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THE FIRST ATTEMPTS OF FLIGHT, AUTOMATIC MACHINES, SUBMARINES AND ROCKET TECHNOLOGY IN TURKISH HISTORY

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I. Introduction

Discovering the skies had occupied people's imagination for many ages. In old Greek mythology, we see the flying attempts of Icarus and Daedalus. It is more than natural for the Chinese, with their culture dating back thousands of years, to dream of flying like birds. Ancient Chinese sources mention a flying vehicle called "fei tschü" around 1760 B.C. In a Chinese work written in the third century, this flying vehicle is referred to as follows:

"The people of Tschi-kung know very well how to build the technical tool used to kill birds. They are also capable of building the 'flying chariot = fei tschü' which can travel great distances with favourable winds. During the T'ang period (ca. 1760 B.C.) western winds brought such a chariot all the way to 'Iü Tschau.' The T'ang had it destroyed so that the people would not see it. After 10 years had passed, T'ang had another similar flying chariot built when the eastern winds blew and sent the visitors of the time to their lands at 40,000 11 (13,000 miles = 20, 921 km), passing through the Iü-men passage."[1]

Tao hung Tsching, who lived between 451-536 A.D., again mentions this flying vehicle in his work titled "Tschen kao". The oldest illustrations of this flying vehicle are in a book titled "Iyu kue" of 1368-1398 A.D. The illustrations of this flying vehicle were later published in 1609 in the works "san ts'ai t'u schuo" and "T'u schu tschi tsch'eng". However, in these illustrations, there is no sign of the force that actuates the flying vehicle. Therefore, until ancient Chinese sources describing the flying vehicle in further detail are found, this flying vehicle is to remain one of the inexplicable mysteries of ancient Chinese culture.

Archytas of Tarentum, who lived in the fourth century B.C., was described by Aulus Gellius as the inventor of a device called the "Flying Dove".[2] Archytas was one of the first founders of the study of mechanics. The "Flying Dove" he built was a type of kite.

It is known that in Alexandria, which was a large cultural centre in the Hellenistic period, the field of technical constructions was of large interest. Ktesibios, an Alexandrian mechanical scientist (third century

* Istanbul University, Faculty of Medicine.
[1] Giles, H. A.: Spuren der Luftfahrt im alten China. Sonderdruck aus der astronomischen Zeitschrift", Hamburg 9 (1917), p. 2; Giles, H. A.: Traces of Aviation in ancient china. In: adversita Sinica, shanghai 1910.
[2] Sarton, G.: Introduction to the History of science. Baltimore 1927, vol. I, p. 116. Darmstaedters, L.: Handbuch zur Geschicte der Naturwissenschaften und Technik. Berlik 1908, p. 14.

B.C.), and Philon and Heron (first century A.D.) were working on the construction of several machines.[3] However, it is not known whether the construction of a flying mechanical device was made in the Hellenistic period. However, it can be proven with documents that in the Middle Ages and the Renaissance Era, flying mechanical devices were built, and the first attempts at flight were made in Turkic-Islamic cultural circles and in Europe.

II. The Abbasid Period

In the Islamic world, great importance was placed upon the study of natural sciences and technology. It is known that as early as during the reign of Harun al-Rashid, a water clock was built in the Islamic world. As told by Einhard[4] who wrote the life of Charlemagne, Harun al-Rashid sent a water clock to Emperor Charles as a gift.

Caliph al-Mamun had a silver and golden tree in his palace in Baghdad in 827, which had the features of an automatic machine. There were metal birds that sang automatically on the swinging branches of this tree built by the Muslim engineers of the time (The German publication of the Ismail b. Ali Ebu'l Feda history, Weltgeschichte, hrsg. von Fleischer and Reiske 1789-94, 1831).

Caliph al-Muktadir also had a golden tree in his palace in Baghdad in 915, with birds on it flapping their wings and singing (Marigny, *A. de: Histoire des Arabes*. Paris 1760, Bd. 3, S.206).

In the Abbasid period, Muslim scholars of Turkish, Persian and Arab origins created quite interesting works in the fields of mathematics and astronomy. It is accepted even by the Europeans that al-Biruni, the Muslim scholar, (973-1051) had argued that the world revolved around its axis 500 years before Copernicus. It is certain that Islamic scholars influenced Europeans in the fields of mathematics, astronomy, and philosophy. In his famous work titled *De revolutionibus orbium coelestium* of 1530, Copernicus refers to al-Zarqali (1028-1087) and al-Battani (858-929), Islamic astronomers.

