Aeronautical Engineering degrees, Chien went on to learn how to pilot from the Curtiss School. He then taught at various schools throughout China, including Tsinghua School, served as Secretary General of the Chinese Engineering Society, and took on various military leadership roles throughout his career. He had subsequent stints in America and Europe as a supervisor to aircraft ordered by the Chinese government, and wound up serving the Ministry of National Defense, and as President of a state-owned Taiwanese company following the Communist Revolution.

After completing "A Study of Chu-Ma as a Textile Fibre" for their Bachelor of Science degrees in Mechanical Engineering, C. Y. Chou and T. K. Hsueh successfully graduated in 1924. There is no information regarding where T. K. Hsueh ended up post-graduation. C. Y. Chou, on the other hand, got great use out of his Mechanical Engineering degree and his textile-focused research. Upon returning to China, Chou served in various Dean and Mechanical Engineering Professor roles in universities across China: National Shandong University, Zhejiang University, National Southwestern Associated University, Kwang Hua University, and even as Vice-Chancellor of Shanghai College of Technology, which was quickly renamed Shanghai Private College of Textile Industry. Among other accomplishments, Chou was the inaugural Dean of the Textile Faculty at Shanghai University of Engineering Science, associate Dean at East China Textile Institute of Science and Technology, and served a five-year term on the Shanghai Municipal People's Congress. MIT Textile Expert G. B. Haven surely would have been proud of Chou's textile-related achievements.

Before completing his Bachelor of Science thesis "The properties of ramie fabric as covering for airplane wings," William Moy Ding was a local Boston resident, and the earliest recorded student from Boston's Chinatown to matriculate at MIT. According to Professor Emma J. Teng, after 1920, Moy Ding worked in various engineering roles at an assortment of companies,

including Stone and Webster (a company started by MIT graduates); Wellers Manufacturing Company, an iron factory in Chicago; and by 1927, as a civil engineer back in Boston. In 1925, Moy Ding went to China to serve as Chief Engineer of the Engineers Training Corp for the Chinese National Government and returned again in 1932 to serve as a Lt. Col. of Engineers for the Chinese Army. Known as “Big Bill” among his Flip Flap fraternity brothers and “Mayor of Chinatown” by the Chinese American Merchants’ Association, Moy Ding and his to advocate for the advancement of Chinese people in all areas of life was known throughout the Boston area (Teng, 2018a). Upon his passing in 1938, the Boston Globe called him “one of the most cultured and respected members of his race in America” (Teng, 2018a).

### ***5.3 Engineering for the Community and the Homeland***

Of the three engineers highlighted in the “Engineering for the Community and the Homeland” section, post-graduation biographical information was only found for Kai Hsu Peng; nothing could be found for Homer C. Ling or Ming Cheng Chou.

After Kai Hsu Peng wrote his 1925 thesis, “A Power Plant for Sha-Shih,” he stayed at MIT to pursue a Master of Science degree for the following year with a focus on characterizing kerosene engines. Following his return to China in 1927, Peng served as a Professor of Peiyang University, Northeastern University, Peiking University, and was even head of the Mechanical Engineering Department at Central University. He had a stint in the financial sector, serving as a Manager of the Central Trust of China Bank and Deputy Director of Financial and Economic Affairs under the Middle-South Bureau. Afterwards, he served as a Director of the Chinese Society of Electrical Engineers.

### ***5.4 Irving H. Cowdrey’s Mentees***

After writing “Bearing Pressure in Wood,” Yuan Lun Ta and Ching Fan Lo both returned to China. Lo ended up working in engineering and managerial positions for various companies, including Wuxi Jiufeng Flour Mill, Renyu Knitting Factory, Shanghai Wuhe Textile Factory, and the Zhenjiang Yicheng Flour Mill. While Lo’s positions were industry focused, Ta pursued a more educational route. After spending three years stateside, Ta returned to his alma-mater Tsinghua University as a Professor in 1926, and by 1928, was appointed Dean of the Department of Engineering. Post Sino-Japanese War, he became Dean of the Department of Mechanical Engineering for National Central University in Nanjing, and at Chongqing University.

