

ORIGINAL ARTICLE

Ibn Firnas and His Contribution to the Aviation Technology of the World

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ABSTRACT

As early as the 9th century A.D., a Muslim scholar named ‘Abbas Ibn Firnas pioneered the study of aviation. Ibn Firnas invented a gliding device which managed to be airborne for a short duration of time. Although he was badly injured during a bad landing, he successfully pioneered the theory on the structure of *ornithopter* which is a vital component for aircraft stability during landing. This article unveils the early history of aviation beginning from the early period of Islamic golden age to the 20th century A.D. that has witnessed Western effort in introducing machine in aircraft. This research employs a qualitative method via library research and document analysis. It argues that the invention of *ornithopter* by ‘Abbas Ibn Firnas has inspired the West to further develop the aviation technology thus influenced the modern method of flying. Therefore, naturally ‘Abbas Ibn Firnas should be recognised as ‘the father of the aviation field’ for his invaluable contribution to the contemporary field of aviation technology of the world.

Key words: Ibn Firnas, Islamic civilisation, Technology, Flight, Aviation

Introduction

Science and technology are among the important aspects in human life today. Consequent to the development in these fields, the world starkly differs from what it used to be. Numerous innovations are making our daily life more convenient. Furthermore, innovations in science and technology create a huge impact onto the building of a civilised society in a country.

History has proven that Islamic civilisation gave priceless contribution to the world civilisation. Islamic civilisation has produced many great scholars in numerous fields such as philosophy, science, politics, literature, social sciences, religious studies and medicine. Previous studies have discussed the role that the Islamic civilisation played in influencing present-day human civilisation (al-Hassani, Salim T.S., 2006; Roziyah Sidik @ Mat Sidek, 2009; Maimun Aqsha Lubis. 2010; Mohd Zambri Zainuddin, 2008; Roziyah Sidik @ Mat Sidek, 2012). Furthermore, the advancement of knowledge in the Muslim world is recognised as the catalyst for the European Renaissance that had produced a great civilisation in Europe. This fact has been acknowledged by The United States of America’s President Barrack Obama during his speech in Cairo, soon after his appointment as the 44th president of the United States of America. In his speech, Obama (Obama, B., 2009) asserted that:

“As a student of history, I also know civilisation’s debt to Islam. It was Islam at places like Al-Azhar University, that carried the light of learning through so many centuries, paving the way for Europe’s Renaissance and Enlightenment. It was innovation in Muslim communities that developed the order of algebra; our magnetic compass and tools of navigation; our mastery of pens and printing; our understanding of how disease spreads and how it can be healed. Islamic culture has given us majestic arches and soaring spires; timeless poetry and cherished music; elegant calligraphy and places of peaceful contemplation. And throughout history, Islam has demonstrated through words and deeds the possibilities of religious tolerance and racial equality”.

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Obama's statement reinforces the fact that the West does not deny the role of Islamic civilisation as the catalyst to the era of *Renaissance* and *Enlightenment* in the West. However, the concept of dualism brought forward by the West has caused the separation of religious and worldly affairs into two separate entities which is contradictory to the teachings of Islam. This is because Islam emphasises the religious aspects in life and considers religion as a fundamental in the establishment of civilisation in any society.

Aviation Early History:

There are archaeological artefacts, dating from the early Mayan civilisation (3000 B.C.), Egypt (3150 B.C.), Greek (25000 B.C.) and Babylon (2000 B.C.), in the form of sketches depicting the ability of human to fly. These are normally associated with legends, myths, supernatural powers or miracles that no ordinary man can perform (www. history-of-flight.com [3 April 2011]).

Later in the 9th century A.D., a Muslim scholar, Ibn Firnas, proved that human can fly in the air by inventing bird-like wings that can support the weight of human body mid-air. Observation on the characteristics and anatomy of a bird gave inspiration to man on how to build a flying device that includes the wings structure, the body frame and the tail. The manner in which a bird flies does not become a reference point for Ibn Firnas only, but it also has become an inspiration for today's modern aviation industry. Scientific research on the bird's body structure and the environment that allows the bird to fly are being studied in the West.

