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THE BIRD AERODINAMICS IN THE QUR'ĀN (The Qur'anic Verses Study of Birds Aviation Mechanics)

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Abstract

This article talks about a flight of birds in the Qur'ān. Because most of words refer to birds in the Qur'ān has not, thematically, researched yet. So that our knowledge of bird phenomenon restricted to scientific research. Therefore this research aimed, thematically, to reveal how tafsir studies explain the bird phenomenon. After analytical and descriptical reviewing, we revive that Allah holds wing of birds by His power to make them flying. As we know, tafsir studies, especially tafsir ilmiy are, further, necessary to be developed. Because aerodynamic theory just explained empirically and rationally aspect. Therefore, it necessary need to integrate between tafsir studies and scientific research to qur'anic contemplating.

Keywords : *Bird Aerodynamic, Flying Bird, I'jaz 'Ilmi*

Abstrak

Tulisan ini membahas tentang penerbangan burung dalam al-Qur'ān. Karena banyak terdapat lafadz burung dalam al-Qur'ān yang belum dikaji secara tematik. Sehingga pengetahuan kita tentang fenomena burung hanya sebatas pada penelusuran sains. Maka penelitian ini bertujuan untuk mengungkap secara tematik bagaimana penjelasan tafsir tentang fenomena penerbangan burung. Setelah dikaji secara deskriptif dan analitik membuka kesadaran kita bahwa Allah menahan sayap burung dengan kekuasaan-Nya, untuk tetap terbang di udara. Selama ini, kajian tafsir, khususnya tafsir ilmi, masih sangat perlu untuk dikembangkan lebih jauh. Karena penjelasan teori Aerodinamika dalam fisika hanya menjelaskan objek secara rasional dan empiris saja. Maka perlu kiranya, menghidupkan sains dengan kajian tafsir al-Qur'ān untuk mentadaburrinya.

Kata Kunci : *Aerodinamika Burung, Penerbangan Burung, I'jaz 'Ilmi*

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Introduction

The study overviews the scientific-philosophical questions in the glorious Qur'an, i.e. "Did not you think", hitherto, to propose a critical question, and "Did not you look to" to project a strong question. These philosophical questions intend to generate discussions of the reciters of Al-Qur'an, for keeping them to think and elevate in life.

The Qur'an translator Scholars categorize the following questions above as the *Kauniah* verses within the Qur'anic *Tafsir* tradition, the scientific universe creation study, and which also defines as *tafsir 'ilmi* method, a literal *tafsir*. It is classified to *Tafsir bi-al-Ra'yi* cluster. Indeed, according to *Abu Hamid Al-Ghazali*, scientific studies are part of The Qur'anic verses.¹

Although the *Kauniah* verses script the universal, direct, implicit, and essential premises,² it is suggested to initiate further study with these following verses, and also supported by Islamic Scholars.³

One of these following themes is the relationship of birds' aerodynamics within the advancements of modern aviation theory, the Physic of Aerodinamics. The birds, which are mentioned eighteen times within The Qur'an,⁴ their migration habits reach in Miles.⁵ A common bird can share its wings for gliding without consuming energies.⁶ Moreover, it able to change the cruise-speed automatically, and to adjust a well-system of the respiratory process during high altitude flight above by Sea-Level.⁷

The scientists observe these physic of aerodynamics principle to discover a plane which able to lift a heavy load of cargo in a flight. The principle of bird wings capable to sustain the weight of the bird body for a flight.⁸

Although, there are some *tafsir 'ilmi* studies conducted by Islamic Scholars.⁹ There are few studies committed to scrutinizing bird aerodynamics based on the Qur'anic verses.¹⁰ The writer did not inquire about the recent studies for this account, the comprehensive relationship study between the aerodynamics of birds physical and *tafsir 'ilmi* the Qur'anic verses, except these two journal articles; *The Migration of*

¹Yusuf Al-Qardhawi, *Majallat al-Buhûts Sanah wa Siroh*, (Duriat: Tanpa Percetakan, 1997 M), 19.

²Farah Nur Fauziah, *Migrasi Burung dalam Perspektif Al-Qur'an (kajian tematik) menurut Thantawi Jauhari*, (Program studi Ilmu Alqur'an dan Tafsir, UIN Sunan Ampel Surabaya, 2015), 4.

³Muhammad Quraish Shihab, *Mu'jizat al-Qur'an*, (Bandung: Mizan,1998), 165-166

⁴Muhammad Fu'ad Abdul Baqi, *Al-Mu'jam al-Mufahros li al-Alfâdz al-Qur'ân*, (Darul Hadist, Kairo, 2007), 532.

