

The History of Aviation Education and Training

Jorge M. M. Barata, Fernando M. S. P. Neves

Aerospace Sciences Department, Universidade da Beira Interior, Covilhã, Portugal

Email: jbarata@ubi.pt

How to cite this paper: Barata, J.M.M. and Neves, F.M.S.P. (2017) The History of Aviation Education and Training. *Open Journal of Applied Sciences*, 7, 196-205.

<https://doi.org/10.4236/ojapps.2017.74017>

Received: March 10, 2017

Accepted: April 27, 2017

Published: April 30, 2017

Copyright © 2017 by authors and Scientific Research Publishing Inc.

This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

Aviation education and training began early in the 20th century just after the first successful powered flight of the Wright brothers. In the present paper, the types of aviation education and training around the world are reviewed. Its developments were distinct in many different countries, and in some cases evolved from the military needs while in others from the dedication of a few enthusiasts. In the 21st century aeronautical and aerospace engineering is taught at the most advanced engineering schools in the world providing skills and competences that integrate advanced disciplines.

Keywords

Aviation History, Education

1. Introduction

Aviation Education and Training as an individual area began soon after the first successful powered flights early in the twentieth century. However, it should be pointed out that the Wright Brothers controlled flight in a heavier-than-air machine (**Figure 1**) would not be possible without the previous studies and experiments of others before them like Sir George Cayley, Otto Lilienthal, or Samuel Langley. In most cases, aviation education and training was an evolution of a well-established military command like in the United States, United Kingdom or Portugal. The military branch that took the first steps depending on the tradition of each specific country, and in some cases like United Kingdom and Portugal it was the Navy. Also, much scientific knowledge necessary to navigate was at that time an adaptation from the nautical methods to aviation [1] [2]. Training appeared in the first place as a consequence of the World War I and then World War II, and the necessity to prepare a significant number of pilots. The aerospace/aeronautical engineering studies appeared two decades after the Wright Brothers flight. Most detailed information on Aerospace Engineering education in the United States can be found in reference [3] that collects the history of



Figure 1. Orville and Wilbur Wright flew the Wright Flyer I, the first airplane, on December 17, 1903 at Kitty Hawk, North Carolina [4].

aerospace/aeronautical engineering from 69 American institutions. However, with regard to the evolution of aeronautics education in the world no systematic study can be found in the literature. In the present paper, the history of aviation education and training around the world is discussed, with a special emphasis on its evolution to the aeronautical/aerospace engineering degrees.

2. Aeronautical/Aerospace Engineering

Aeronautical/aerospace engineering may be considered an evolution of the ancient efforts on aviation training. However, before the first flight of a lighter-than-air machine there were several teaching initiatives of aeronautical/aerospace disciplines with profound scientific content. It is difficult to establish a clear milestone for the beginning of Aeronautical/Aerospace or Aircraft Education. So, in the present paper some events that were important to aviation education will be discussed, but no unequivocal idea of which university in the world was the first to offer such studies because the risk of not mention important initiatives that could have been relevant. Some of history's greatest mathematicians and physicists such as Newton, Bernoulli, Euler, and D'Alembert, developed and verified essential theories for the science of flying. The first scientist to study and publish about the design of flight vehicles was Leonardo da Vinci (1412-1519). After a long period of no apparent development, the next experimental designers were the inventors of the hot air balloons, Joseph and Jacques Montgolfier (1740-1810 and 1745-1799 respectively). The first person to separate lift and drag was George Cayley (1799-1853) followed by the first successful glider designer Otto Lilienthal (1848-1896) who was the first person to study control and stability of airplanes. In 1891 an American astrophysicist and astronomer, Samuel Langley made model airplanes powered by whirling arms and steam engines. One of them flew for 3/4s of a mile before running out of fuel.