As generally known, birds flap their wings in order to harness thrust when flying. When a bird changes the position of its wings, it forms an angle of attack that creates the lift force. Whereas, an aircraft harnesses power from the engine for thrust and the angle of attack is formed by the flap/aileron shape to provide for the lift. During landing, a bird changes the position of its wings for drag, whilst its tail that acts as a rudder to manoeuvre and decreases its mid-air speed. On the other hand, an aircraft changes the positioning of landing flap on its wing to increase drag thus decreasing the thrust. The aircraft tail is used as to manoeuvre and to provide for stability (Hansen, J.R., 2004; Videler, J.J., 2006).

Apart from the bird's movement, the shape of its wing has also been modelled to build wings of aircraft. Engineers designed the shape of an aircraft wing based on the structure of the bird's wing which can bend upwards and downwards (Arnold, C., 2003). The excellent aerodynamic shape of a bird's wing enables it to fly. It provides for lift and thrust when flapped for take-off and landing.

In the 17th century A.D., an Italian scientist Giovanni Alfonso Borelli studied the body structure of a bird (Pulkkinen, J., 2008). His writings became a reference in building of aircraft in the 20th century A.D. Nonetheless, Muslim scholars in Cordoba had done scientific research on birds as early as in the 9th century A.D. (al-Maqqari, Ahmed Ibn Muhammed, 1840). Many aspects were studied, including the shape of the wing, the body structure and the variety of feathers. However, the objective of their study on birds at that time was not to invent a flying device but rather to uncover the secrets of Allah's (s.w.t.) creation as mentioned in The Holy Qur'an, verse 19 of Surah al-Mulk:

"Do they not observe the birds above them, spreading out their wings and folding them in? None upholds them except Allah the Most Gracious. Truly (Allah) Most Gracious: Truly it is He that watches over all things".

The above verse calls upon men to observe the creation of birds so that they can learn from it and appreciate the greatness of the Creator. Observing the surrounding environment with the right mind will lead to one's passion in the quest of knowledge, creating more new knowledge. For instance, the understanding of bird's anatomy and its movement will open up new knowledge such as that of air composition, climatic influence, use of light alloys for the aviation industry and scientific calculation required to create thrust and lift for an aircraft. Such philosophy and spirits were internalised by Ibn Firnas. To him, understanding the law of nature through appreciation of the content of the Holy Qur'an can bring human beings closer to their Creator. It was the observation of nature, through mimicking birds, which led him to carry out his flying experiment scientifically.

Background of Ibn Firnas:

Abu al-Qasim 'Abbas Ibn Firnas Ibn Wardus, also known as Ibn Firnas, was born in the 9th century A.D. in Ronda (Bosworth, C.E., 1986; The Encyclopaedia of Islam, 1986). Ronda was a well-known city of tourism in the province of Malaga. The uniqueness of its nature was the main attraction of this city. Ronda played the role as the city centre for southern al-Andalus during the rule of Ummayyad Kingdom. It was the only city to have been built in the mountainous Serenia known as Takarona. After Islam came to al-Andalus in 711 A.D., fortresses were built around the town and the city went through rapid development.

Although Ibn Firnas was a native of Ronda, he migrated to Cordoba in the pursuit of knowledge. His passion for knowledge led him to leaving his hometown. Apart from that, Ibn Firnas had also travelled to Iraq for some time before returning home (Mahayudin Yahaya, 1986). As generally known, the city of Baghdad, is renowned for its centre of knowledge, i.e. the *Dar al-Hikmah*, which was home to a huge number of Islamic

scholars, scientists, writers, poets, artists and craftsmen (Cavendish, M., 2011). It was there that Ibn Firnas studied a range of knowledge and mastered many studies such as astrology, astronomy, engineering and music.