⁵Zaghlul Raghib Muhammad An-Najjar, *Tafsir Âyât Kauniyyah fî al-Qur'ân al-Karîm*, (Kairo, Maktabah Shourouk Dawliyah, 2007), 174.

⁶An-Najjar, 171.

⁷An-Najjar, 175.

⁸An-Najjar, 179.

⁹ The study enclosed the connection science and religious tradition in theories, concept, and application, i.e. Artworks by Ridwan Abdullah, *Sains Berbasis Al-Qur'an*, Bumi Aksara, Jakarta. ISBN 978-602-217-9, Azaki Khoirudin, "Sains Islam Berbasis Nalar Ayat-Ayat Semesta," *At-Ta'dib* 12, no. 1 (2017): 195–217, <https://doi.org/10.21111/at-tadib.v12i1.883>.

¹⁰ Columba Livia et al., "Karakteristik Gaya Aerodinamika Pada Burung Merpati," *Pharmakon-Program Studi Farmasi, Fmipa, Universitas Sam Ratulangi* 8, no. 3 (2019): 679–85.

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Bird in the Qur'ānic Perspective Studies (The Thematic Studies of Al-Jawahir fi Tafsir al-Qur'ān al-Karim) by Farah Nur Fauziah, translated from-“*Migrasi Burung Dalam Perspektif al-Qur'ān (Kajian Tematik Kitab Al-Jawahir fi Tafsir al-Qur'ān al-Karim)*”. This first article overviewed the Qur'ānic verses which particularly highlight the bird migration habit of *al-Jawahir*, without convey about the modern aerodynamics of aviation.¹¹ The Second journal outlined particularly for the single verse of the Q.S. 79th of *An-Nahl* perspective to the principles of bird aerodynamics of the glorious Al-Qur'ān.¹²

Therefore, the article project relationship between the glorious Al-Qur'ān verse, 19th of *Al-Mulk*, and aerodynamics theories. Overall, it outlined to overview of the *Kauniah* verses with modern science. The article employed *the tafsir 'ilmi* method, which explored two focuses of the elaborations; First, How do the *tafsir* verses of bird aerodynamics on cotextual *I'jaz ilmi*, and second; How do the relevance of the *tafsir* verses with aerodynamics theory.

The Analyze Of Qur'ān Verses Of Birds' Flying

Among of verses which scripts about the birds' flying mechanism,¹³ the 19th verse of *Al-Mūlk*, *Allah swt* reveals:

أَوَلَمْ يَرَوْا إِلَى الطَّيْرِ فَوْقَهُمْ صَفَّتْ وَيَقْبِضْنَ ۚ مَا يُمَسِّكُهُنَّ إِلَّا الرَّحْمَنُ ۚ إِنَّهُ بِكُلِّ شَيْءٍ بَصِيرٌ ﴿١٩﴾

Translation: “Do they not see the birds above them with wings outspread and [sometimes] folded in? None holds them [aloft] except the Most Merciful. Indeed He is, of all things, Seeing”. (Q.S. Al-Mulk [67]: 19)

Referring to Shaykh Muhammad Al-Amin Asy-Syinqithi, the phrase “*al-tairi fawqahum ṣaffāt*” from the above verse translates as “to spread wings”, the meaning of “*yaqbiḍna*” as “to sustain or holding its body-weight”. However, within these literal terms, Abu Hayyan pointed out for the sentence nominal (*Ism*) is followed with the sentence verbally (*Fi'il*) which interpretative for birds' flying mechanisms are committed by spreading the wings. The nominal indicate the gliding event, and the verbal indicates these sequences of flying mechanisms, as if, the bird fly by spreading its wing in the sky, and Allah *swt* holds it by His Almighty gift of air resistance.

¹¹ Farah Nur Fauziah “Migrasi Burung Dalam Perspektif al-Qur'an (Kajian Tematik Kitab al-Jawahir fi Tafsir al-Qur'an al-Karim Karya Tantawi al-Jawhari)” *Tesis: Fakultas Ushuluddin Program studi Ilmu al-Qur'an dan Tafsir, Universitas Islam Negeri Walisongo, Surabaya, 2015.*

¹² Sri Jumini, “Gaya Aerodinamika Dalam Penerbangan Perspektif Q.S. An-Nahl: 79,” *Syariat: Jurnal Studi Al-Qur'an Dan Hukum* 4, no. 2 (2018): 143–52.

