

Altitude: Cal Poly's Aeronautics Department and "Learn By Doing"

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By

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Introduction

The California Polytechnic State University, San Luis Obispo, started as a humble polytechnic school in a time when such schools had little repute. Given these origins, one might not think that Cal Poly would latch on to the latest technologies of its day as quickly as the larger, more established universities. But, in 1927, just 15 years after the first-ever powered flight, Cal Poly had established an Aeronautical Engineering Department with a class that had students build a functional airplane. This paper will examine if this applied learning approach to aeronautics education, ingrained in the Cal Poly slogan “Learn By Doing,” was unique to Cal Poly at the time.

Cal Poly, at the earliest days of powered flight, was still just a fledgling, largely-agricultural school in a time where polytechnic institutions were far from the premier colleges of the day.¹ The premier institutions were the wealthy liberal arts, classical education schools, whereas the polytechnic catered to the lower-income students, providing education for life as a mechanic or a farmer. Cal Poly constantly had to prove its worthiness of existence whilst in competition against other California colleges such as UC Berkeley and the Throop Polytechnic Institute (now CalTech).² But in 1927, just fifteen years after the Wright brothers had flown their first plane, Cal Poly had an aeronautics class that by 1928, produced its first plane modeled after the famed *Spirit of St. Louis* which had crossed the Atlantic. The cross-Atlantic voyage of Charles Lindbergh in the *Spirit of St. Louis* was an inspiration to Glen Warren and John “Monty”

¹ Myron Angel, *History of the California Polytechnic School at San Luis Obispo, California* (San Luis Obispo: Tribune Print, 1907), pg. 34 *

Montijo who would go on to teach the first students.³ According to some reports, the plane they oversaw, dubbed the Glenmont, is the “first student-built monoplane (in the United States).”⁴

This paper will compare the different approaches to aviation taken by different colleges around the country. Furthermore it will examine the courses offered during the 1920s and 30s by polytechnic colleges, which were most like Cal Poly, to see if the advance to the air was something occurring throughout the nation, or if Cal Poly was indeed leading the charge in enabling students to pursue aviation.

In 1935, Cal Poly was recognized by the already-famed Amelia Earhart who visited Campus over the summer.⁵ This visit by a figure of such high-repute in the world of flying might be interpreted as validation for the young California Polytechnic, its “learn by doing” philosophy, and its new aeronautics program. An Aeronautics program created without the help of a serious donor, that built real planes, following the cutting-edge shows Cal Poly was not only advanced for its time, it was the leading aviation school in the country. A humbly-funded vocational school, literally, dared to fly.

Historiography

While there is an overwhelming amount of scholarship about the rise of American aviation, there is not much research in the way of how schools approached flying education. But, Cal Poly’s program was born within what is often called the “Golden Age of Flying,” which took

² “A Great Hope Fulfilled: Creating the California Polytechnic School 1901-1933,” *Cal Poly: The First Hundred Years* (San Luis Obispo: Robert E. Kennedy Library, California Polytechnic State University, 2001,) pp. 15

³ Frank L. Warren, “My Uncle’s Airplanes: The Cal Poly Designs, 1927-1931,” *Skyways: The Journal of the Airplane*, July 1998, 2.

⁴ “First Student Built-Monoplane to Take-Off Today or Tomorrow,” *The Polygram*, 23 March 1928, 1.

⁵ Earhart with Aeronautics Department-restricted, photograph, 1935. Engineering-Aeronautics-Earhart, University Archives. Special Collections and Archives, California Polytechnic State University.

place around the 1920s. During this time there were numerous advancements in flying technology. The rise of the monoplane over the biplane, smooth-skin surfaces to reduce drag, single-shell construction of aircraft, the slotted wing and wing flaps, retractable undercarriages, metal propellers, and the radial engine were all coming into use around this time.⁶

Augmenting this progress and fostering greater advancement was funding from Daniel Guggenheim. The fund he established would start the aeronautics programs of some well-known schools such as the Massachusetts Institute of Technology.⁷ In fact, between 1926 and 1930, the Guggenheim fund had allowed for the creation of six aeronautical engineering programs at universities.⁸ In the same time frame, \$1,693,000 had been donated plus an additional \$500,000 donated to New York University in 1925, all of which would go to new facilities, laboratories, equipment, etc. Where at the beginning of the funding only 96 students were studying for aeronautics degrees, mostly at Guggenheim schools, the attention aeronautics had gained led to hundreds of students to enter the aeronautics field.⁹ The impact of the funding would be “reflected in the fact that by mid-century virtually all the senior aerospace engineers and scientists in the United States, and in many foreign countries as well, had graduated from Guggenheim-funded schools.”¹⁰ “Almost”, in part because Cal Poly, was not a beneficiary of the funding. Cal Poly’s ascent as an aeronautics school then, is somewhat more surprising.

