

HELICOPTER HISTORY: THE IMPLICATIONS OF THE VON BAUMHAUER ARCHIVE

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Abstract. The legacy of Albert von Baumhauer, a Dutch helicopter pioneer, extends beyond his contributions to the development of the helicopter. His extensive correspondence and notebooks that have been preserved and catalogued are a testimony of contacts between aviation theorists, helicopter pioneers and specialists of aerodynamics. This study gives a first glimpse of his correspondence concerning helicopter patents as well as a second experimental helicopter that was designed by him but did not materialize. The correspondence shows that von Baumhauer was in contact with Burke Wilford from the United States and Anton Flettner from Germany and that he had extensive correspondence with Oscar Asbóth from Hungary for whom he rewrote an English patent application. The second helicopter project by von Baumhauer remained largely unknown since the machine was never built. It shows the diversity of von Baumhauer's designs that has also been attested for other helicopter pioneers.

1. INTRODUCTION TO THE VON BAUMHAUER ARCHIVE

Albert Gillis von Baumhauer was a Dutch helicopter pioneer who lived between 1891 and 1939 in Amsterdam, the Netherlands. He is remembered for an early application of a tail rotor together with a single main rotor system as well as his design of a cyclical blade pitch and cyclic pitch control system. His early death during a test flight of a prototype Boeing Stratoliner in the state of Washington, USA, shortened his career that was not limited to helicopters but was mainly concerned with safety in aviation.

1.1 History of the archive

Von Baumhauer kept an archive with international correspondence, administration and notebooks that were preserved by his family. Documents of the Von Baumhauer Fund that awarded the von Baumhauer medal for many years after the Second World War and also dossiers of the Daniel Guggenheim Fund as well as the organization that helped fund the first helicopter trials by von Baumhauer, the Dutch Helicopter Society, were added in later years.

The von Baumhauer family transferred most of the archive to the Royal Dutch Airline KLM, which, with the family's permission, handed the archive to the National Aerospace Laboratory (NLR) in the 1980s. The NLR succeeded the Rijksstudiedienst voor de Luchtvaart (RSL), the organization where von Baumhauer was employed from 1921 onwards.

At present the archive consists of 138 numbered folders that mostly contain reports. An additional group is numbered from A1 to A101 and consists of more than twenty two-inch binders that are filled with correspondence. It also includes offprints of most of his publications as well as various notebooks that go back to 1906, when he was only fifteen years old.

When appropriate, the number of the folder or binder in which the information below can be found has been added in brackets for future reference. Each binder of correspondence is alphabetized, mostly according to the last name of the correspondent, and when appropriate a capital letter is added to references below, which allows a particular letter to be located more efficiently.

1.2 Previous research

The archive was used by a limited number of people that were almost exclusively interested in his helicopter exploits. Other sources have only quoted published articles and lectures. Most helicopter historians, including the most recent ones [1,2], have used the published descriptions of his helicopter that were authored by von Baumhauer, journalists and the occasional technical expert. In addition, the accounts of Mr. P.J. Six, a good friend and an occasional pilot of von Baumhauer's helicopter, have been quoted in various reports.

One of the first to use the archive for research purposes was Mr. W. van Nifferick who answered questions raised by Mr. Serge Gagarin at Sikorsky Aircraft, Bridgeport, Connecticut. In 1947, Mr. Gagarin was working on an encyclopedia and raised seven technical questions concerning the design of von Baumhauer's helicopter, including the construction of the rotor blades, the rotor hub connection, the controls, the tail rotor, the autorotation provisions and the nature of

the flight tests. All of these questions were answered in great detail by van Nifterick although in the subsequent publication only a limited part was used. (A101)