¹³ Q.S Al-Mulk ayat 19, Q.S Al-Nahl ayat 79, Q.S Al-Nur ayat 41, Q.S Al-An'am, Q.S Al-Mulk ayat 19

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Therefore, the bird is not falling while gliding in the air as it for the Almighty of Allah.¹⁴

On the other hand, The *Jalalain Tafsir* elaborates the phrase “*awalam yara*” for commencing to give attention, and “*ilā al-ṭairi fawqahum*” resemble the birds in the sky, “*ṣaffāt*” resemble to spread birds’ wings, “*yaqbiḍna*” resemble to hold its wings, nonetheless, “*mā yumsikuhunna*” resemble to hold, “*illā al-Rahmān*” resemble to only the Merciful of Allah, “*Innahū bikulli syaiin baṣīr*” resembles to the Allah *swt* only Who Able to do so. Thus, it indicates a clear sign to humans “*Do you not see the Almighty of Allah swt with the flying of birds in the sky*”¹⁵

Sayyid Quthb in *Fī Żilāl al-Qur’ān* pointed out the bird phenomena which depicts by the glorious Qur’ān as supposedly unseen wonder and vivid to human eyes. He ratified the phrase “*awalam yaraw ilā al-ṭairi*” which implies giving full attention to the spreading, flapping of bird wings processes and gliding in the sky. The phrase “*mā yumsikuhunna illā al-Rahmān*” contains the Almighty and Merciful of Allah *swt*, to sustain the big and small creatures, to hold in the sky, and resemble Allah *swt* only Who Able to do so. Therefore, the phrase “*Innahū bikulli syai’in baṣīr*” means only Allah *swt* only who able to cover and protect the whole creatures in the universe.¹⁶

The phrase “*ṣaffāt*”, according to Quraish Shihab, linguistically is translated as the orderly line, however, terminologically is interpreted as the process of bird-wings spreading as the visual line of close orders for wings feather spreading, the phrase “*yaqbiḍna*” resemble to hold it in the sky. Quraish Shihab outlined about the bird that flapping its wings in the sky and Allah *swt* sustain it.¹⁷

Zaglul An-Najjar mentioned the phrase “*awalam yaraw ilā al-ṭairi*” which contemplates the bird's natural flying ability as the divinity sign of Allah *swt* above the universe. The phrases also imply to state for the unbelievers who did not turn to Allah *swt* creations; such as the birds, before studying the theories of birds’ aerodynamics, and it is as the sign of the Almighty Allah *swt*.¹⁸ In addition, the signs of the Almighty Allah *swt* in the birds’ creation, as follow:

- a. The body shapes suitable for the ability to fly that most types of birds have so that they can split the air easily
- b. The wings are supported by bones and covered by feathers that have excellent intensity
- c. The bird has a very amazing bone structure and can be filled with base air from the front end, both of which are covered by feathers that serve to neutralize if

¹⁴ Muhammad Al-Amin bin Muhammad Al-Mukhtar jakni al-Syanqity, *Adwaul bayan fii idhohil Qur’an bil Qur’an* jilid 8 1980, 410

¹⁵ Jalaluddin Muhammad bin Ahmad al-Mahally and Jalaluddin Abdurrahman bin Abu bakar As-Suyuthi, *Tafsir jalalain* (Kairo: Dar el Hadist, tanpa tahun), 756

¹⁶ Sayd Qutub Ibrahim As-Syatibi, *Tafsir Fidzilalil qur’an* (Beirut: Dar Syuruq, 1412) Jilid, 3630

¹⁷ Muhammad Quraish Shihab, *Tafsir Al-Misbah*, Vol 14. (Ciputat: Lentera Hati, 2012), 218

¹⁸ An-Najjar, *Tafsir Al-Ayat Kauniyah fii-I Qur’anil kariim*, 174

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- there is a temperature change when it flies low or far above sea level and is one of the determinants of a bird's habitat.
- d. It has two lungs that are different from other creatures because the bird needs a more appropriate lung design to use when it flies.
 - e. It can digest food that is with the ability to chew all foods to accelerate the burning that occurs in the body.
 - f. The birds have lungs that function for the storage of oxygen in the body that helps them to float in the air and there will be no lack of oxygen.
 - g. It has a very sharp vision to be able to know the movement of the victim or the enemy when it is far above sea level.
 - h. It can recognize the direction or path passed when it migrates and can return to its habitat even if it migrates a very long distance.
 - i. it has a very strong heart so that it can pump blood throughout the body quickly when it flies
 - j. it has a high body temperature that determines the burning of food in the body
 - k. It has bones designed to hold air inside so that birds can lift their bodies to fly in the air.