In 1866 the Royal Aeronautical society was founded in London to further developments in the field of aeronautical science. This was shortly followed by

similar associations and institutes in France, the USA and Germany. In 1881 Hermann Ganswindt gives a talk at the Technical University of Berlin on spatial flight and in 1902 a professor of mathematics of the Technical University of Munich, Martin Wilhelm Kutta, and states that the lift of an airfoil is proportional to the circulation around it. Kutta became an associate professor of TU Munich in 1907, and two years later the Wright brothers Wilbur and Orville received an honorary doctorate from this university “in recognition of their purposeful, bold and successful solution to the flight problem”. In addition to a pioneering work with balloons, Santos-Dumont made the first European public flight of an airplane called 14-*bis* or *Oiseau de Proie* (“Bird of Prey”) on October 23, 1906 (Figure 2). This first flight was witnessed by the European press and French aviation authorities, and has been certified by the *Aéro Club de France* and the *Fédération Aéronautique Internationale (FAI)*. There is still some discussion on whether the Wright 1903 Flyer I, or the 14-Bis was the first airplane to fly. Santos-Dumont used wheels whereas the Wright brothers stuck with skids for too long, which necessitated the use of a catapult in the absence of significant wind. However, Wright brothers 1904 and 1905 Flyer machines could also take off unassisted given sufficient wind. Also, the 1905 Flyer (also called the Flyer III) flew more than 20 miles in October 1905, a full year before the 14-bis made its first flight. Santos-Dumont continued to fly until he had an accident in 1910 with the *Demoiselle*. He then felt serious ill and retired to a seaside village where he took astronomy as a hobby, and then came back to Brazil where he died in 1932 in not completely clear circumstances. One of the first initiatives of aviation education and training was military and occurred in the United States. On October 1909, Wilbur Wright instructed Lieutenants Frank P. Lahm and Frederic E. Humphreys on Signal Corps Airplane No. 1, which the Army had recently purchased from the Wright brothers (Figure 3).



Figure 2. Santos Dumont November 12th flight (in *Reviewers for Australasia*, 1907 issue [5]).



Figure 3. 1st Lt. Frank Lahm and Orville Wright in the first U.S. Army airplane, July 27, 1909 [10].

The two men received about "three hours training before soloing on 26 October 1909 [6]. In 1910 Lt. Benjamin D. Foulois taught himself how to fly in Signal Corps No. 1 while stationed at Fort Sam Houston, Texas. The Air Education and Training Command (AETC) only began their activities on 23 January 1942, when the War Department constituted and activated the Army Air Corps Flying Training Command. The history of the Aeronautics and Astronautics Department of the Massachusetts Institute of Technology (MIT) goes back to 1896 when the student Albert J. Wells built a 30 in² wind tunnel as a part of his thesis in mechanical engineering. However, the first evidence of the academic community becoming interested in human flight is found in 1883 when Professor J.J. Montgomery of Santa Clara College conducted a series of glider tests. Seven years later, in 1890, Octave Chanute (**Figure 4**) presented a number of lectures to students of the Sibley College, Cornell University entitled "Aerial Navigation" [3], and in 1894 he published the book "Progress in Flying Machines" [7]. In 1909 the Colonel Jean-Baptiste Roche, officer of the French army, and Vice-Director of the Engineering School of Versailles based in Paris the Graduate School of Aerospace and Mechanical Engineering, and begin offering the first established degree in Aeronautical Engineering. It became *École Nationale* (the highest designation and recognition of an university in France) in 1930 and changed its name to National School of Aeronautics and originated (1972) the national school of aeronautics and Space (SUPAERO). Nevertheless, as far as aeronautical engineering is concerned there appears to be some discussion as to where the first courses were taught. Reference [8] mention that the first formal courses in aerodynamics at academic level were taught in France by Professor Lucien Marchis at the University of Paris in 1910. However, Imperial College in London, England claims that they first taught a course in aeronautics in 1909 with a first chair in aeronautics established in 1920 [9].



Figure 4. Octave Chanute (American railway engineer and aviation pioneer that provided the Wright brothers with help and advice, and helped to publicize their flying experiments) [11].