The Curricula

⁶ Charles H. Gibbs-Smith, *Aviation: An Historical Survey of Aviation from its Origins to the End of World War II* (London: Her Majesty’s Stationery Office, 1970), 180-193.

⁷ “The Guggenheim Report,” *New York Times*, 6 February, 1929, 21.

⁸ Richard P. Hallion, *Legacy of Flight: The Guggenheim Contribution to American Aviation* (Seattle: University of Washington Press, 1977), 45.

⁹ Hallion, 70

¹⁰ Hallion, 70

Cal Poly, reputed to be the first school in the United States build a functioning monoplane from scratch, had the building of the plane as a stated goal in its 1927 curriculum, from the very start of the Cal Poly Aeronautics Department.¹¹ The goal of building a plane in the first year of the department's history appears ambitious. Whether or not that was true can in part be assessed by comparing Cal Poly's coursework to those of other schools. Two universities were selected for the purposes of this paper, Cornell University and the Massachusetts Institute of Technology.

Cornell University was selected because Myron Angel, in touring the country for ideas about how to run a Polytechnic school, used Cornell University as a model for Cal Poly.¹² Being a more established school than Cal Poly (Cornell started in 1865 and Cal Poly in 1901) establishing and improving an Aeronautics Department should be easier for Cornell than Cal Poly. Furthermore, Cornell, being a polytechnic, probably has a similar teaching philosophy to Cal Poly, and with more experience that philosophy should be more refined. Cornell's version of Learn by Doing should, by virtue of time, be more progressed.

In the 1910s Cornell had started an aero club called the Cornell Soaring Club, which built biplane gliders and competed with some other Ivy schools.¹³ The adoption of this early flying interest into a genuine academic program, however, took some time. In 1927, the same year that Cal Poly's Aeronautics Department was born, Cornell only had one class. The class was one of

¹¹ Academic Affairs, *The California Polytechnic Bulletin With Junior College Division 1928-29* (San Luis Obispo: California Polytechnic State University-San Luis Obispo), 32.

¹² Myron Angel, *History of the California Polytechnic School at San Luis Obispo, California* (San Luis Obispo: Tribune Print, 1907), pg. 34

¹³ Francis C. Moon, "A Brief History of the Sibley College and School." 15 January 2015. <http://www.mae.cornell.edu/about/briefhistory.cfm>, accessed 31 January 31 2016.

the “Special Topic Courses” and it was called “Aerodynamics and the Mechanics of Flight.”¹⁴ This course was “a study of horizontal flight, climbing, gliding, propellers, airplane characteristics and conditions for stability.”¹⁵ In the same year, Cal Poly’s Aeronautics department had two classes set to take place in its Aeronautics laboratory: *Motors*, which dealt with the “theory and practice of overhauling motors” for various types of motors, and *Construction and Care of Planes*, where students learned how to make and assemble different parts of planes as for real flying. So, despite a later start in the field of aviation, Cal Poly brought to bear more classes, and more intensive classes. The Cornell course, being only a “special topic”, indicates its purpose as a class for interested students hoping to dabble in the aeronautics field, to try it. The Cal Poly courses were meant for students who really want to enter the aviation industry. The level of work required, and the amount of hands-on practice, separated Cal Poly from its predecessor, Cornell University.

The Massachusetts Institute of Technology today is one of the leading technology schools in the country, and its reputation in aviation was already quite strong when in 1914 it “offered the nation’s first course in Aeronautical Engineering.”¹⁶ This strong tradition was supported by a Guggenheim grant of \$230,000 which went towards the construction of several facilities including wind tunnels and laboratories.¹⁷ It began its undergraduate program for aeronautical engineering in 1926, “Course 16”, under their department of Mechanical Engineering. Given its head start and enhanced facilities, the MIT Aeronautics course stood to be more advanced than

¹⁴ Cornell University, *Official publications of Cornell University V.22 1927/28* (Ithaca: Cornell University, 1928), 59.

¹⁵ Cornell University, 59.