The second time that this archive was consulted, it was also still located at the house of his widow. It was the engineer Meijer Drees who was particularly interested in the cyclical blade pitch that von Baumhauer had developed and patented. Meijer Drees subsequently exchanged letters with Six who remained the main advocate of the accomplishments of von Baumhauer. (A101) Meijer Drees is remembered as the developer of the first production helicopter in the Netherlands, the Kolibri, and later was employed by Bell Helicopters in the United States. [3]

Once the archive resided at the NLR, Mr. Vodegel and Mr. Jessurun prepared a paper for the Twenty-first European Rotorcraft Forum. They presented von Baumhauer in the context of Dutch helicopter developments. Meijer Drees featured in the development of the post-war Dutch helicopter Kolibri and von Baumhauer as the first helicopter pioneer of the Netherlands. They repeated the tail rotor design as well as the various patents by von Baumhauer including one on a windmill design. [3]

In the 1990s, volunteers at the NLR who organized themselves in a museum foundation started to evaluate the full scope of this archive. In the current study, which started in 2006, the von Baumhauer archive is used to give insight in matters other than the text of his patents. His correspondence and notebooks show that his first helicopter is part of a series of ideas and that he was in contact with a wide range of helicopter pioneers, aviation scientists and specialists of aerodynamics. It places a single engineer in an international context. It is this context that makes the von Baumhauer archive of particular value, while his individual accomplishment recorded in patents remain a footnote, although an interesting one, in helicopter history.

The implications of the archive are illustrated here with two accounts that are so far absent in the historical literature. The first speaks of foreign interest in his patents. The second speaks of an unbuilt helicopter experimental design.

2. VON BAUMHAUER'S CORRESPONDENCE ON PATENTS

Von Baumhauer corresponded with aviation specialists in ten different countries. Helicopters were discussed in letters from at least seven countries in Dutch, German, French and English. This exchange of letters with often well-known helicopter pioneers, such as Nicolas Florine, Juan de la Cierva or Arturo Crocco, gives insight in the dissemination of knowledge in the 1920s and 1930s when helicopters developed into a practical machine. A small part of this helicopter correspondence concerns patents and is presented below.

Patents record much of helicopter history; they are evidence of an invention, in French a 'Brevet d'Invention'. Von Baumhauer was inventive and presents a long list of ingenious solutions to mostly mechanical problems. Only some of these he sought to register as new. He investigated possibilities of obtaining a patent in Britain, Germany and the Netherlands, obtaining what is known in the Dutch system as an 'octrooi'. The registrations could expire, were often limited to one country and in order to get familiar with them they were facilitated and sometimes researched by a patent agent or 'octrooibezorger'.

The first contact between von Baumhauer and the patent world concerned a windmill. The application took place in November 1918, when he was 27 years old. Earlier patent applications

on helicopters by von Baumhauer dating from 1912 and 1914 have entered the literature but have no basis in his notes, his archive or in the patent registration office. This 1918 octrooi was awarded in April 1922 and given number 7177. In August 1923 he discontinued this octrooi by not paying the yearly tax. This patent created a short correspondence with Moscow. In November 1933 a letter is received from G. Sabinin, a known figure in early Soviet helicopter developments. The letter does not relate to helicopters but to an article that von Baumhauer sent on the aerodynamics of windmills. Sabinin was one of few who also developed windmill improvements at that time and he thanked von Baumhauer for the articles he sent. (A66 S) As early as 1929, Sabinin's publication on windmills is quoted in one of von Baumhauer's reports on windmill improvements. It is one of few instances in which von Baumhauer is shown to have corresponded with his colleagues in Russia.

In the Netherlands, helicopter patents are not frequent in the 1920s except for one by the Cierva Autogiro Company in London, which in July 1929, four years after its application, was awarded octrooi-number 20485 for the invention of the 'freely rotating lifting-wing system'. It is a curious example since de la Cierva already registered his inventions in Britain, France, and Germany. The Netherlands seemed hardly a competing market.

