Aeronautical Engineering: History And Impact On Modern Society

Theoretical and historical background of aerodynamics:

The first flight of a man-made object was during 400 BCE with the invention of the kite. During this time these kites were developed to carry out religious ceremonies in China. It until 1783 when the successful flight would be achieved by humans. However, during the meantime, studies of aerodynamics were conducted by inventors such as Leonardo da Vinci. Da Vinci produced over 100 drawings that illustrated his theory of flight. This was largely based on his study of bird flight. Da Vinci had produced prototypes that required the use of human muscle power however, there is no evidence of his prototypes being tested. During the 17th century, two brothers from France had set out to develop what would be known as a hot air balloon today. Joseph- Michel and Jacques- Etienne Montgolfier, observed and experimented with lighter than air devices. The brothers observed as they directed heated air into objects such as paper bags or fabric bags, causing it to rise and float for a very short period of time. After several successful tests, the brothers decided to publicly demonstrate their invention. The Montgolfiers built their invention with the use of silk, lined with paper that was 10 meters in diameter. To power this the brothers used a coal heater which produced high-temperature fumes which were directed inside the “hollow silk cover. The hot air balloon lasted in the air for approximately 4 minutes, carrying 2 passengers. On January 19th 1784 the Montgolfiers corrected their design allowing them to carry 7 passengers over an altitude as high as 914 metres.

With the transition towards the 18th century, Sir George Cayley became responsible for providing a better understanding of aerodynamics. Cayley was fascinated by flight since his childhood days. His most important contributions include the advantages of streamlining, understanding and adopting longitudinal and lateral stability, elements of wing designing and providing an understanding of the use of rudders and elevators for aircraft control. Cayley was well educated in Physics and understanding which helped his understanding of aerodynamics. However, Cayley’s most important development was is his newly constructed design idea of the plane wing. This changed the traditional view of flight through the motion of birds to what is known today, a more realistic fixed plane wing. The new design allowed for air to correctly flow over and under to generate correct proportions of lift and downforce, with stability.

Lawrence Hargrave was an aeronautical pioneer and inventor. Hargrave was born on the 29th of January 1850. His most important inventions include the box kite and the invention of the rotary aircraft engine. Hargraves greatest contribution to aeronautics was his invention of the box kite. The box kite had four stages of development, starting from a simple cylinder kite to a more capable double celled kite with potential to lift Hargrave 5 metres from the surface. The box kite was one of Hargraves greatest inventions and became an inspiration for many other inventors, such as Alberto Santos, who undertook controlled flight In Europe in 1906. The radical rotary invention was developed in 1889 and provided the advantages of being compact, smooth-running, having a phenomenal power to weight ratio and providing efficient cooling of the engine, as the air would revolve around the engine. However, though creating a groundbreaking invention for the time, Hargraves rotary engine was considered inefficient and

unreliable, thus leaving its potential untouched.

Orville and Wilbur Wright, also known as the Wright brothers, are condemned to their contributions to the history and development of aviation, as they were the first to fly a heavier than air object with complete piloted control. Having an interest in flight and income to fund their inspirations the brothers were determined to take flight. The brothers began testing their plane designs with “wing warping”, made with small biplane kites. The testing was conducted in Dayton in the summer of 1899 and upon discovering the brothers could cause the kite to climb, dive and bank, right or left at will, the Wright brothers began to design their first full-scale plane glider. Realising that their original location of Dayton was not ideal for conducting flight due to low winds and flat terrain, the testing grounds were decided to be moved to an isolated area of North Carolina. In October 1900, the glider was tested however, it developed less left than expected. The Wright brothers solved their issues with lift, through developing a wind tunnel and conducting a variety of experiments to gather information. With the major aerodynamic issues solved the Wright brothers set out to construct what would be known as the wright flyer. The plane was powered by a 4-cylinder internal combustion engine co-designed by the Wright brothers and Charles Taylor. On the morning of December 17th 1903, the Wright brothers made the first successful flight, covering approximately 36 metres in the air in 12 seconds, followed by their second attempt achieving 60 metres in 15 seconds. The Wright brothers managed to fly 259 metres in 60 seconds, demonstrating for the first time in history sustained flight, under the complete control of the pilot.

In 1909, 6 years after the accomplishments of the Wright brothers, Colin Defries makes the first powered flight in Australia. This flight was achieved with one of the Wright brother’s commercial inventions known as the “Wright Model A”. Defries managed to reach a maximum height of 6 metres, whilst flying for 100 metres in a straight line. Despite the Wright brother’s being the first to achieve piloted flight, the accomplishment of Colin Defries remains important in the history of Australian aeronautics.