¹⁶ “A Brief History of MIT Aeronautics and Astronautics” <http://aeroastro.mit.edu/about-aeroastro/brief-history>, accessed 28 February 2016. *

¹⁷ Richard P. Hallion, *Legacy of Flight: The Guggenheim Contribution to American Aviation* (Seattle: University of Washington Press, 1977), 59.

that of Cal Poly. In the description of the undergraduate program, the department states that the course was meant for the general education of students in the principles of flight as well as design and construction.¹⁸ Being a full-fledged undergraduate program, the MIT Course 16 offered several more classes than Cal Poly. The classes covered a range of topics meant for a more rounded aeronautical education. There were courses in theory and design practice, and applied mechanics, much the same as Cal Poly. The separation point between the two schools then, was the building of a functional plane. Keeping with the polytechnic spirit of hands-on training, Cal Poly's Aeronautics program allowed students to take on the challenge of building an advanced monoplane. Also, the project to build the plane shows Cal Poly's different area of emphasis in aviation education when compared to the Massachusetts Institute of Technology. Cal Poly had specialized its students to a greater degree to be professional airplane mechanics and engineers. The Cal Poly course was meant to guide students directly into the aeronautics industry by providing them with "comprehensive knowledge of what is necessary to keep an airplane in as nearly perfect condition as possible in order to insure safe and uninterrupted service."¹⁹ On the other hand, MIT's courses were "not so specialized as to go beyond the proper and necessary interest of any man entering any part of the aeronautical field"²⁰. The MIT courses were more introductory, more to give students ideas about the aeronautics industry to pursue and not necessarily meant to mold students into people working directly on aircraft.

So while the hands-on "Learn By Doing" approach may not be a solely Cal Poly philosophy, the extent to which Cal Poly pursued that philosophy was greater than any of its

¹⁸ *Bulletin, Massachusetts Institute of Technology: Catalogue For 1926-1927* (Cambridge: Massachusetts Institute of Technology, 1926), 109.

¹⁹ Academic Affairs, *The California Polytechnic Bulletin With Junior College Division 1928-29* (San Luis Obispo: California Polytechnic State University-San Luis Obispo) 32.

²⁰ *Bulletin, Massachusetts Institute of Technology: Catalogue For 1926-1927* (Cambridge: Massachusetts Institute of Technology, 1926), 109.

peers. Students worked on aircraft just as they would in any future career. As a result, Cal Poly students were more prepared to put machines in the air, just as Daniel Guggenheim would have wanted.

Building a Reputation

The California Polytechnic State University, San Luis Obispo was not California's first school. Other institutions had already been well established as a part of California's education system. Schools such as UC Berkeley and the Throop Polytechnic Institute (now CalTech) were some of the markers for what people were expecting out of a California school. These schools would serve as Cal Poly's competition in a way that went beyond academics: Cal Poly's right to exist. Cal Poly's achievements in the field of Aeronautics helped the young polytechnic make its case as having merit to its existence. They helped prove that California could use another school. Furthermore, they showed that Cal Poly was not just an average school, but a standout that people would respect.

Cal Poly's first plane, *The Glenmont*, modeled after the *Spirit of St. Louis* of Charles Lindbergh, was a product of the first year of the Aeronautics Department, 1927-1928. Charles Lindbergh's flight across the Atlantic Ocean had occurred the same year. A plane capable of accomplishing such a feat constituted state-of-the-art technology and the students of Cal Poly, the humble polytechnic, had already managed to replicate its form. Just before its first test flight "experienced aviators who have inspected the craft declare[d] that it is as fine a piece of workmanship as has been seen in flying circles and they predict[ed] that its test hop will show

the machine perfectly airworthy.”²¹ In its first year the Cal Poly Aeronautics department showed that it could take in students and have them ready for the aviation industry, fully up-to-date with knowledge of the latest materials, instruments, and techniques to building an aircraft. And, the *Glenmont* was the first Student-built monoplane in the country, highlighting Cal Poly’s “Learn By Doing” style, its effectiveness, and a confidence in its students not known in most other universities.

In July 1930 Cal Poly continued to show its expertise in aviation by smashing an altitude record for student-built planes. The record stood at 12,000 feet until Cal Poly’s plane reached 18,200 feet. Furthermore, the pilot reported that the plane, the “*Warren Taperwing*”, had the potential to climb even higher had it not been for a lack of oxygen that would have endangered the pilot, not the plane. The entire plane was of student construction except for the motor, instruments, and air wheels.²² This record attests to Cal Poly’s ability to keep up with the latest in the aviation field and its leadership among schools in the air.

Perhaps in part because of Cal Poly’s aerial prowess, Amelia Earhart, the famed female flyer who had just recently crossed the Atlantic, visited the Cal Poly campus in 1935.²³ While John Montijo, one of the professors for the Cal Poly Aeronautics class, had a personal connection to Miss Earhart (he was her flight instructor), the visit still affirms Cal Poly’s reputation as a strong aviation institution. Amelia Earhart was already famous, and visits from the famed do not just occur upon a random school. Furthermore, Miss Earhart even had her plane

²¹ “First Student Built-Monoplane to Take-Off Today or Tomorrow,” *The Polygram*, 23 March 1928, 1.