In 1912 the German Institute for Experimental Aviation (DVL) and the Scientific Society of Instruments for Aviation is founded in Berlin. A couple of years later, in 1914, the first American collegiate aeronautics program begun at the University of Michigan. The first course was taught by Felix Wladislaw Pawlowski, who had graduated at Paris with Lucien Marchis [12]. In the next year, by November 1915 in the United Kingdom 2,500 acres of farmland were requisitioned, and in the following month, construction of a hutted camp and aircraft hangars began. The Royal Naval Air Service Central Service Training Establishment Cranwell was commissioned on the 1st April 1916, under the command of Commodore Godfrey M. Paine. The Royal Air Force only came into existence on the 1st April 1918. On September 28th 1912, Lieutenant Colonel *Albino Costa*, born at *Sever do Vouga*, Portugal, naturalized as Brazilian citizen, offered to its Motherland a *Deperdussin type B* monoplane [13]. On January 28th 1913, Portugal was affiliated to the *Fédération Aéronautique Internationale*-FAI (International Aeronautical Federation). Harnessing this enthusiasm, on February 8th 1913 was named a commission of Army and Navy Officers with the purpose to study and consolidate the main bases for the organization of a Flight School with military character and to choose the area as well as the airplanes to acquire. Later that year the Committee presented a report with some recommendations that led to a Law Decree signed by President of the Republic, Dr. *Manuel de Arriaga*, the Minister of War, General *Pereira D'Eça* and the Minister of the Navy, Commander *Augusto Eduardo Neuparth*, dated on 14th May 1914, creating a School of Military Aeronautics. The inclusion of a Marine Aviation section was thought narrowing the options of choice at locations near the Tagus River. The initial recommendation proposed *Alverca* as a location for the School, but great difficulties have arisen in connection with onerous land expropriations, and the location at *Vila Nova da Rainha* was adopted. It was inaugurated in 1916 with the designation of *Escola Militar de Aviação* (Military Aviation School, **Figure 5**). In August of 1916 Sacadura Cabral finished his apprenticeship at France

and returned to Portugal, and became pilot instructor at *Vila Nova da Rainha* (Figure 6).

Also in 1916 the first 4-year program in aeronautical engineering was established at the University of Michigan together with a department of aeronautical engineering. Sacadura Cabral and Gago Coutinho crossed the South Atlantic Ocean by air in 1922. They developed and used for the first time scientific methods of astronomic navigation when flying out of sight of land. A new model of sextant that could be used to measure the altitude of a star without the need of the sea horizon was developed. Another instrument called “path corrector” was introduced to calculate graphically the drift of an airplane and the direction of flight, taking into account the intensity and the direction of the winds. For the very first time in the history of the aviation the crossing of the South Atlantic had been achieved, and using an instrument that enabled an airplane’s position to be precisely determined by astronomic navigation when flying out of sight of land. Ten years after the Wright brothers, in 1919, Hugo Junkers received an

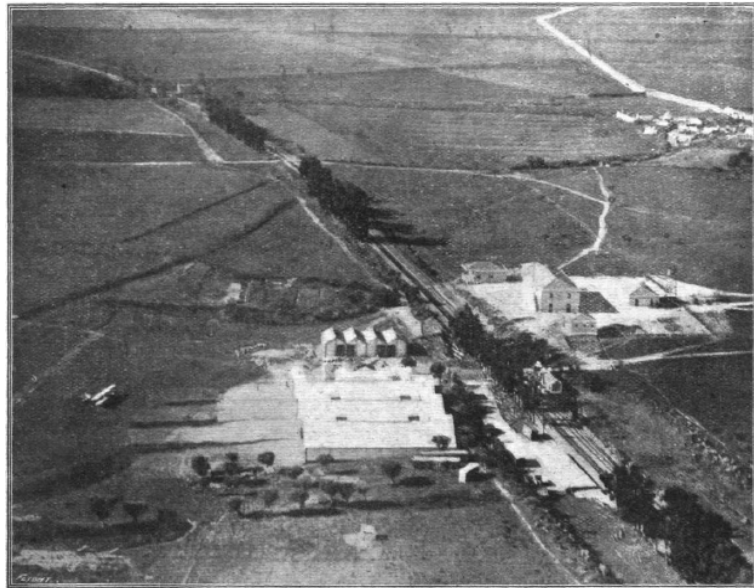


Figure 5. Military Aviation School at *Vila Nova da Rainha* (Portugal) [14].