The phrase “*ṣaffāt wa yaqbiḍna*” resembles the bird's perfect creature which is not only in the amazing body structure but also possesses the ability that Allah has given to the weak animal.¹⁹ Birds can move in the air and move because burning gas atmosphere around the surface of the Earth (Ground-Speed).²⁰

There are two basic theory occurs when a bird flies over the air, i.e. *al-Ṣaff* resembles hovering and cruising, *al-rafrāfah* resembles flapping the wings, a constant gliding,²¹ and flapping.²² The original terminology for *al-Ṣaff* is spreading the wings idly in the sky for the shape of wings airfoil.²³ These are the various concept of aviation engineering principles in designing the wings of airplanes, which generating *Dynamic gliding soaring thrust*.²⁴

The basic principle in changing course direction during a flight, the bird moves its tail through wind even in the condition of the strong wind. As the result, it should not change a move when it has reached the proper cruising speed, it only moves its wings around winds. The tails play an important role to direct and flap, yet, the bird

¹⁹ An-Najjar, 424

²⁰ There is a dynamical difference in motion when it glide in sky and surface of the Earth.

²¹ The particular bird flying mechanics, to commence a distance flight.

²² A method that utilizes the speed of flapping the wings up and down, the first movement is upward to push the bird forward, and the second is to lift the bird. And this is used for short distances, especially small birds.

²³ An-Najjar, *Tafsir ayat kauniyah fi qur'anil kariim*, 174

²⁴ This flight is achieved because the bird can control the angle of the wing according to its curvature and causes less pressure above the wing than under the wing which makes it easier for the bird to propel itself forward and up.

also has strong and flexible chest muscles to adjust its position in the sky during flight.²⁵

The phrase “*ma yumsikuhunna illā al-Rahmān*” pointed out the signs of the Merciful of Allah *swt* is The Creator Who provides various extraordinary creature, the birds flying process by the binding wind to flap and holds its wings, and changing course direction in the sky. Indeed, Allah *swt* is the Creator of the universe, the Most Merciful, The Creator Who gives air to sustain and hold the bird in the sky and will not fall.²⁶ These facts, the creation, and flight, only shall be uncovered through conducting experiments and research.

In addition, Allah *swt* also reveals about the bird in the verse of 79th *An-Nahl*:

أَلَمْ يَرَوْا إِلَى الطَّيْرِ مُسَخَّرَاتٍ فِي جَوِّ السَّمَاءِ مَا يُمْسِكُهُنَّ إِلَّا اللَّهُ إِنَّ فِي ذَلِكَ لَآيَاتٍ لِّقَوْمٍ يُؤْمِنُونَ

Translation: “Do they not see the birds controlled in the atmosphere of the sky? None holds them up except Allāh. Indeed in that are signs for a people who believe” (Q.S. An-Nahl [16]: 79)

The verse states how the unbelievers do not pay attention to the Merciful Allah Who able to hold the bird flying miraculously gliding over the sky, potentially serve as aerodynamic law, which also as a gift to those who believe.²⁷

Al-Maraghi outlined a bird capable to sustain his body weight over the sky, without supporting and hanging pillars. In this case, Allah the Almighty Who holds the air to sustain the bird which preventing its descent over to the ground.²⁸ The older scholars did not compromise about the principle of airflow which plays an important role to bird-fly, i.e. as if aerodynamics, is exposed in the modern world invention.

Supporting the following elaboration, Allah *swt* reveals about His rational creature in the verse of 41st *An-Noor*:

أَلَمْ تَرَ أَنَّ اللَّهَ يُسَبِّحُ لَهُ مِنْ فِي السَّمَوَاتِ وَالْأَرْضِ وَالطَّيْرِ صَوَّافَاتٍ كُلُّ قَدْ عَلِمَ صَلَاتَهُ وَتَسْبِيحَهُ وَاللَّهُ عَلِيمٌ بِمَا يَفْعَلُونَ

Translation: “Do you not see that Allāh is exalted by whomever is within the heavens and the earth and [by] the birds with wings spread [in flight]? Each [of them] has known his [means of] prayer and exalting [Him], and Allāh is Knowing of what they” (Q.S. An-Nur [24]: 41).

²⁵ An-Najjar, *Tafsir Al-Ayat Kauniyah fii-l Qur'anil kariim*, 175.

²⁶ An-Najjar, 427.

²⁷ M.Quraish Shihab, *Tafsir Al-Misbah*, Vol 6. (Ciputat: Lentera Hati,2012), 676

²⁸ Ahmad Musthofa al-Maraghi, *Tafsir al-Maraghi*, Jilid 5(Beirut: Dar fikr,2010), 163.