²² “Altitude Record Set with Trade School Plane,” *Union Oil Bulletin*, July 1930, 21.

²³ Earhart with Aeronautics Department-restricted, photograph, 1935. Engineering-Aeronautics-Earhart, University Archives. Special Collections and Archives, California Polytechnic State University.

repaired by students on the campus,²⁴ showing her confidence in the students' ability and the Cal Poly system of instruction.

The United States Navy also had a certain confidence about Cal Poly. They selected the university to be one of its few Naval Flight Preparatory Schools during World War II.²⁵ The Navy was interested in having Cal Poly provide "aviation ground school instruction for naval aviation cadets prior to their pre-flight training."²⁶ Given Cal Poly's demonstrated prowess with aircraft instruction, the Navy's interest in the school is understandable. Several classes that had gone through the university had constructed planes and would thus know how they function and how to maintain them. So, the Navy could trust that new cadets would be properly instructed in airplane caretaking and operation. With this trust from the Navy, Cal Poly solidified its reputation as an institution that was leading the way for students in aeronautics.

Conclusion

Cal Poly has continued its excellence as an aeronautics institution throughout its history, doing so through sheer enthusiasm. The program allows for students to innovate, leading to progress and new endeavors in unexplored areas of the science.

John McKeller, a Cal Poly student, in 1937-38 created a Flying Wing for which he "designed and patented" a control system.²⁷ The flying wing is theoretically the most aerodynamically efficient style of aircraft design, but very difficult to successfully control. The

²⁴ Earhart with Aeronautics Department-restricted, photograph, 1935. Engineering-Aeronautics-Earhart, University Archives. Special Collections and Archives, California Polytechnic State University.

²⁵ Randall Jacobs and F.U. Lake, letter to Julian A. McPhee, 31 October, 1942, McPhee Papers, Box 54 Folder, Special Collections and Archives, California Polytechnic State University.

²⁶ Randall Jacobs and F.U. Lake, letter to Julian A. McPhee, 31 October, 1942, McPhee Papers, Box 54 Folder, Special Collections and Archives, California Polytechnic State University.

²⁷ "From Biplanes to Reusable Launch Vehicles: 75 Years of Aircraft Design at Cal Poly"

Flying Wing, should it be feasible, would be at the cutting edge of flight technology. McKeller's design is just one design out of many others over decades of the program, each design a unique one. Arguably one of the most interesting designs to come out of the program, and one that was actually constructed, took flight on December 10, 1989: the world's first human-powered helicopter.²⁸ Perhaps one of the greatest successes from the University comes from alumnus Burt Rutan. He, with his company Scaled Composites, have designed dozens of aircraft including Voyager, the first plane to circle the globe without refueling.²⁹ Additionally, he designed SpaceShipOne, the first ever private spacecraft.³⁰ "Rutan said his learning experience at Cal Poly was invaluable to him, and the lessons have served him well, which included testing new planes while working at Edwards Air Force Base early in his career before starting his own business with a \$15,000 loan from his father."³¹ The accomplishments of these individuals all attest to Cal Poly's successful development of aeronautics students whose practical experience gave them a strong start. "I spent a lot of time in the hangar at Cal Poly," Rutan said."³² Even ongoing today, Cal Poly aeronautics, past the transition to aerospace, is a contributor. Cal Poly was even recognized by *Aviation Week and Space Technology*, the largest multimedia information and services provider to the global aviation, aerospace and defense industries, as "first in the nation for industry workforce recruiting" based on the academic reputation of the institutions coupled with the success of previous hires from the school by the corporation."³³ Furthermore, its

²⁸ Johnson, Douglass, "First Certified Human-Powered Helicopter Flight", photograph, 9 December, 1989. Centennial Book Photographs, University Archives. Special Collections and Archives, California Polytechnic State University.

²⁹ "Burt Rutan," photograph, Centennial Book Photographs, University Archives. Special Collections and Archives, California Polytechnic State University.

³⁰ Wilson, Nick, "Burt Rutan, Cal Poly grad and aerospace pioneer, has high hopes for space travel," *The Tribune*, 21 November, 2014, A1.

³¹ Wilson.

³² Wilson.