Ibn Firnas was also known as a great poet but his invention of the flying device made him legendary. The flying device that he designed was the first man-made object to have flown man in the air. His proficiency in poetry is evident from his appointment as the royal poet of Cordova's *Imarah* palace. He lived under the rule of four *Amirs* in the era of *Imarah*, which witnessed the leadership of al-Hakam I, 'Abd al-Rahman II, Muhammad I and al-Mundhir. Most historians are in the opinion that Ibn Firnas passed away in 887 A.D. [17, 18] in the ruling era of al-Mundhir (al-Maqqari, Ahmed Ibn Muhammed, 1840).

Pioneer in the Field of Aviation:

Numerous sources maintained that 'Abbas Ibn Firnas was the first man to have flown (Hitti, P.K., 1964; Lear, J., 1961; Masood, Ehsan. 2009; White, L.J., 1961). This fact is also recognised by a Western scholar, Phillip K. Hitti, who studied the Arab world. In his book entitled, *History of the Arabs: From the Earliest Times to the Present*, he stated that, "Ibn Firnas was the first man in history to make a scientific attempt at flying". In Latin, Ibn Firnas is known as Armen Firman (www.muslimheritage.com). However al-Hassani (2006) could not agree with the West that latinised Ibn Firnas' name as the former insisted that the West should address the latter with his real name. In his response to al-Hassani, Lienhard (2003) stated that Armen Firman is a different individual that had given inspiration to Ibn Firnas to fly. However there is no authentic source of validation. Hence the source that contended Armen Firnas and Ibn Firnas as the same person is deemed more accurate.

As far as Ibn Firnas' contribution in aviation is concerned, it is almost clear that he began inventing the flying device that let him fly from one place to another in 875 A.D. This flying device, made of silk and feathers from eagle, required him to be on a higher place for take-off, gliding down while flapping the wing with his hands. In his efforts to fly, Ibn Firnas was very persistent and tenacious. He never gave up tweaking and redesigning the structural design of the flying device from time to time. At 65 years old, he tested his flying device in front of a number of spectators that came out to watch at Jabal al-'Arus, Rusafa. The highland allowed him to glide through the air flying for more than ten minutes before a bad landing that damaged his glide. Consequently, Ibn Firnas injured his back badly and one of his backbones was broken. The incident prevented him from further flight trials. Twelve years later, in 887 A.D., he passed away at the age of 77 with another account saying he was 80 years old.

Ornithopter Theory:

Upon the accident of flight trials, Ibn Firnas realised that the tail end structure is a vital part for landing, and this is similar with how a bird uses its tail to decrease its speed. This structure is later named *ornithopter* by da Vinci (Scholz, M.P., 2007). *Ornithopter* is a theory founded by Ibn Firnas after his attempt to launch himself using the glider for the first time. The theory is confirmed in a manuscript written by Roger Bacon, elaborating about the tail known as the *ornithopter*. In the year 1260 A.D., Bacon wrote the article, *On the Marvelous Power of Art and Nature*, included it in two methods how man can fly. According to him, one of the methods is by using *ornithopter* as he says, "There is an instrument to fly with, which I never saw, nor know any man that hath seen it, but I full well know by name the learned man who invented the same". It was known that Bacon studied in Cordoba, the historical place which is also the place where Ibn Firnas attempted his flight. Bacon explanation in his writings on *ornithopter* could have been based on Muslim manuscript in Spain which has disappeared without trace. The missing of any solid proof that spells out Ibn Firnas as the pioneer in the study of aviation deterred the world to acknowledge his contribution in *ornithopter* for ages (White, L.J., 1961).

It is apparent that his attempt has open up the door to the study of aviation whilst revealing the *ornithopter* concept as a vital aircraft component in maintaining stability when landing. The significance of Ibn Firnas work gave a huge impact to the world, especially in the field of aviation studies. Today, all modern and sophisticated aircrafts land by the back-end structure first. Alas, Ibn Firnas' glide was devoid of tail at its back-end thus his flight ended up tragically.