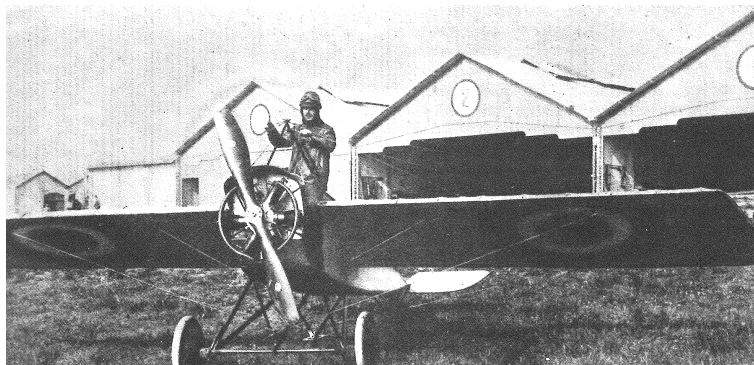


Figure 6. Sacadura Cabral at the Military Aviation School in a Morane Saulnier at *Vila Nova da Rainha*, Portugal (1917) [15].

honorary doctorate also from the TU Munich which was entitled “The pioneering engineer in the field of construction of metal aircraft” (Figure 7).

In 1929 Junkers became Honorary Senator of the Technical University of Munich, that continued playing an important role in engineering teaching. In 1923 Willy Messerschmitt graduate in mechanical engineering with a work on gliders, and became lecturer of aircraft in 1930 and finally Honorary Professor in 1937. This university would interrupt its relevant role in aircraft teaching when it was heavily damaged by allied bombing during World War II (the city of Munich was hit by 71 air raids over a period of six years). After reconstruction other areas of study emerged, and only in 2002 a new program “air and space” was launched. On the 4th June 1925 Daniel Guggenheim (Figure 8) School of Aeronautics officially opened at New York University. Daniel Guggenheim Fund for the Promotion of Aeronautics also made gifts to MIT, University of Michigan, Stanford University, and the California Institute of Technology. The Daniel Guggenheim Fund for the Promotion of Aeronautics was formally established on June 16, 1926, and was decisive for the development of programs in aeronautical engineering. Its major goals related to aeronautical education, aeronautical research, the development of commercial aircraft and aircraft equipment, and the application of aircraft to a variety of economic and social activities. The MIT’s undergraduate program in aeronautical engineering began in 1926, under the Department of Mechanical Engineering. In 1928 the Daniel Guggenheim Aeronautical Laboratory opened in MIT building 33, and in 1939 Aeronautics became a distinct department. Another important American initiative in the 20’s began on the 17th December 1925 when John Paul Riddle and T. Higbee Embry founded the Embry-Riddle Company at Lunken Airport in Cincinnati, Ohio. They realized that after World War I interest in flying was increasing rapidly, and this could become a prosperous area of business. So, their company opened the Embry-Riddle School of Aviation to train airplane pilots in an efficient manner. The demand dropped down in the 30’s, but with the World War II the company received more than 25,000 men to be trained at pilots and

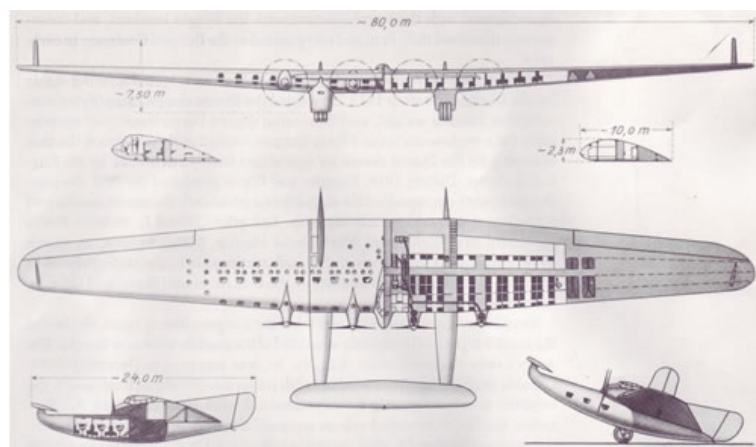


Figure 7. Hugo Junkers’s 1924 design for a giant airplane closely approximated a true flying wing in concept [16].