### ***5.5 Chinese Institute of Engineers***

In 1917, the Chinese Institute of Engineers was founded in the United States by a group of Chinese graduates and brought to Shanghai upon the return of those graduates to China. While locals trained in engineering was relatively new phenomenon in China during this time, there were

a flurry of professional organizations that sprang up: the Guangdong Association of Chinese Engineers, and the Chinese Engineering Society, just to name a few (“CIE History,” n.d.). By 1931, these early precursor organizations were ultimately merged into a single Chinese Institute of Engineers. Circa 1931, the Chinese Institute of Engineers had 2,169 members from all the organizations folded into one.

Thus, the Chinese Institute of Engineers became China’s premier, singular professional engineering society, of which, many MIT Mechanical Engineering graduates played a role in maintaining and fostering.

## ***6. CONCLUSION AND PERSONAL REFLECTION***

The Chinese overseas students discussed above came from a wide variety of localities within China, and through the demonstration of their academic merits in their respective secondary schools, were able to secure scholarship funding to attend American schools like the Massachusetts Institute of Technology. They picked Mechanical Engineering, a major whose broad set of specializations has direct applications to the modernization of China. These students, the best and brightest that China had to offer, came through means of personal or government sponsorship to America with the express purpose of learning critically important technical skills, which they would use upon returning to China. Kai Hsu Peng’s, Homer C. Ling’s, and Ming Cheng Chou’s theses all function as highly applicable reference documents for advancing the modernization and infrastructural development of their homeland. Kai Hsu Peng’s thesis in particular, “A Power Plant for the City of Sha-Shih,” not only analyzes the existing state of the art for energy generation around the world, but also proposes an energy solution for his own home that is directly in line with Sun Yatsen’s vision for the advancement of China.

MIT and its Chinese study-abroad students had a symbiotic relationship with each other. Chinese study-abroad students created affinity groups like the Chinese Students Club. They established fraternities and professional engineering societies in the American model, but explicitly for students of Chinese origin. They wrote topical periodicals like the Chinese Students Monthly, which were syndicated and distributed to Chinese study-abroad students throughout the East Coast. They made time to engage in their own culture while making a point of exposing the greater Boston community to their culture as well. Moreover, based on the limited data points acquired through combing through their theses and treatises, the faculty of the Mechanical Engineering department (and presumably, the whole of MIT) provided financial and intellectual resources to ensure these Chinese study-abroad students graduated successfully, with complete theses, which paved the way for their individual successes upon returning to China.

Thanks to the combination of finding a sense of belonging, affinity spaces, goal-oriented education, and ambition as the chosen intellectual ambassadors of China, these students created a foundation for themselves that led them successfully through the trials of the Institute. It is important to note, though, that the narrative of Chinese students at MIT during the early twentieth century is an incomplete recollection of smaller experiences being used to paint a cohesive portrait of the average experience during the time.

Gaps in knowledge surrounding the Chinese experience during the early twentieth century at MIT are numerous: on average, how were their relations with non-Chinese students? Did faculty spontaneously volunteer to take on Chinese students, or was it highly encouraged by the higher leadership of the Institute? What was the MIT experience like when a Chinese study-abroad student was outside of his affinity group? Consider the case of Black Americans attending MIT in 1985, whose social and academic experiences can offer a rough baseline for postulating the undocumented facets of the MIT community towards Chinese study-abroad students, 75 years prior. Shirley M. McBay's report "The Racial Climate on the MIT Campus," through analysis of the 1984 Quality of Student Life Survey data and the 1985 Black Alumni Survey data, quantifies the grievances of MIT's Black student community in a data-driven way:

- *"[55% of respondents] communicated generally negative perceptions of the personal and academic support provided by MIT faculty members; ... 31% voluntarily said that faculty members expected failure or a lack of ability in Blacks*
- *While 82% had to make general adjustments related to pace, pressure, and workload, about 44% mentioned that they had to make additional adjustments as Black students*
- *Three-quarters of those who lived in predominantly white living-group settings described their experiences there in generally negative or mixed terms, while those who lived in predominantly Black living group settings ([one-third]) were unanimously positive about their experiences there" (McBay, 1986).*

If this negative climate that MIT furnished for its Black student community in post-Civil Rights Movement era America, one can postulate how difficult it may have been for Chinese students studying at the Institute, 75 years prior, during the height of the Chinese Exclusion Act. In the *Chinese Students' Directory* itself, there are records of Chinese study-abroad students who did not successfully receive their degree from the Institute, which is to say, the students highlighted must not represent the entire set of experiences had by students at MIT.