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The above verse states the phrase “*Man*” which resemble to incline personality, which praying states in sky and earth, not all for the creatures have inclination, however, *shalat* and *tasbiḥ* are the activity to those who have inclination. Furthermore, the “*Man*” indicates the action who incline with *shalat* and *tasbiḥ*. According Quraish Shihab, *tasbiḥ* is purification with utterance or *Kalam*, it is expressed in the mind for certain ways with hand signals or head nods.²⁹

Although according Ibnu ‘Asyur, the phrase:

كُلُّ قَدِّ عِلْمٍ صَلَاتُهُ وَتَسْبِيحُهُ وَاللَّهُ عَلِيمٌ بِمَا يَفْعَلُونَ

According to Ibnu ‘Asyur in his *Tafsir Tahrir wan Tanwir*, It is a combination of the words *tasbiḥ* and *ṣalat* to refer to two types, namely first to something that makes sense and second to something that does not make sense. The *tasbi'* that makes sense refers to the word prayer while the *tasbi'* that doesn't make sense is the *tasbi'* majazi as mentioned in the verse about birds that are unique when they fly using their wings.³⁰

Fakhruddin Ar Razzi in his tafsir highlights the phrase “*Alam tara anna Allah yusabbiḥu lahu*” as a reminder of Allah to mankind that Allah is the God who should glorify Him. Because all beings in heaven and on earth always glorify Him. *Tasbiḥ* means to glorify Allah with all His perfections either orally or in other ways, in this case, there are creatures of Allah who glorify with signs or gestures or majaz, while in the verse it is explained that what is in the heavens and the earth and between the two is the bird that develops their wings are fading indeed they glorify Allah, the Creator of the universe.³¹

There is a difference in understanding of the verse above, first, there are those who understand that the perpetrators are God's creatures who already know how to pray the prayer beads and their respective prayers, and second, that the perpetrator is God, that is, God knows and understands how to pray and the *tasbiḥ* of His creatures.

The next verse, 38th of Al-An'aam, Allah *swt* reveals:

وَمَا مِنْ دَابَّةٍ فِي الْأَرْضِ وَلَا طَائِرٍ يَطِيرُ بِجَنَاحَيْهِ إِلَّا أُمَمٌ أَمْثَالُكُمْ مَا فَرَّطْنَا فِي الْكِتَابِ مِنْ شَيْءٍ ثُمَّ إِلَىٰ رَبِّهِمْ يُحْشَرُونَ

5 Translation: “And there is no creature on [or within] the earth or bird that flies with its wings except [that they are] communities like you. We have not neglected in the Register [302] a thing. Then unto their Lord they will be gathered” (Q.S. Al-An'aam [06]: 38)

²⁹ M.Quraish Shihab, *Tafsir Al-Misbah*, vol 8. (Ciputat: Lentera Hati, 2012), 574.

³⁰ Muhammad bn Thahir ‘Asyur Tunisi, *Tafsir Tahrir Wan Tanwir*, (Tunis: Dar Tunisia Linnasr), 258.

³¹ Fakhruddin Ar-Razi, *Tafsir Mafatihul Ghaib*, juz 24 (Beirut : Dar Ihya' turost Al-‘Arabi,1420) cet.3, 401

Referring to Abu Hayyan, this surah explains all animals on land and in water and birds that fly with their wings are the same people as humans. In this case, the bird is mentioned as flying with wings which shows that without wings, the bird will not be able to fly, then what is meant in the same way as humans is that they have also been determined about his sustenance, death, and work.³²

The Bird Biology Anatomy At Glance

In Biology, the structure of bird anatomy is design to fly. Considering the shape and mass of its light body causes birds to have a light body. Because the birds have cavities in their bones. It has air sacs scattered around its body, and these pockets are like small air balloons, while the tail and feathers covering its wings have an important role in flight-like wings.³³

Airfoil-shaped bird wings, causing air, to flow under the wing, thus affecting the pressure. This is what causes the lifting force on the bird. Birds have different wing shapes, seabirds have long and slender wings, these birds don't flap their wings too often because the wider or longer the shape of the bird's wings, the birds just need to flap their wings a few times and make more use of the airflow through their wings. Whereas in small birds and have small wings then he flaps his wings more often to lift his body.

In addition to the shape of the wings, the airfoils of birds' wings are also covered with feathers, and the feathers on the birds have a great influence on their flight and for keeping their bodies warm, the feathers on birds are made of thin spines like interlocking hairs. As if to make a neat line then there is a strong spine located in the middle of the wing feathers to strengthen it when flying. There are differences in the shape of feathers in birds, which have their respective duties.³⁴ In this case, it can be seen that the interlocking structure of the feathers prevents the airflow from penetrating between the feathers and disrupting the flight of the bird.

The bones in birds are different from the bones in land animals. Because the bird's body is designed to be as light as possible, birds have not as many bones as other animals, not as hard and not as complicated as other animals, the bird's inner bones are not filled or hollow so that the bird becomes light.³⁵ The hollow bones of the bird will be filled with air which has a relationship with the bird's respiratory system.