³³ Public Affairs. *Cal Poly is First in the Nation for Recruitment of Aerospace and Defense Workers*. Press Releases. 2010.

students, along with those of Stanford University, helped launch the CubeSat program in 1999 through which Universities, and now high schools, can build and launch satellites through NASA (National Aeronautics and Space Administration), a program continuing through the present.³⁴ Jason Crusan, director of the advanced space exploration systems division at NASA also acknowledged Cal Poly's impact: "Universities like Cal Poly have played a critical role in advancement capabilities for the world."³⁵ Cal Poly not only served as a way for students to enter the aeronautics world, but to push it forward as well.

The California Polytechnic State University, San Luis Obispo, began as a small school tailored to the laborers of the country. It had to struggle to prove that it had merit as an institution. But with some inspiration and a will to try, Cal Poly rapidly developed its Aeronautics Department into one that would produce a plane. That first success would be the keystone upon which Cal Poly's later success in aviation would be built. Few universities at the time could match such an accomplishment. And even today, Cal Poly and its students and alumni continue to push the boundaries of what was thought possible. In giving its students strong fundamental knowledge through "Learn By Doing", Cal Poly gives them a foundation from which to create new things and reach new altitudes. The depth to which Cal Poly took "Learn by Doing" made it a leader at the start of its aeronautics program. Its persistence with that philosophy has kept it a leader in aeronautics today. The humble polytechnic may not have to be so humble anymore.

Bibliography

Primary Materials

³⁴ Rachel Gasparini, "Cal Poly satellites set to launch," *Mustang News*, 19 November 2013.

³⁵ Gasparini.

Cal Poly: The First Hundred Years. San Luis Obispo: Robert E. Kennedy Library, California Polytechnic State University, 2001.

Academic Affairs, California Polytechnic State University – San Luis Obispo. *The California Polytechnic Bulletin with Junior College Division 1928-1929*. Course Catalogs. 1928.

“Altitude Record Set with Trade School Plane,” *Union Oil Bulletin*, July 1930, 21.

Angel, Myron. History of the California Polytechnic School at San Luis Obispo, California (San Luis Obispo: Tribune Print, 1907).

Bulletin, Massachusetts Institute of Technology: Catalogue For 1926-1927. Cambridge: Massachusetts Institute of Technology, 1926.

“Burt Rutan,” photograph, Centennial Book Photographs, University Archives. Special Collections and Archives, California Polytechnic State University.

California Polytechnic State University. *Cal Poly Is First in the Nation for Recruitment of Aerospace and Defense Workers*. N.p., 25 Aug. 2010. Web. 13 Mar. 2016.

Cornell University. *Official publications of Cornell University V.22 1927/28*. Ithaca: Cornell University, 1928.

“Earhart with Aeronautics Department-restricted”, photograph, 1935. Engineering-Aeronautics-Earhart, University Archives. Special Collections and Archives, California Polytechnic State University.

Gibbs-Smith, Charles H. *Aviation: An Historical Survey of Aviation from its Origins to the End of World War II*. London: Her Majesty’s Stationery Office, 1970, 180-193.

“The Guggenheim Report.” *New York Times*, 6 February, 1929, 21.

Johnson, Douglass, “First Certified Human-Powered Helicopter Flight”, photograph, 9 December, 1989. Centennial Book Photographs, University Archives. Special Collections and Archives, California Polytechnic State University.

“First Student Built-Monoplane to Take-Off Today or Tomorrow.” *The Polygram*, 23 March 1928, 1.

Jacobs, Randall and F.U. Lake, letter to Julian A. McPhee, 31 October, 1942, McPhee Papers, Box 54 Folder, Special Collections and Archives, California Polytechnic State University.

Public Affairs. *Cal Poly is First in the Nation for Recruitment of Aerospace and Defense Workers*. Press Releases. 2010.

Secondary Materials

- “A Brief History of MIT Aeronautics and Astronautics.” MIT AeroAstro <http://aeroastro.mit.edu/about-aeroastro/brief-history>, accessed 28 February 2016.
- “From Biplanes to Reusable Launch Vehicles: 75 Years of Aircraft Design at Cal Poly”
- Gasparini, Rachel. “Cal Poly satellites set to launch.” *Mustang News*, 19 November 2013.
- Hallion, Richard P. *Legacy of Flight: The Guggenheim Contribution to American Aviation*. Seattle: University of Washington Press, 1977.
- Moon, Francis C. “A Brief History of the Sibley College and School.” 15 January 2015. <http://www.mae.cornell.edu/about/briefhistory.cfm>, accessed 31 January 31 2016.
- Warren, Frank. “My Uncle’s Airplanes: The Cal Poly Designs, 1927-1931.” *Skyways: The Journal of the Airplane*, July 1998.
- Wilson, Nick. “Burt Rutan, Cal Poly grad and aerospace pioneer, has high hopes for space travel.” *The Tribune*, 21 November, 2014, A1.