Professor G. B. Haven took on a great number of Chinese students as mentees, which is hopefully a reflection of his genuine desire to cross cultural gaps, but his omission of the Chinese students' contributions to his understanding of Asia-grown fabrics in his "Mechanical fabrics" treatise is peculiar. Was this omission made because Haven did not feel the Chinese students' work sufficiently contributed to his understanding of the materials, or were there external pressures and biases that would have made his publication look less legitimate for including Chinese references?

Success is a very difficult topic to define because the standards of success differ dramatically across cultural backgrounds and even amongst individuals. According to traditional Confucian values, the most successful career is the scholar who works in service of the government, while Western definitions of success usually hinges on material attainment. While it is true that MIT Chinese study-abroad graduates ended up in varied roles in China, as official-scholars, educators, engineers, businessmen, and inventors, who is to say that any of these careers represent success more than the other? Quantifying success in a series of metrics, moreover, is an even more difficult task. It is for this reason that success, for these Chinese study-abroad students in the Mechanical Engineering Department, will be defined as "achieved" when a student finishes their undergraduate degree requirements and receives their diploma. After all, receiving a degree from the Institute is difficult enough already, without the added pressure of conducting life in a non-

native language, adjusting to a foreign culture, and socializing with a set of faculty and students who may harbor preconceived ill feelings towards oneself.

If the behaviors of these Chinese students could be distilled down to essential elements necessary for creating students who will most likely “succeed,” it would look like this: Students, regardless of ethnicity, creed, or origin, have a common set of basic necessities that allows them the greatest chance of finding success in a school like MIT. First and foremost, students must be able to find a sense of belonging in their course of study, amongst their peers, and as apprentices of the faculty in charge of educating them. Students must have spaces where their identities do not make them feel isolated, which is to say, students of a particular affinity group should have the appropriate spaces that reinforce a general sense of belonging. Based on the author’s personal observations during this thesis’ composition, students who are purposeful and intentional in their educational goals will fare better than those who are not. Additionally, students who are self-confident, self-driven, and self-motivated also fare better than those who are not. Assuming that the effectiveness of a student at a given academic pursuit is a function of these characteristics solely (ignoring variances in individual time management skills, pre-exposure to concepts, etc.), there exists a formula for creating students who will most likely succeed. That being said, the aforementioned formula is meaningless without placed in the proper, influential context of a student’s actual ethnicity, creed, and origin.

The Massachusetts Institute of Technology of the 21<sup>st</sup> century offer plenty of socioeconomic, ethnic, religious, sexual, and gender diversity. As of Fall 2017, MIT provided \$142.3 million dollars in financial aid to its undergraduate student body, allowing 57% of the undergraduate body to receive a financial-need based scholarship, or attend entirely tuition-free. Moreover, 47% of the undergraduate student body are members of a US minority group (MIT, 2018a). The 21<sup>st</sup> century Institute also holds the opportunity for each of these affinity group members to carve out spaces of their own, cementing their cultural identities in the fabric of the Institute, just as a few Chinese study-abroad students had done a century prior.