III. Seljuk Turks Era

Sultan Malik Shah (1055-1092), the great Turk Seljuk emperor, had observatories built in Isfahan and Baghdad. In these observatories, famous astronomers like Omar Khayyam, Abu'l Mudaffar Isfizarî, and Maymun al-Najip al-Vâsitî practised their art. A new calendar (the Jalalaean Calendar) was created by the Islamic astronomers of the era for Sultan Malik Shah.[5] Mathematics, astronomy, physics, natural sciences, and technical sciences flourished in Turkic-Islamic cultural circles. Several manuscripts on mechanics and automatic machine construction in various libraries in Constantinople are sufficient to demonstrate this.

[3] Drachmannn, a. G.: Ktesibios, Philon and Heron. Kopenhagen 1948; Klemm, F.: Technik, eine Geschicte ihrer Probleme. Freiburg-München (1954), p. 527.
[4] Sarton, G.; ibid, p. 527.
[5] Ibn Funduq, Tatimma sivan al-hiqma, by M. Shafi, Lahore 1935, Bd. I, p. 115, 119, 163.

Figure 1. *A machine working by water, design of al-Jazari, the chief engineer of Artuq Turks (an illustration from al-Jazari's book, al-Jamiu bayn al-ilm wa'l-amal al-Nafi fi sinaat al-hiyal) (Ahmet III Library, Topkapi Palace Nr 3472, p. 1366).*

During the era of the Artuqs, one of the small Turkic states that appeared after the Great Seljuk Empire collapsed, technical works were built. Upon the encouragement of Malik us-Salih Nasruddin Abu al-Fath Mahmud b. Kara Arslan b. Davud b. Sokman b. Artuq (1200-1222), the Artuq emperor who reigned in Diyarbakir, Bedi' al-Zaman Ebu'1-Izz Ibn Ismail Ibn al-Razzaz al-Jazarî wrote a book with the title *Kitâb al-Jâmi' bayn al-ilm wa'l-amal al-nafi' fi sinaat al-hiyal* which mentioned several automatic machines, water clocks, water pumps, water levels, and musical instruments, with construction drawings. Even though the original of the book does not exist, there are five handwritten copies in Turkey, four of them in the Topkapi Palace Museum (Ahmed III, No. 3472, No. 3461, No. 3350 and Treasury No. 414) and in the Suleymaniye Library (St. Sophia No. 3606), and ten other hand-written copies in the libraries of Oxford, Leiden, Paris, Dublin and St. Petersburg.[6]

The Oxford copy of this work was studied by E. Wiedemann, the German science historian, and his conclusions were published in various articles as of 1908.[7] The Oxford copy of this book was translated into English by Donald R. Hill and was published in 1974.[8] Al-Hassan had compared several hand written copies of this work, and published the Arabic text in Aleppo in 1979 with an English summary.[9] Of the existing hand-written copies, the copy at No. 3472 of the library of Ahmed III in the Topkapi Palace is most probably the most valuable one, as it is stated that the drawings in this copy are drawn by Badi' al-Zaman Abu'l-Izz Ismail ibn al-Razzaz al-Jazarî himself and the manuscripts are copied by Muhammad Ibn Yusuf Ibn Osman, from the original copy of the author. According to Prof. Kazim Cecen, who made valuable research

[6] Bodleian Library oxford graves M. S. 27. Library of the university of leiden, Or. M. S. 656, chester beatty library Dublin. M. S. 4187, bibliothique nationale paris, fonds arabe 2477, Leningrad library M. S 2539.
[7] Wiedemann, Eilhard; Hauser, F.: Über die uhren im bereich der Islamichen Kultur. NOVA ACTA Band C, Nr. 5, Halle 1915, p. 3-272.
[8] Hill, Donald, R.: The Book of knowledge of ingenious mechanical devices. Dordrecht (Holland) Boston (USA) 1974.
[9] Al-Hassan, Ahmad Y.: al-Jami bain al-ilm wal-amal al –nafi fi sinâ'at al hiyal. Institute for the history of Arabic science university. Of