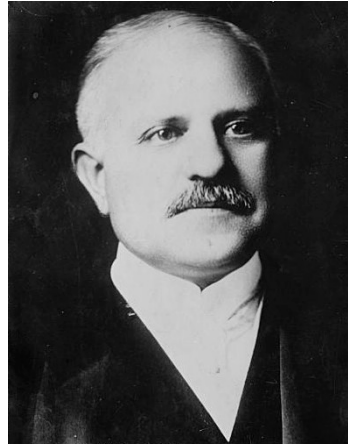


Figure 8. Daniel Guggenheim [17].

technicians. During the Korean War the US Air Force contracted with Embry-Riddle to train airmen in the fundamentals of airplane maintenance. In the late 60's Embry-Riddle gained the stature of University and presently offers more than 35 programs that include not only the aerospace engineering area but others like management, Electrical Engineering, Mechanical Engineering among others.

The University of Cranfield in the United Kingdom was formed in 1946 as the College of Aeronautics on the former Royal Air Force base of RAF Cranfield which opened in 1937. The main campus is located in Bedfordshire and is unique for having its own operational airport (Cranfield Airport) next to the main campus. The facilities at the airport are used by Cranfield University's own aircraft in the course of aerospace teaching and research.

A study program for Aerospace Engineering has existed in the Netherlands since 1940, when Prof. Dr. ir. H.J. van der Maas was named Professor of Aeronautical Engineering at the Delft Technische Hogeschool. The goal of the study program is to educate engineers in the field of aeronautics, as well as in space technology. The faculty's history from 1940 to 1990 has been recorded in a jubilee book, published for the faculty's fiftieth anniversary by Delft University Press. The title of this unique book is *Vijftig jaar Vliegtuigbouwkunde in Delft*. The book is available at the desk of the Society of Aerospace Students "Leonardo da Vinci". Presently, hundreds of aviation training institutions and higher education schools exist, and in the present paper only the aspects related to the foundation of these activities were mentioned. Many other important institutions [18] occupy an important role in the present world education aviation and training as, for example, Beihang University, Bengal Engineering and Science University, Brno University of Technology, California Institute of Technology, Georgia Institute of Technology, Imperial College, Indian Institute of Technology Kampur, Instituto Superior Técnico Lisbon, Islamabad Institute of Space Technology, Loughborough University, Nanjing Aeronautics and Astronautics University, National University of Sciences and Technology of Pakistan, Newcastle University, Rzeszów University of Technology, Politecnico di Milano, Po-

litenico di Torino, Queens University Belfast, Royal Melbourne Institute of Technology, RWTH Aachen, Seoul National University, Stanford University, United States Air Force Academy, United States Naval Academy, Universidad Carlos III de Madrid, Universidad Politecnica de Madrid, Universitat Politècnica de Catalunya, University of Bath, University of Belgrade, University of Bristol, University of Cambridge, University of Illinois, University of Limerick, University of Maryland, University of Nottingham, University of Pisa, University of Sheffield, University of Southampton, University of Texas at Austin, University of Toronto, Virginia Tech, Warsaw University of Technology, Wichita State University.

3. Conclusion

Aviation education and training began early in the 20th century just after the first successful powered flight of the Wright brothers. Its roots were in France, although important events occurred in England and Germany. The evolution in the United States was very intense due to several vision men like Octave Chanute or Daniel Guggenheim. During World Wars I and II there was a rapid evolution of aviation training, but in the second half of the twentieth century civil schools become more important. Presently there are hundreds of colleges and degrees in aeronautics and aerospace engineering around the world.

Acknowledgements

The present work was done in the scope of the activities of LAETA-Associated Laboratory of Energy, Transports and Aeronautics (UID/EMS/50022/2013).