³² Yusuf Sayyid Abu Hayyan Al-Andalusi, *Tafsir Bahru Muhith*, Juz 4. (Beirut: Dar el kutub ilmiyah,1993), 125.

³³ Abdul Lathif 'Asyur, *Mausû'ah wa al-Hayawân fi al-Hadîst al-Nabawiy*, (Kairo: Tanpa Penerbit, tanpa tahun, Maktabah Shameela), 262.

³⁴ Among them are: outer wings: Strong feathers give strength when flying, second: inner wings: Smooth and flat to help fly, third: Tail feathers: long and thin for steering and balance when flying. Fourth: Body feathers: Soft and fit to keep birds warm. Arlone, *Ensiklopedia mengenal sains Hewan Animal*, 50.

³⁵ Hisyam Thalbah et al, *Ensiklopedia Mukjizat Al-Qur'an dan Hadits*, vol. 5. (t.tp: Sapta Books, 2013), 107.

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Birds are animals that do not have teeth but have a pointed beak, according to their food, namely grains. There are also nectar-eating and meat-eating birds in this case the tip of the bird's beak has a different shape but basically, the bird's head has a small and light shape then the beak is tapered so that the bird does not collide or fight the wind current but the bird can easily split and penetrate air to make it easier when flying.³⁶ The absence of teeth in birds also causes birds to be lighter.

Generally, animals that live on land breathe through their lungs. Because the air that passes through the lungs moves in two directions, namely the breath that is drawn in through the air cavity and then out through the air cavity.

However, in the respiratory process carried out by birds, the air will always go in the same direction. In this case, the bird has small pouches connected to the lungs which are empty of air. When the bird takes a breath, it fills the air it takes for the lungs and the airbag in the back, at that time dirty air passes in the lungs from the airbag in the front, and when he exhales the airbag is empty. In the forward direction. But at the same time, the pocket which was filled cleanly at the back became empty. In addition to the lungs become full of clean air.³⁷

Birds also have a unique excretory system than other creatures, because birds do not have a bladder to store feces so that when birds excrete feces, the feces will come out together with urine. The absence of a bladder in birds can reduce weight and make birds lighter and easier to fly.³⁸

In reproduction system, the birds lay eggs, the female bird does not have a uterus, but the female bird has an egg place in her body. If the bird has a uterus, the bird will always carry its child in its stomach until the bird gives birth which causes its body to be heavy and difficult to fly.³⁹

The chest anatomy mantled a large breastbone, where the large and strong pectoral muscles are attached to move the wings, which approximately 25 to 30 % from the overall bird bodyweight.⁴⁰

The Aerodynamics Theories At Glance

The creation of birds inclines scientist to design an aeroplane. Therefore, it initiated a physical theories on the motion of airflow that lifts objects to fly, which is called as the theory of aerodynamics.

Aerodynamics overviews the airflow movement through an aircraft or flying object.⁴¹ It is originated from the Greek words, Aero and dynamics. Aero which mean air, and dynamics mean strength and energy. It is defined and is the study of the

³⁶Al-Hakim al-Syaikh Thantawi Jauhari, *Al-Jawâhir fi Tafsîr al-Qur'ân al-Karîm*, (Mesir: Mathba'ah al-Mushthafa al-Bab, 1351 H), 204.

³⁷Thalbah et al, *Ensiklopedia Mukjizat Al-Qur'an dan Hadits*, 116

³⁸Mansur Abu Syari'ah Al-'Ibadi , *al-I'jâz al-'Ilmiy*, (Makkah: Dar Ilmi, tanpa tahun), 18.

³⁹Mansur Abu Syari'ah Al-'Ibadi , *I'jaz Ilmi*, ..., hlm.18

⁴⁰Lajnah Pentashihan Mushaf Al-Qur'an, *Tafsîr 'Ilmi: Hewan dalam Perspektif Al-Qur'an*, Jakarta: Badan Pelatihan dan Litbang Kementrian Agama RI, 2012), 204.

⁴¹Greg Dimitriadis, *Introduction to Aircraft Design*, (Liege: Universite de Liege, t.t.), 1.

motion of gaseous objects and the motion of solid objects in air or the science of the consequences of air or other moving gases.⁴² On the other hand, it simply the transformation of the motion of an object due to air obstruction when the object is moving fast.

The flying objects, which called as aircraft, i.e. hot air ballon, helicopters aircraft etc., while airplane comes from the English word meaning airplane, while Aerodynamics works on such objects as has been explained above that aerodynamics, is everything caused by moving air or gases. In this case, the events that occur in the case of aerodynamics are that the forces working on the object come from two basic sources, namely pressure and friction force on the surface of the object.