on this subject, in the handwritten copy of this work in the Bodleian library, Oxford, it is stated that al-Jazarî completed the original book on *4 jamaziyulahir 602* (January 16, 1206), and, in copy no. 3472 in the Ahmed III library, it is stated that this hand-written copy is completed around end of *shaban 602* (April 10, 1206), and as, al-Jazarî is referred to as deceased, it can be deduced that al-Jazarî passed away between these two dates.[10] Accordingly, it is understood that al-Jazarî worked for 32 years in the Artuqlu palace between 570 (1174) and 602 (1206). However, most probably due to a copying mistake, in the Suleymaniye Library copy of this text (St. Sophia No. 3606) on page 2a, it is stated that al-Jazarî worked in the Artuqlu palace as the head engineer *(Reis'ul-Amal)* for 25 years. In the preface of the work, al-Jazarî states that he had studied the books and works of scholars preceding him, but finally he had freed himself from their influences and solved the problems through his own point of view. He underlined the importance of the work, saying: "This book contains some tears that have been patched, some methods that have been classified and some sketches that have been discovered. I do not believe there exists another similar work".[11] In his work, which consists of six chapters, al-Jazarî discloses his discoveries concerning important technical issues such as water clocks, water clocks with oil lamps, the constructions of pots and pans for wine making, the construction of ewers and bowls for use as cups, the sketches of pools and fountains and music automatons, and the sketches of devices able to elevate water from shallow wells or flowing rivers.

Figure 2. *An automatic clock design from al-Jazarî's book, al-Jamiu bayn al-ilm wa'l-amal al-Nafi fî sinaat al-hiyal (Ahmet III Library, Topkapi Palace Nr 3472).*

It was most probably al-Jazarî, the engineer, who built the giant complex in Hisn Keyfa, covering an entire district and consisting of a bridge with bazaars underneath, caravanserais, and other structures, upon the request of Fahreddin Karaarslan, the Turkish Artuq emperor.[12]

Aleppo. Syria 1979.

[10] Cecen, Kazim: El-Cezerî'nin su saatinin konstruksiyonu. I. uluslararası türk-islam bilim ve teknoloji tarihi kongresi. 14-18 Eylül 1981, Bildiriler V, Istanbul 1981, p. 322.

[11] Suleymaniye Library, Ayasofya nr. 3606, folio 2-4.

[12] De Vaux, Baron Carra: Les Penseurs de l'Islam. Paris 1921, Bd. II p. 173-4; Yaqût: Mucem'ul-Buldan. Beirut 1957, Bd. II, p. 65; Turan,

It is seen that the technical and natural sciences were encouraged and flourished not only during the Artuqs, but also in the other Seljuk *beyliks,* and in Syria and Egypt later on during the Mamluke sultans.

Especially during the first Crusades, there was an obligation for Islamic scholars to work on the discovery of gunpowder and explosive weapons as early as the twelfth century, in order for the Turkic-Islamic world to succeed against the Christian armies.

Kajgarh Mahmud, mentioning a primitive gun that shoots bullets,[13] and later Aydinogullari using guns firing bullets using springs and which are audible,[14] shows that the gun was invented by the Turks in its primitive form, together with gunpowder. In the twelfth century, the Seljuks had facilities in Sivas for manufacturing war machines.[15] It is stated in *Nesrî Tarihi* written at the end of fifteenth century that in the Ottoman army canons and guns were used from 1421-22.[16]

It is understood from the reports of a Frenchman who witnessed the battle that the Muslim engineers used explosive weapons against the Crusade Army V, led by King Ludwig der Heilige.[17]

It is stated in Tung-kiang-kang-m, the Chinese Empire Chronicle, that the Chinese used explosives earlier, in 1232, when defending Pien-king against the Mongols. However, whether the inventor of this explosive material was Wei-sching, the Chinese supreme commander, or not, it is not known.[18]

Still, it is understood from the following information, again from old Chinese sources dating back to the Kubilay Khan era, that the Turkic-Islamic world was more advanced than China in manufacturing explosive materials and ballistic weapons.

Between 1271 and 1273, Kubilay Khan had requested Abaka Khan (Chinese transcription Apu-ko-wang) to send Muslim engineers in order for his own army to win during the siege of the Chinese cities Hangshow and Hsiang-yang. Again according to Chinese sources, Abaka Khan sent two Muslim engineers, Alaaddin and Ismail, from Turkestan. It is obvious that these engineers, who were Muslims and from Turkestan, are Turks. These two Turk-Muslim engineers built machines of a ballistic-weapons nature before the besieged city of Hang-show. Aladdin, the engineer, later crossed the Yang-tsze River with the army of General Alihaya and played a major role in the conquest of several Chinese cities. Aladdin died in 1312. His son Ma-ho-scha took after his father.[19]