References

- [1] Neves, F.M.S.P., Barata, J.M.M. and Silva, A.R.R. (2010) Gago Coutinho and the Aircraft Navigation. *Proceedings of the 48th AIAA Aerospace Sciences Meeting Including the Horizons Forum and Aerospace Exposition 2010*, Vol. 3, 1823-1832. <https://arc.aiaa.org/doi/abs/10.2514/6.2010-156>
<https://doi.org/10.2514/6.2010-156>
- [2] Silva, A.R.R., Barata, J.M.M. and Neves, F.M.S.P. (2016) Gago Coutinho and the Scientific Navigation. *Open Journal of Applied Sciences*, **6**, 751-769. <https://doi.org/10.4236/ojapps.2016.610067>
- [3] McCormick, B., Newberry, C. and Jumper, E. (2004) Aerospace Engineering Education During the First Century of Flight, Library of Flight Series, American Institute of Aeronautics and Astronautics - AIAA.
- [4] Wright, O., Wright, W. and Daniels, J. T. (1903) First Flight, 120 Feet in 12 Seconds, 10:35 Kitty Hawk, North Carolina, Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA. <https://lccn.loc.gov/00652085>
- [5] Judkins, W.H. (1907) The Review of the Reviewers for Australasia. Volume 31.
- [6] Manning, T.A., Ashcroft, B.A., Emmons, R.H., Hussey, A.K. and Mason, J.L. (2005) History of Air Education and Training Command 1942-2002, Office of History and Research Headquarters, Randolph Air Force Base, Texas, USA.
- [7] Chanute, O. (1894) Progress in Flying Machines. [Re-Edited (2003) Dover Publications. Inc., 978-0486299815].

- [8] McCormick, B.W. (2002) The Growth of Aerospace Engineering Following Its Beginning, AIAA Paper 2002-0560, 40th Aerospace Sciences Meeting and Exhibit, 14-17 January, Reno. <https://arc.aiaa.org/doi/abs/10.2514/6.2002-560>
- [9] Ransom, E.C.P. and Self, A.W. (2002) The Origins of Aerospace Engineering Degree Courses. *Aircraft Engineering and Aerospace Technology*, **74**, 355-364. <https://doi.org/10.1108/00022660210434433>
- [10] https://commons.wikimedia.org/wiki/File:Lahm_and_orville_wright.jpg
- [11] Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA, Digital ID cph 3a51897. <http://hdl.loc.gov/loc.pnp/cph.3a51897>
- [12] Adamson Jr., T.C. (2002) Aeronautical and Aerospace Engineering at the University of Michigan, AIAA Paper 2002-0567, 40th Aerospace Sciences Meeting and Exhibit, 14-17 January, Reno. <https://arc.aiaa.org/doi/10.2514/6.2002-567>
- [13] Gruntman, M. (2007) The Time for Academic Departments in Astronautical Engineering, AIAA Paper 2007-6042, AIAA SPACE 2007 Conference & Exposition, 18-20 September, Long Beach. <https://arc.aiaa.org/doi/10.2514/6.2007-6042>
- [14] Cardoso, E.P.C. (1981) História da Força Aérea Portuguesa, Vol. II, Edição Cromocolor, Lda, Lisboa, Printed in Gratel, SARL, 2700 Amadora.
- [15] Neves, F.M.S.P., Barata, J.M.M. and Silva, A.R.R. (2016) Sacadura Cabral and the Dawn of Portuguese Aviation. *Open Journal of Applied Sciences*, **6**, 16-30. <https://doi.org/10.4236/ojapps.2016.61003>
- [16] <http://www.century-of-flight.net/Aviation%20history/flying%20wings/Early%20Flying%20Wings.htm>
- [17] Library of Congress's Prints and Photographs division, Digital ID ggbain.03559, <http://hdl.loc.gov/loc.pnp/ggbain.03559>
- [18] US News & World Report, Best Colleges 2011, 17 August. <http://www.usnews.com/articles/education/best-colleges/2010/08/17/best-colleges-2011-about-the-rankings-methodology.html>



Submit or recommend next manuscript to SCIRP and we will provide best service for you:

Accepting pre-submission inquiries through Email, Facebook, LinkedIn, Twitter, etc.

A wide selection of journals (inclusive of 9 subjects, more than 200 journals)

Providing 24-hour high-quality service

User-friendly online submission system

Fair and swift peer-review system

Efficient typesetting and proofreading procedure

Display of the result of downloads and visits, as well as the number of cited articles

Maximum dissemination of your research work

Submit your manuscript at: <http://papersubmission.scirp.org/>

Or contact ojapps@scirp.org