The theory has four components that are inseparable from it; Pressure, Force, Moment, and Flow. It also has four forces required for non-accelerated flight; Thrust, Drag, Weight, and Lift.

1. Drag is a backward pulling style caused by interference of airflow by the wings, fuselage, and other things this style is the opposite of Thrust style.
2. Weight is the combined weight force of the aircraft's payload, crew, cargo fuel, and luggage, weight pulling the aircraft down due to the force of gravity, Weight against the lift force
3. Lift is a lifting force against the force of the weight generated by the dynamic effects that react to the wings.
4. Thrust is a thrust force or force that moves an aircraft forward, produced by propellers or engines on modern aircraft.⁴³

In-flight, aerodynamics works in the wing of the aircraft because the wing of the aircraft is shaped (airfoil) which is a curved shape at the top of the wing and flat shape at the bottom, the curved shape causes the flow that flows at the top requires a longer distance and flows faster which causes pressure in the top is smaller than the pressure below so that the plane can be lifted upwards.⁴⁴

Within the operational of flight, the Lift force must exceed the weight of the aircraft itself, then the force Drag is an obstacle that is caused when the aircraft hits the air, and to fight the obstacle there must be a force that opposes it, namely the Thrustforce, the thrust force works against the obstacle force. This Thrust is produced from a turbofan engine or turbojet owned by an aircraft.

According to the type, aerodynamics that occurs in aircraft include the type of dynamic fluid, the ideal fluid has the following characteristics:

1. It is not compressed or does not change in volume when pressed
2. It has on-viscous (non-viscous) no friction between fluid layers with each other

⁴²Elizabeth A. Martin, *Kamus Sains*, Terj. Ahmad Lintang, (Yogyakarta: Pustaka Pelajar,2012), 25.

⁴³Kristeen Rogers et.al, *Ensiklopedia Sains Usborne*, (Jakarta: P.T. Bhuana Ilmu Populer, 2014), 142.

⁴⁴Awalu Ramadhan dan Dana Hardiana, *Analisis CFD karakteristik Aerodinamika pada sayap pesawat LSU-05 dengan penambahan vortex generator*, Lembaga Penerbangan dan Antariksa Nasional, 47.

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3. It has non-turbulent flow means it has a straight-line flow, and should on time - independent, means that the flow is constant at a certain point and forms a turbulent flow.⁴⁵

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43 In this case airplane flight establishes Newton's third law (of motion) and Bernoulli's principle. Newton's third law is that if an object exerts a force of equal magnitude and opposite direction to the first object, then there is an action and reaction between two objects exerting force.⁴⁶ While the Bernoulli principle is that the largest fluid pressure is found in a fluid with a small flow speed, while the smallest pressure is found in a fluid with a large flow speed.⁴⁷

The shape of the wings on the plane is when moving forward the wing pushes the air down. The air pushes the wings upwards in the opposite direction, giving the aircraft a lift.⁴⁸

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29 Apart from the aerodynamic force above, there are three main surface controls on the aircraft, namely elevator, aileron, and rudder. These three controls have the function of controlling the movement of the aircraft so that it can fly stably when in the air based on its axis of rotation.⁴⁹ Then, the three controls cause three movements, namely the aileron located on the wing of the aircraft that is the control plane when the aircraft performs movement roll,⁵⁰ while the elevator is located on the horizontal stabilizer that is on the tail which is the control plane when the aircraft performs movement pitch,⁵¹ then the rudder is located on the vertical stabilizer which is the control field when the aircraft performs the movement yak or controllers.⁵²

The Relevance Of Qur'anic's Verses About Bird Creation With Aerodynamic Theory

Avionic Scientist draw the principle of airplane from the Albatross bird, which classifies as seabird that fly efficiently is named as an efficient pilot. Referring the theory, the albatross is capable to soar high and fly thousands of kilometers without flapping wings, albatross flight pattern is flies low on the surface then towards the

45 Tim Solusi cerdas, *Short Cut Fisika*, (Jakarta: Sekata Media, 2015), 191.

46 Sri Soeyati dan Agus Salam, *Ensiklopedia Fisika Gaya, Usaha dan Energi*, (Jakarta: Ganeca Exact, 2007), 30.

47 Tim Solusi cerdas, *Short Cut Fisika*, 193.

48 Robin Kerrod dan Sharon Ann Holgare, *Pengetahuan Populer Mengenai Sains Cara Kerja Sains, The Science Works*, terj. Reynaldo Krissanca dan Febe Fenya, (Jakarta: P.T Aku Bisa, 2012), 34.