Ismail (Chinese transcription I-ssu-ma-yin), the other Turk-Muslim engineer, was present in the Mongol siege of Hsiang-yang in 1273. He built a war machine with the characteristics of a ballistic weapon in the southeast of the city. Chinese sources mention that when this war machine was fired the earth and skies

O.: Selcuklular tarihi ve Turk Islam Medeniyeti, Istanubl 1969, p. 368.
[13] Kasgarli Mahmud: Divanu Lügat it-Turk. By Kilisli Rifat, Istanbul 1333, 1335; trans. B. Atalay, Ankara 1940-41, I, p. 325.
[14] Düsturnâme, p. 59; Turan, O.: p. 291.
[15] Nesevi, M.: Siretu Jala al-din Mengübirti. Published by O. Houdas, Paris 1891, p. 186; Quatremere: Historier des Mogol de la Perse. Paris 1836, p. 132-136.
[16] Mehmed Nesri: *Tarih-i cihannuma*, by Faik Resit Unat, Mehmet A. Koymen, Ankara 1957, II, 565, 611, 639.
[17] Hunke, S.: Allahs sonne über dem Abendland. Stutgart (1967), p. 36.
[18] Darmstadler, L.; ibid, p. 52.
[19] Giles, H. a.: A chinese Biographical Dictionary, London-Shangai 1898, p. 1; Sarton, G.: Vol II, Part, p. 1034.

shook, the canons were buried seven feet into the ground and destroyed everything.[20] Yakub, the son of Ismail the engineer who died in 1330, also took after his father.[21]

Syria (and particularly Damascus) was a major centre of the sciences in the thirteenth century with the madrasas and hospitals built by Turkic Atabegs. It was very natural for Muslim scholars to manufacture gunpowder and build explosive weapons in Syria as it witnessed many gory battles during the Crusades. Islamic scholars in the thirteenth century had technical information sufficient to use gunpowder for rockets.

Figure 3. *A rocket plan from Ibn Aranbugha's book Kitabül anik fil manajik kitabül hiyal fil hurub ve fath, Kitabul esliha (Armoury Manual), Ahmet III Library, Topkapi Palace Nr, 3469.*

In the books "*Kitap al-furusiya val-muhasab al-harbiya*" and "*Niyahat al-su'ul val-ummiya fi ta'allum a'mal al-furusiya*" written by the Islamic scholar Hasan ar-Rammah Najm al-Din al-Ahdab in the thirteenth century, explosive materials, firearms, and, for the first time, torpedoes driven by a rocket system were mentioned.[22] In this work on battle techniques written around 1275 by Hasan ar-Rammah, the illustrations of a torpedo running with a rocket system filled with explosive materials and having three firing points can also be found. Hasan al-Rammah lived in Syria during the reign of Sultan Baybars, during the Mamluk era and died in 1294 or 1295.[23] A hand-written copy of this work can be found in the Topkapi Palace Library (Topkapi Palace A. 2651). Another copy is registered with No. Ancien fond MS. 1127 in the Bibliotheque National, Paris.

Another book on arms and military in the Topkapi Palace is a very valuable document copied in the fourteenth century that consists of three different works. The first section is called *Kitab anîq fi'l-manajniq* and written in 775 for Ibn Aranbugha Al-Zardkâsh, the Ayyubid commander or for Mingili Boga al-Shimmin. According to more recent research, the author is not known. The second section is the book called *Kitab al-hiyal fi'l-hurub ve fath almada'in hifz al-durub*, on rockets, bombs and burning arrows, written by the Turkish commander Alaaddin Tayboga al-Omari al-Saki al-Meliki al-Nasir. It was copied in 1356 (Topkapi Palace A. 3469, Es'ad Ef. Library No. 1884).

[20] Giles. H. A.: ibid, p. 354.
[21] Sarton. G.: ibid, p. 1039.
[22] Sarton, G.: p. 1039-1040; Joseph Toussaint Reinaud und ildephonse fave: Histoire de l'artillerie, I, ere partie: Du feu gregois, de feux de guerre et des orignes de la poundre a canon. Paris 1845.
[23] Satron, G.: ibid, p. 1039.