Impact on modern society:

With the invention of the aeroplane, society has been able to become advanced in it ways of travel, with the modern commercial aircraft being used more and more each day to transport its passengers all over the globe. Firstly, modern commercial aeroplanes allow for the transportation of passenger to destinations around the globe. This allows the cultures and commodities across the world to come closer. Furthermore, alongside the primary role of transportation, the invention of the aeroplane has allowed economic growth through creating new jobs for people, some jobs include; service engineers, aeronautical engineers, Baggage collectors, etc. Another example of economic growth through aeronautical inventions involves the transportation of goods for businesses. This essentially allows businesses to transport their goods across the globe with faster transportation times when compared to traditional transportation methods such as cargo ships. However, with the invention, there have many negatives impacts which affect both society and the earth's environment. Due to the constant reliance of the aeroplane, carbon emissions have significantly increased, which affects the atmosphere of the environment as the carbon is forced into the air. Furthermore, these aircraft require large amounts of fuel in order to fly, which contributes to the drainage of the earth’s resources eg. Coal. To further add to the environmental impacts, airports need to be built in order to accommodate for these planes and in some cases, multiple airports are built in a city,

which is the case of Sydney. This affects the environment as green space is reduced in order to build these airports. As a result of building airports, residents who live near zones of the area would experience significant noise pollution, which results In a lower quality of life for those residents. Society would be further affected, due to the increase of traffic density, around the areas of these airports.

Planes have positively benefited within an economical means for it has increased international trade and has caused major economic growth. They have made adaptations in the way transportation influences communication and

Role of Aeronautical Engineers:

An engineer's job consists of managerial responsibilities. Firstly, an engineering manager is required to coordinate activities at the construction site of the aircraft. When in management of project engineering managers are required to inspect and ensure quality assurance through testing. In addition, engineering managers also have the responsibility of preparing budgets, hiring staff, and supervising employees. Engineering managers are required to solve technical problems that prevent the completion of the project and spend a great deal of time coordinating the activities of their staff through conferencing with other managers, including those in finance, production, and marketing. Engineers are required to act accordingly with professionalism and ethics when confronted with complex and conflicting decisions. Ethically engineers have the responsibility to report their findings truthfully and accurately even during situations where the consequences may be detrimental to their or their employers' career. This is to uphold the top priority of an engineer, which is in the interest of public safety. This is especially important in the certification of new aircraft designs and the establishment of repair and maintenance routines. Aeronautical engineers are required to conduct in-flight tests to gauge the handling and performance characteristics of the aircraft to ensure it is safe and fully operational.

However, in order to progress to this level of responsibility, the aeronautical engineer requires extensive amounts of training in the form of high levels of education and practical experience. The decision of adopting a career in the path of an engineer is recommended to be decided during high-school. This is because certain subjects act as a prerequisite in order to attend an engineering course within a university. Some of the subjects include; 3 Unit or extension maths, Physics and in some courses, engineering is also required. After successfully completing these subjects, an aeronautical engineer is required to attend a university course related to their future field of work. Typically, an aeronautical engineer would attend an aeronautical engineering course or a mechanical engineering course until completion of a master's degree which requires approximately 6 years. After completing a master's degree, an engineer is required to gain practical experience before they are employed by any firm. This can be in the form of internships provided by potential future employers. Within employment, an engineer would be required to attend a short refreshers course in most cases provided by the employer. During this time aeronautical engineers will complete small tasks to familiarise themselves with the profession, this may include tasks such as servicing the aeroplanes. As an aeronautical engineer acquires more experience tasks of more responsibility can be expected. Throughout the professional career of an aeronautical engineer, it is important to constantly attend training courses. This to ensure that the knowledge of an engineer remains relevant and up to date with newer developed technology.

Bibliography

1. Lynn, Joseph. “Architectural and Engineering Managers: Occupational Outlook Handbook.” U.S. Bureau of Labor Statistics, U.S. Bureau of Labor Statistics, www.bls.gov/ooh/management/mobile/architectural-and-engineering-managers.htm.
2. Sharp, Tim. “The First Hot-Air Balloon | The Greatest Moments in Flight.” Space.com, Space, 9 Apr. 2019, www.space.com/16595-montgolfiers-first-balloon-flight.html.
3. Crouch, Tom D. “Sir George Cayley.” Encyclopædia Britannica, Encyclopædia Britannica, Inc., 23 Dec. 2018, www.britannica.com/biography/Sir-George-Cayley.
4. Smith, Alford. “ BiographySir George Cayley1773-1857.” Heritage, https://aerosocietyheritage.com/biographies/george-cayley
5. Editors, History.com. “Wright Brothers.” History.com, A&E Television Networks, 6 Nov. 2009, www.history.com/topics/inventions/wright-brothers.
6. Crouch, Tom D. “Wright Brothers.” Encyclopædia Britannica, Encyclopædia Britannica, Inc., 27 Sept. 2018, www.britannica.com/biography/Wright-brothers
7. Wallace, Mark. “Australian Dictionary of Biography.” Biography - Lawrence Hargrave - Australian Dictionary of Biography, adb.anu.edu.au/biography/hargrave-lawrence-6563
8. Larence Hargrave Centre. “Radical Rotary Engine .” Lawrence Hargrave Centre - Radial Rotary Engine, http://lawrencehargravecentre.com/radialrotary.html
9. O-Brian, Jackson. “Box Kite Designed by Lawrence Hargrave.” MAAS, 16 Jun. 2019, https://collection.maas.museum/object/236326