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49 Mokhamad Khozin, "Desain dan implementasi Automatic Flare maneuver pada proses landing pesawat terbang menggunakan kontroler PID" Jurusan Teknik Elektro, Fakultas teknologi industri, Institut Teknologi Sepuluh November Surabaya, 2011, 2.

50 *Rolling motion* is a rolling movement to the right and left by the aircraft by controlling the ailerons on the wings of the aircraft, Khozin, "Desain dan implementasi Automatic Flare maneuver pada proses landing pesawat, 2.

51 *Pitching* is a nodding or upward and downward movement carried out by the nose of the aircraft by moving the elevator up and down controlled by the pilot, Mokhamad Khozin, "Desain dan implementasi Automatic Flare maneuver pada proses landing pesawat, 2.

52 *Yawing* movement is a right and left movement by the nose of the aircraft by moving the rudder right and left. Khozin, "Desain dan implementasi, 2.

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wind to reach a higher position, that is after reaching a height of 15 meters and then glide with easily then begins to fly high, this makes it possible to fly far and high because it has special muscles on his wings so that he can lock his wings in one position.⁵³ The anatomical quality of this bird is applied to the part of the aircraft to bring out the aerodynamic force.

Throughout the course of airplane history, there many trials and errors have been committed to make humans fly like birds. Therefore, there are many scientists were injured and even died from falling while doing the experiments. But this does not make scientists in despair to solve the problem.

The phrase “*mā yumsikuhunna illā al-Rahmān*” the flight performed by a bird will probably be a common thing for the ignorant and will be something obligatory to be discussed and resolved by the knowledgeable, and this is what became law and was eventually applied to aircraft flight.⁵⁴ The creation of birds is one of the secrets of Allah and a sign of his greatness as *al-Khaliq* and *al-Mushawwir*.

The observation of birds led scientists to design the shape of the aircraft based on the shape of a bird. The two important things in the aircraft are the wings and the tail. The shape of the wings on an aircraft is a fixed-wing shape (fixed wings) not like the wings of a bird that is always moving.

The wing shape of aircraft must have certain requirements to perform the flight. The first is the center of gravity, where the plane at the point of intersection of the line connecting the two wings with the line between the head and tail is needed to keep the plane flat and suspended in space. The second is to provide enough force to lift the aircraft in the air so that the lifting force exceeds the weight of the aircraft. To reduce aircraft power and the amount of power consumed the aircraft designers reduced the mass of the aircraft to a minimum and maintained the required size, using the densest and most durable materials. The fixed-wing of the aircraft must have a lift force that is directly proportional to the wing area and the square of the speed of the aircraft. Some factors include aspect ratio, airfoil, lift force, drag force, angle of attack.

Aspect ratio is the ratio of wing length to width for a given area. The higher the ratio the higher the proportionality constant, which leads to a higher lifting force. Then the shape of the wing airfoil, in this case, is the big secret in aircraft flight that is a flat or concave wing at the bottom and convex at the top that causes the airflow to flow over the air faster and the bottom pressure is lighter and cause (lift force) then (drag force) air barrier force caused by the collision of an aircraft with the air. Then the angle of attack that is the wing is often directed at a certain angle called the angle of attack to increase the lift objects.⁵⁵

⁵³Anmaria Redy Pinta Dasyanti, *Burung Albatross jadi Inspiratory Pesawat Masa Depan*, regional.kompas.com, accessed on January 29, 2020

⁵⁴Jauhari, *Al-Jawâhir fî Tafsîr al-Qur'ân al-Karîm*, 211.

⁵⁵Al-'Ibadi, *al-I'jâz al-'Ilmiy*, 16

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Conclusion

54 The article concluded that God created the wings of birds to be able to fly in the
53 air, and without wings, birds cannot fly. Birds have two ways to be able to fly and lift
24 themselves in the air, namely by flapping their wings and then spreading the wings as
wide as possible so that the airflow flows on its wings so that the bird saves energy
when flying. In this case, God subdued the air to make it easier for birds to fly. As in
al-Qur 'an surat al-Mulk verse 19, that is when flying Allah restrains the bird from
falling to the ground and Allah makes the shape of the bird's wing airfoil which is the
shape of the wing that causes the airflow above the wings faster than the air flowing
below and raises a lifting force on the bird, so that the bird will not fall. From this
arises the theory of aerodynamics, namely the lifting force, gravitational force,
restraint force, and thrust force on the flow of air passing through an object.

46 This interpretation has been proven to be an aircraft inspiration by the way birds
fly applying 4 styles of aerodynamics and Bernoulli's law and Newton's third law. And
for the umpteenth time, the Qur'an has proven its authenticity that the Qur'an is a
revelation of God as a guide to human life and is not man-made.

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