Figure 4. *Another rocket plan from Ibn Aranbugha's book Kitabül anik fil manajik kitabül hiyal fil hurub ve fath, Kitabul esliha (Armoury Manual), Ahmet III Library, Topkapi Palace Nr, 3469.*

Later on, it is seen that explosive weapons using gunpowder were used by Muslims in Spain in their battles with the Christians. The Muslims in Spain had victories against the armies of Christian knights in Baza in 1325, in Alicante in 1331, and in Algejiras and Crecy in 1342.[24]

With the translation of Islamic works on natural sciences and techniques into Latin, technical advances were possible in the Christian world in the Renaissance era.

Giovanni de Fontana, the Italian engineer, was the scientist who designed water mines (See Minen) for the first time in Europe.[25] Giovanni de Fontana designed in 1420 a "mechanical bird" that was powered by a rocket system, and which was used for measuring the heights of castle walls and buildings. However, it is not known whether this mechanical bird was put into practice or not. In the fifteenth century, Giovanni Torriano, another Italian engineer, built a wooden mechanical bird that flew.

It is known that in the fifteenth century Regiomontanus, the German astronomer, built a mechanical eagle and a mosquito. Regiomontanus, whose real name was Johann Muller, was ordained as the cardinal of Regensburg by Pope Sixtus IV. It is stated in the sources that around 1470 or 1477, while he was in Rome, he died of plague or of poison. In a source from 1739, the following was written on the flying mechanical constructions of Regiomontanus.

"... we have to admit that he [Regiomontanus] was so skilled in making machines that he built an iron mosquito that flies and a wooden -or a metallic, according to some sources-eagle. This mechanical eagle met the Emperor Maxilian flying when he came to Nurnberg and accompanied him to the city".[26]

[24] Hunke, S.: ibid, p. 37.
[25] Darmstaedter, L.: ibid, p. 61. fontana's book about tehcnique Munchen, Staatsbibliothek. Cod. Iconogr. Nr. 242.
[26] Grosses vollstandiges Universal Lexicon aller Wissenschaften und Künste. Leipzig und Halle 1739, Bd, XXII. P. 224; for Regiomontanus' flying mechanical constructions first see: Ramus, Peter: Scholar, mathem., II, Frankfurt 1599 (Bühel, J. A.: De aqvila et Mvsca ferrea, quae mechanico artifice apud Noribendgenses gvondam volitasse feruntur, Altdorf 1707). See. Feldhaus, F. M.: Die Technik München, (1970).

Regiomontanus had written a commentary on the astronomical works of al-Battani (877-918), the famous Muslim astronomer, and this was published in 1537 in Nurnberg together with the work of al-Fargani. The title of this work, in its second publication in Bologna in 1645, was as follows:

"The Astronomy Book of al-Battani with some Additions of Johannes Regiomantanus".[27]

Leonardo da Vinci is often mentioned as the first inventor of the dark box (a primitive version of a camera [Camera obscura]), water pump, flywheel, and flying machines. However, it is known that Leonardo da Vinci was under the influence of Islamic scholars, and he was particularly inspired by the work of al-Hazen.

We have to remind here that a hand-written copy of the technical work of Ahmed b. Musa, the Islamic engineer, is still in the Vatican Library.[28]

Furthermore, in the Turkic-Islamic cultural world, the first attempts at flight are seen long before the European Christian world. A Turkish scholar of Sayram (Ispidjap) had researched the relationship between the wing surfaces of birds and their weights, to find the physical causes for flight.[29] This work set new horizons in the field of aerodynamics. "The old Turks called heaven *ugmak* [to fly]. And hell was called *Tamuk* or *Tamu. Tamuk* means covered building. *Ucmak* means reaching the skies".[30]

Furthermore, the word *ugmak* (to fly) can be found in the lyric poems of the work of Sultan Veled, "Divan-i Turkî Sultan Veled", printed in 1925 by Veled Celebi Izbudak for the Ministry of Education. For example:

Ugmak asindan dilervem hir canak

Nur hamurundan iki uc bazlama.

Tahurdur hak sucusu ucmak icre

Eger tahirsen ondan sen icersin?[31]

Considering that flying is a much-desired sacred ideal for Turks, one should not be surprised at the flight attempt of Ismail Ibn Hammad al-Javharî, the great Turkish scholar, of Farab, Turkestan as early as the beginning of the eleventh century. Al- Javharî who boasts the famous work of "al-Sihah" attempted flying when he was in Nijabur. He tied two wooden wings with a rope, and climbed the roof of a mosque in Nijabur. He addressed the people of Nisabur who gathered around the mosque with surprise and curiosity, as follows:

"O People! No one has made this discovery before. Now I will fly before your very eyes. The most important thing on earth is to fly to the skies. That I will do now", and let himself free from the roof of the mosque

Sp. 50.
[27] Hunke, S. A.: ibid. P. 93.
[28] "L'ouvrage sur la mecanique d'Ahmed fils de Mousaexiste en manuscrit au Vatican, avec des figures, 6 Berlin et a Gotha; mais le texte n'en serait pas tres correct, d'apres Wiedemann qui l'a un peu erudie." (De Vaux, Baron Carra: Les Penseurs de L'Islam. Paris 1921, Bd. II, p. 172). "L'ouvrage sur la mecanique d'ahmed fils de Mousaexiste en manuscrit au Vatican, avec des figures, 6 Berlin et a Gotha; mais le texte n'en serait pas tres correct, d'apres Wiedemann qui l'a un peu erudie." (De Vaux, Baron Carra: Les Penseurs de L'Islam. Paris 1921, Bd. II, p. 172).
[29] Turan, O.: ibid. p. 368.
[30] Necip Asim Yaziksiz: Istanbul'da Balon. *Turk Tarihi Encumeni Mecmuasi*, 18 (1926), pp. 384-385.
[31] Velet Celebi Izbudak: *Divan-i Türki Sutan Veled*. Ankara 1925.

with his two wings. After flying for some time, he fell and died.[32] The date of the flight attempt, which was delayed due to the death of al- Javharî, is given as 1003 (393 A.H.), 1007-1008 (398 A.H.) and 1009-1010 (400 A.H.) in sources.[33]

Similar flight attempts were also made in Spain in the ninth century, which coincided with the brightest era of Islamic culture. Islamic scholar Abbas b. Firnas, who discovered the manufacture of crystals, made a flight attempt with the flying surfaces he built in 880, and after flying some time, he landed again without being hurt.[34]

The most interesting of the flight attempts in the Turkish-Islam cultural circles were those of Hazarfan Ahmed Celebi and Lagarî Hasan Celebi in 1630-1632 during the reign of Sultan Murad IV. Evliya Celebi, who personally witnessed these flight attempts, gave the following information in his travel book, the hand-written copies of which can be found in the Libraries of Istanbul:

"Hazarfan Ahmed Celebi: First he practiced by flying over the pulpit of Okmeydani eight or nine times with eagle winds, using the force of the wind. Then, as Sultan Murad Han was watching from the Sinan Pasha mansion at Sarayburnu, he flew from the very top of the Galata Tower and landed in the Dogancilar Square in Uskudar, with the help of the south-west wind. Then Murad Khan granted him a sack of golden coins, and said:

'This man is a scary man. He is capable of doing anything he wishes. It is not right to keep such people,' and thus sent him to Algeria on exile. He died there".[35]

Evliya Celebi's anecdote of Lagarî Hasan Celebi flying with a seven-winged rocket of his own invention is still more interesting, and is as follows:

"Lagarî Hasan Celebi: The night Murad Han's daughter, Kaya Sultan, was born was as brilliant as a star, and there was an infant ceremony. Lagarî Hasan had invented a seven-winged rocket using fifty *okka* (140 lbs) of gunpowder paste. In Sarayburnu, he mounted the rocket before the emperor. His students lit the wick. Lagarî said 'O my sultan! Be blessed, I am going to talk to Christ', and he ascended praying. He lighted the rockets he took with him, illuminating the surface of the sea. When the big rocket ran out of gunpowder, he splashed into the sea while landing. Thereon, he swam and came before the sultan naked. He kissed the ground and joked 'O my sultan! Christ sends his regards to you'. He was granted a sack of silver coins, and was enrolled as a cavalry soldier with seventy silver coins for his salary:

Then he went to Selamet-Giray Khan in Crimea, and died there. The deceased was a close friend of mine. God bless him".[36]

Dr. John Wilkins, Chester High Priest and mathematician, mentions these flight attempts of Turks in Istanbul in his work "Wilkins Discovery of a New World", of 1638.[37] As his source, he names Augerius

[32] Hayrettin Zirikli: *El-alam Kamusu'l-Teracim*. Cairo 1927, p. 105; Sarkis, Joseph Elian: *Dictionnaire Encyclopedique de Bibliographie arabe*. Fascicule XI. Caire 1930. pp. 723-724.
[33] Cheneb, M. ben al-Djawhari: *Enzyklopaedie des Islam*. Hrsg. M. Th. Houtsma. Leiden-Leipsiz 1913, Bd. I, s. 1073.
[34] Lévi-Provencal, E.: *La Civilitation Arabe en Espagne*. Paris 1948, p. 77; Sitzungsberichte d. phys. –med. Sozietat, Erlangen, Bd. 38, 1906, p. 146.
[35] Evliya Celebi: *Seyahatname*. New Edition. Istanbul (1969). II, 335; Manuscript Topkapi Palace B. Nr. 304; Suleymaniye Besir aga, nr. 448.
[36] Evliya Celebi: Seyahatname Istanbul (1969), II, 335-336.