APPENDIX A: CHINESE MECH E GRADUATES 1877-1931

	B	C	D	E	F	G	H	I
1	Last Name	First	Class Year	Degree	Thesis	Subject	Advisor	Additional Notes
2	Chow	Hou Kun	1913 B.S.		The effect of time upon the elongation and set of copper and composition wires	Metals	unlisted	
3	Keh	Sih Sung (S. S.)	1913 B.S.		The effect of time upon the elongation and set of copper and composition wires	Metals	unlisted	
4	Ying	Yuen Tse	1914 B.S.		An investigation of the flow of air through a Venturi meter	Fluids	C. W. Berry	
5	Kao	Ta Kang	1915 B.S.		Comparative economy tests of a 20 H-P internal combustion engine using kerosene and gasoline	Engines	(Other Author) George T Woolley	
6	Li	Sing Dji	1915 B.S.		An investigation of the strength of bamboo under cracked and weathered conditions	Materials	unlisted	
7	Loo	Wai Po	1915 B.S.		An investigation of the longitudinal stability of an aeroplane	Fluids	(Other Author) O. E. Strahlmann	
8	Loo	Wai Po	1915 M.S.		An investigation of the performance of aeroplane struts under compression	Fluids	unlisted	listed as Other Author
9	Lam	Von Fong	1916 B.S.		A study of the launching of a submarine torpedo	Fluids	W. Hovgaard, H. H. W. Keith	Dept. of Naval Architecture and Marine Engineering
10	Loo	Ping Yok	1916 B.S.		The effect of heat-treatment upon the physical properties of wrought iron	Metals	Henry Fay	listed as primary author
11	Tai	Shui Tao	1916 B.S.		The effect of heat-treatment upon the physical properties of wrought iron	Metals	Henry Fay	
12	King	Ping Sing	1918 B.S.					
13	Ling	Homer C.	1918 B.S.		A study of movable crests for dams and a design of an automatic rolling counterweight crest gate in conjunction with the	Manufacturing	E. F. Miller	Thesis listed as The Strength of Micarta Gear Teeth in student book; listed as BS but is definitely MS
14	Wong	Zen Tze	1918 M.S.		Investigation of the dynamical stability of a Dunne hydroaeroplane		E. P. Warner	
15	Yao	C. F.	1918 B.S.					
16	Lee	Wei Hua	1919 B.S.					
17	Chou	Ming Cheng	1920 B.S.		International Standardization of Screw Threads	Manufacturing	G. B. Haven, R. H. Smith	
18	Moy-Ding	William	1920 B.S.		The properties of ramie fabric as covering for airplane wings	Textiles	A. L. Townsend	cowritten with Ki Kee Chen, BEA degree
19	Sun	Yun Hsiao	1920 B.S.		An experimental verification of the curved beam theory with relation to link eyes	Materials	Professors Fuller, Haven and Hayward	listed as other author
20	Chang	K. C.	1921 B.S.		Effect of Chilling and Annealing on Physical Properties and Microstructure of Cast Iron	Metals	Mr. Fales	did he get two degrees, another in CE????
21	Ku	Ku Cheng	1921 B.S.		Moisture effect on light cotton fabrics	Textiles	George B. Haven	
22	Li	Kuo Chou	1921 B.S.		Effect of Chilling and Annealing on Physical Properties and Microstructure of Cast Iron	Metals	Mr. Fales	
23	Lo	Jung An	1921 B.S.		Measurements of Distortion of Steel Rings	Metals	Professors Fuller and Smith	listed as primary author
24	Seetoo	Sik	1921 B.S.		Measurements of Distortion of Steel Rings	Metals	Professors Fuller and Smith	
25	Tu	Kuang Tsu	1921 B.S.		Moisture effect on light cotton fabrics	Textiles	George B. Haven	
26	Chen	Chi Shan	1922 B.S.		An investigation of the relative adhesion between rubber and fabric of two specimens of firestone automobile tires	Textiles	G. B. Haven, J. F. O'Neill	same person???????
27	Chen	Chi Shan	1922 B.S.		Design of Paper Clip Machine on Rotating Principles	Manufacturing		
28	Chien	Chang Tsu	1922 B.S.		Relative Strength of Staple Cotton in Comparison with Mixed Long and Short Staple	Textiles	George B Haven	
29	Ho	Tsun	1922 B.S.		A Study of Carbon Hydroelectric Dev. In California	Energy		
30	Kao	H.	1922 B.S.		Relative Strength of Staple Cotton in Comparison with Mixed Long and Short Staple	Textiles	George B Haven	