Repeated Attempts at Flying:

After the demise of Ibn Firnas, attempts at flying were continued by both Muslims and non-Muslims. In the year 1007 A.D., a teacher al-Juhari produced a wing made of wood and rope. When the produced wing has been perfected, he dared himself to launch-fly from a 1,002 feet minaret at Turkistan's Ulu Mosque. However, his attempt failed and resulted in his fatal casualty at site. Afterward, in the 11th century A.D., a local from Malmesbury, Eilmer attempted to glide from a height of 1,000 feet. Eilmer attempt was considered a success because he flew at 600 feet. However, his failure to take lessons from Ibn Firnas' attempts led to Eilmer's

failure to complete the flight because his glide was also devoid of a tail for landing. Eilmer's failure resulted in a bad accident with an injury of two broken legs.

Aviation of the Renaissance Era:

Following the failure of flight trials by al-Juhari and Eilmer, similar attempts were halted for a while. The episode re-emerges during the era of Renaissance, 600 years afterward, especially when Leonardo da Vinci produced several sketches of flying machine. Da Vinci made these drawings but in reality he never constructed any of them. This Italian scholar managed only to sketch several flying machines but was not able to prove that they can fly as he had never tried any of them. In the 19th century A.D., i.e. 900 years after the death of Ibn Firnas, there were attempts to fly using huge wings as designed by da Vinci in Europe. Among others was the attempt by a German engineer, Otto Lilienthal. He was a remarkable glider at that time. Lilienthal studied a few aspects of aviation such as the lift force from earth surface, the wing shape and its differences that would result in different pressure which is an important factor for flight stability. However, during his flight attempt in 1896, the wind suddenly blew hard and he was unable to control his glide and crashed in the hilly area of Berlin. Due to this misfortune he passed away the next day.

Gliding without engine was successfully further expanded by the Wright brothers until their invention of engine powered aircraft flew 260 metres. The Wright brothers are well known today for their first attempt to fly on 1st December 1903. Since then, they have gained their fame and the field of aviation has been developing rapidly with the integration of engine to the aircraft. Wilbur Wright's key to this is by studying how birds fly similar to what Ibn Firnas had done 1,000 years ago. Wright realised that a bird maintains its stability mid-air or when veering left or right by changing the positioning of its wings. Prior to building the aircraft, the Wright brothers used gliders in order to avoid any mishaps. They invented a kite with a similar function in order to confirm the effectiveness of the method (Old, W., 2002). The role that the Wright brothers played in bringing out progress in aviation could not be denied. However it was Ibn Firnas' attempts at flying that pioneered the world of aviation and at the same time giving birth to the concept of *ornithopter* which is the key component in maintaining flight stability during landing.

In 1908 A.D., the Wright brothers demonstrated flying the flight in France (Anderson, J.D., 2004) and the demonstration was witnessed by the public. About a year later, the field of aviation continues to be developed by Henri Farman and Louis Bleriot (Claxton, W.J., 2009). Successes upon successes have been achieved through observation and analysis on the good aviation concept while performing improvement to the existing aircraft structure. As such, a number of inventions of flying means have been invented such as jet, rocket and spacecraft.

Conclusion:

The history of aviation and even man's effort for space travel is rooted in a great Muslim scholar's pioneer effort, 'Abbas Ibn Firnas. His achievement in flying has given inspiration to the West to develop the aviation discipline, especially on the structure of *ornithopter*, the main structure for stability of aircrafts. Although the invention of Ibn Firnas seems humble, it is proven to have influenced today's modern aviation technique. His far reaching contribution to aviation has been given a proper acknowledgement by the Libyan government when his attempt of flight is featured on postal stamps while a monument of remembrance on his service has been built in Baghdad, Iraq. Other than that, his name is also eternalised as the name of one of the moon's crater and commemorated to a bridge built early 2011 at the Guadalquivir River, Cordoba. Unequivocally, he should be considered and conferred as 'the father of the aviation field of the world'.

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