Gislenus Busbequius (1522-1592), who came to Istanbul as the Austrian envoy during the reign of Suleyman the Magnificent.

Figure 5. *Augerius Gislenus Busbequius (1522-1592), the Austrian Ambassador who had indicated as the reference in Europe, to the flight trials of Turks in Istanbul.*

In the work "The Birth of Flight" published in 1941, G. Busbequius is also named as a source, and the Istanbul attempts of Turks are briefly mentioned as follows:

"If it be enquired what means there may be conjectured for our ascending beyond the space of the earth's Magnetical. Vigor, I answer: It is not perhaps impossible that a man may be able to fly by the application of wings to his own body as Mercury and Deadalus are feigned and as has been attempted by Divers, particularly by a Turk in Constantinople as Busbequis relates".[38]

Accordingly, it must be accepted that as early as during the reign of Suleyman I Ottoman Turks made a number of attempts at flight.

Hezarfen Ahmed Celebi, who opened a new era in the history of aviation, being sent to Algeria on exile, and Lagarî Hasan Celebi not receiving enough attention, and his departure to Crimea later on, do answer the question of why the development in this field did not continue.

The Turkish engineer Lagarî Hasan Celebi, flying with a seven-winged rocket of his own invention and then landing safely on the sea with eagle-like wings, is very similar to the sea-landing methods of Americans, with parachutes after their voyages into space. Therefore, Lagarî Hasan Celebi deserves a special place in

[37] Wilkins, John: Discovery of a New World. London 1638.
[38] The Birth of Flight. Edited by Hartley Kemball Cook George allen/Unvin Ltd. London 1941, p. 29.

the history of aviation, with his flight attempt, which opened new horizons in rocketry techniques. This success of Lagarî Hasan Celebi is a result of the technical developments in the Turkic-Islamic world, such as of gunpowder and fire arms being first developed in the Seljuk era in the twelfth and thirteenth centuries, ballistic arms being built by Turkic-Islamic engineers, and even the preparation of sketches of torpedoes powered by a rocket system. Indeed, during the conquest of Constantinople, and as the Ottoman Empire expanded across three continents, the major role of the advanced state of the Turks in making explosive arms and in technical fields is without doubt. It must not be forgotten that when

Lagarî Hasan Celebi made his flight attempt with a rocket-like vehicle; the Ottoman Empire was going through its last bright era under Sultan Murad IV.

One of the most important anecdotes of Evliya Celebi on these flight attempts is that Lagarî Hasan Celebi went to Crimea to Selamet Giray Khan after these trials, and later died there.

According to the researches by S. N. Kuzmenko, a Russian scientist on rocket technology, the study of rocket technology began in Ukraine for the first time after the seventeenth century, and the first description of a rocket dates to 1650 in Ukraine. Afterwards, Nikolojev and K. I. Konstantinov (1818-1871) based their works on these first studies in Ukraine, which enabled the current success of Russian rocket technology.[39]

The first Russian rocket technology studies in Ukraine coinciding with just after Lagarî Hasan Celebi's residence in the Crimea and his death supports the opinion that studies in the field of Russian rocket technology could have been influenced by the Turkish engineer Lagan Hasan Celebi and his students. When I supported this thesis in the 13th Congress on the History of Sciences in Moscow, on August 26, 1971,[40] the Russian scientist S. N. Kuzmenko who was reporting on Russian rocket studies in Ukraine, stated that he agrees with me and that he is carrying out research in the Russian archives to support my assertions.

In the work called *Ummul-Gaza*, written by Ali Aga, the second caliph of the Bombardiers class in the reign of Sultan Ahmed III (1703-1730), which is in the Topkapi Palace currently; the rockets called *tulumbas* invented by himself and used for castle sieges in the seventeenth century were described. These are illustrated to be *11-12 arsin* (7-8 m) long and the diameter was difficult for one person to encircle. In this work, Ali Aga relates the failures of the battles to the recession in inventing and developing arms and recommends to the sultan that new arms be developed. Thus, it is seen that the developments and new discoveries in the Turkic-Islamic world in this field came to an end.