31	Li	Yao Huang	1922 B.S.		Impact Test of Heat Treated Cast Steel	Metals	(Author) Bickle, Samuel Ewart	
32	Lo	Ching Fan	1922 B.S.		Bearing pressure in wood	Manufacturing	E. P. Warner and I. H. Cowdrey	listed as primary author
33	Ta	Yuan Lun	1922 B.S.		Bearing pressure in wood	Manufacturing	E. P. Warner and I. H. Cowdrey	
34	Chan	F. C.	1923 B.S.		Efficiency Determination of Motorbic Hoist	Engines	(Author) William Brewster Gurney	listed as "other author"
35	Gong	G. H.	1923 B.S.		Annealed Steel Tensile Specimens w/ Grooves of Constant Radius and Various Depths	Materials		
36	Lam	Cho Kwan	1923 M.S.		Thermal conductivity & "film" coefficient of water	Thermo	Gordon B. Wilkes	
37	Shih	Chih Jen	1923 M.S.		Investigation of the strength of shrouded gear teeth	Manufacturing	unlisted	listed as 1924 in student doc
38	Tsang	P. L.	1923 B.S.		Investigation of the effect on tensile strength of a hole drilled in round machine member	Manufacturing	I. H. Cowdrey	
39	Young	I Kwei	1923 B.S.		To investigate the effect of different shapes of grooves on tensile strength of low carbon steel, having constant cross-section	Manufacturing	I. H. Cowdrey	
40	Chang	Wen Tsun	1924 B.S.		The construction of a new abrasion machine	Textiles	George B Haven	his B.S. was missing from student doc
41	Chou	Cheng Yu	1924 B.S.		A Study of "Chu-MA" as a Textile Fibre	Textiles	George B Haven	George B Haven SB MIT 1894
42	Hsu	Hsueh Chang	1924 B.S.		The construction of a new abrasion machine	Textiles	George B Haven	
43	Hsueh	Tsu Kang	1924 B.S.		A Study of "Chu-MA" as a Textile Fibre	Textiles	George B Haven	
44	Li	Ching Shan	1924 B.S.		A comparative test in annealed and spheroidized steels after quenching and tempering at different temperatures	Manufacturing	I. N. Zavarine	listed as primary author
45	Zien	Ziang Pian	1924 B.S.		A comparative test in annealed and spheroidized steels after quenching and tempering at different temperatures	Manufacturing	I. N. Zavarine	
46	Lee	Hung Fong	1925 B.S.		Power plant investigation at 84-16 Orsborne Stret, Cambridge, Mass. (Study of Power Distribution)	Energy	W. H. Jones	Other Authors:
47	Li	Ching Shan	1925 M.S.		A study of the effect of heat treatment on the drawing properties of steel wires	Metals	R. S. Williams and I. N. Zavarine	
48	Peng	Kai Hsu	1925 B.S.		A Power Plant for the city of Sha-Shih	Energy	unlisted	
49	Shih	Chia Yang	1925 B.S.		A study of the vibration of engines and the methods of balancing	Engines	J. C. Riley	
50	Zien	Ziang Pian	1925 M.S.		A study of the effect of heat treatment on the drawing properties of steel wires	Metals	R. S. Williams and I. N. Zavarine	listed as primary author
51	Chang	Wen Tsun	1926 M.S.		Investigation of 2-Ton York Refrigerator & Cooling Chamber	Thermo	C. W. Berry, C. E. Fuller	
52	Chu	Shih Ming	1926 B.S.		Bolt Failure on Account of a "Poor Fit"	Manufacturing	I. H. Cowdrey	
53	Peng	Kai Hsu	1926 M.S.		A study of kerosene engines	Engines	J. C. Riley	
54	Soolfoo	Theodore L.	1926 M.S.		Photoelastic Determination of Stress in Anchor Shackles	Metals	T. H. Frost.	naval dept
55	Shih	Chia Yang	1928 M.S.		Experiments on the Characteristics of a Jet Pump	Fluids	G. E. Russell	
56	Yin	Cho Lan	1928 B.S.		Duty test on the centrifugal pumping unit, Springsvale Pumping Station, Natick, Massachusetts	Fluids	J.J. Eames	chem eng dept
57	Thom	Jun Duk	1929 B.S.		The deformation of gear teeth under static load	Manufacturing	(Author) C. R. Greene	Thesis (B.S.)--Massachusetts Institute of Technology, Dept. of Mechanical Engineering,
58	Chao	Chao Hsiung	1930 B.S.		An investigation on the underlying thermodynamic principles in the manufacture of solid carbon dioxide ice	Thermo		"MICROFICHE COPY AVAILABLE IN ENGINEERING"
59	Wang	I Pao	1930 B.S.		Fuel Injection in High Speed Diesel Engines	Engines	Joseph C. Riley	

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