However, again during the reign of Sultan Ahmed III (1703-1750), which is during the Tulip Age, there is strong evidence both in the *Surname* (chronicle) of Mehmed Hazîn and the *Surname* of Vehbi, as the witnesses of the era, that Ibrahim Efendi, the dockyard architect, had invented the submarine which was called *"Tahtelbahir".* Seyyid Vehbi compared this submarine invented by the architect Ibrahim Efendi to an alligator, and tells in his *Surname* that during the circumcision ceremony that Sultan Ahmed III held for his sons, while the sultan, the viziers, and sultan's sons were watching the shows in the coastal palace in Aynali Kavak, the alligator-like submarine slowly emerged on the water and moved slowly to the sultan, and after staying on the sea for half an hour, submerged in the sea again to the great surprise of the public;

[39] Kuzmenko, S. N.: Froom the History of Rockettry in Ukrania. XIII th international congress of the history of science. Section. N. 12. Histroy of aircraft, rocket and space science and technology, Moskou 1971, pp. 74-75.
[40] Terzioglu, Arslan: Handschriften aus dem gebiet der Technik und aerodynamik sowie ersten Flugversuche im IX. XVII. Jh. İm islamisch-türkischen Kulturbereich. XIII. th international congress of the history of science. Section. N. 12. Histroy of aircraft, rocket and space science and technology, Moskou 1971, pp. 75-77.

then emerged one hour later, with five people walking outside the mouth of this alligator-like submarine, with trays of rice and *zerde* (dish of sweetened rice) on their heads. The book *Surname-i Humayun* of Seyyid Vehbi, which explains the technical information concerning this sub-marine submerging in the sea and the crew being able to breathe through pipes while under the sea,[41] demonstrates to us that the first Ottoman trials of submarines were successful. The *Surname*[42] of Mehmed Hazîn, who told of the events of October 1, 1720, during the circumcision ceremony of the sons of Sultan Ahmed III, related that a fish-like submarine was present; however, his secrets were buried with him.

Although it is mentioned by Bahaeddin, the historian, that the first submarine was used[43] during the Seljuk period, against the Crusader knights in the siege of Akka in 1150, it is understood that the submarine built by Ibrahim, the architect, in the Ottoman era during the reign of Ahmed III was more developed and could stay under water for one hour. Considering that the British tried to build a small submarine half a century after Ibrahim and failed,[44] it is obvious that the Ottoman success in this field is most notable. However in 1776, the submarine developed by the American scientist David Bushnell was a success.[45] The sketches of a submarine project in the archives of Stockholm Military Organization are interesting for the assessment of all the technical developments of the era.

IV. Conclusion

The Islamic renaissance, which began in the ninth and tenth centuries, brought about major advances in the technical field and as early as the ninth century the first attempts at flight had begun in Turkistan and Andalusia. It is understood from the works of Hasan ar-Rammah and Aladdin Tayboga al-Umari as-Saki and other works the copies of which are in our libraries, which during the Seljuk and Mamluk era, rocket driven torpedoes and rockets were developed. At the beginning of the seventeenth century, the Turkish engineer Lagarî Hasan Celebi's flight in Istanbul is very similar to the sea-landing methods of Americans, with parachutes, after their space trials. Evliya Celebi mentioning that Lagarî Hasan Celebi went to the Crimea after this trial, to Selamet Giray Khan, and the first Russian rocket technology studies in Ukraine coinciding with just after Lagarî Hasan Celebi's residence in Crimea and his death, support the opinion that studies in the field of Russian rocket technology could have been influenced by the Turkish engineer Lagarî Hasan Celebi and his students.

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[41] See. Seyyid Vehbi: Surnâme. Suleymaniye Library, Hamidiye 952, foliea 171b.
[42] See. Mehmed Hazîn: Sûrnâme, Bayezid Library, Nureddin Paşa, 10267, folio 132 b.
[43] Saban Dogen, Musluman ilim onculeri ansiklopedisi, İstanbul 1984, s. 205.
[44] See. Flack, N. D.: Diving vessel by the Ms. Day. London 1775.
[45] Feldhaus, F. M.: Die Technik. Ein Lexikon der Vorzeit, der geschichtlichen Zeit und der Naturvölker. München 1970, sp. 1122.

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