In a short exchange of letters with the octrooi-council in September 1923, von Baumhauer asks about the expiry date of French patents and requests an overview of international patent particularities. He is referred to a German publication: "Samtliche Patentgesetze des In- und Auslandes" by J. Tenenbaum, published in Dresden. He immediately requests a copy although it is not certain that the book was actually available to him in the library. (A11 H) Instead his archive holds an overview of European patents and those in the Americas in poster format, published by W. Pataky in 1924. It shows clear differences between the patent applications of that year. (A13 P) The taxes or levies are expensive and in the Dutch case also increase during the 15 year period, as he is told in an explanatory letter. (A11 O) In April 1924, perhaps also for this financial reason, von Baumhauer applied for a patent in Britain on 'improvements relating to the construction of flying machines particularly helicopters', which was accepted on 19 October 1925. It was followed by a second application on 30 October 1925 also concerning 'improvements in or relating to flying machines', which was granted only in January 1927. They relate to the cyclical blade pitch and the cyclic control for helicopter rotors. Research by his patent agent Peter Thurston in London put his invention in sequence to that of Oemichen, Pescara and others.

At least two attempts have been made to buy or officially use these patented inventions by other helicopter pioneers. In 1932 it was Burke Wilford who wrote several letters to von Baumhauer but in the end cooperated with some German engineers. (A17 A) In May 1933, Anton Flettner from Berlin wrote a letter showing his interest in the rights of the patents. He requested copies of the patents, both German and foreign, photographs, drawings and everything else that was known about von Baumhauer's helicopter attempt. (A17 F) No further correspondence with Flettner can be found until 1938 when a short letter was sent accompanying a book that was of interest to von Baumhauer. The Dutch octrooi on the improvement of flying machines dating from July 1927 and that was submitted in the name of the Dutch Helicopter Society, had already been discontinued as of March 1932, which may explain the limited success of these two foreign requests.

In 1933, von Baumhauer assisted Oskar Asbóth with his patent application in Britain, partly rewriting and translating the text. (A16 A) Asbóth made his own helicopter in the early 1930s

at which time he had found a business partner in the Netherlands, among which a company by the name of Ruhaak & Co., and was seeking assistance from the Air Ministry in London to have tests conducted at the laboratories in England. He communicated in German with von Baumhauer and his letters were filled with requests including financial help, invitation letters to the Netherlands and help with contacting his Dutch associates. Only some of these requests were answered. Once Asbóth arrived in England and exchanged his Dutch for British partners, he thanked von Baumhauer for his assistance with the patent applications but was no longer willing to exchange his ideas on helicopter design.

Also in 1933, von Baumhauer sends a request, in name of the Dutch Helicopter Society, to a patent agent in The Hague. The agent was to investigate the possibility of registering a new patent in Germany. He sent his two British patents that, according to a remark in a reply, had now expired. The patent agent found twelve relevant patents that largely covered the inventions on cyclical blade pitch and flapping. The oldest dating back to 1926, the remainder dating to the early 1930s. De la Cierva had submitted seven of them. The patent agent mentions only de la Cierva's name. The other relevant patents were submitted by the pioneers Oemichen, Nagler & Hafner and inventors by the name of Josef Breitfelder, the oldest patent in the list, Robert Gobereau and Rudolph Chillingsworth.

Later research by helicopter historians [1,2] has shown that patents by Ellehammer in Denmark, Bréguet in France and several Russian inventions had also relevance to these investigations of earlier patents but they remained unnoticed.

3. THE SECOND HELICOPTER

The 1933 patent research request by von Baumhauer on behalf of the Dutch Helicopter Society was part of a new plan. This plan was based on an idea that can be traced back to a notebook entry of 4 January 1931. It is entitled helicopter-airplane (Helicoptère-vliegtuig) that flies fast and slow but cannot hover while the enlarged screw serves as lifting and propelling screw in flight. In his plan, he suggested two lifting screws turning in opposite directions on either side of the pilot. This was changed to a design with airfoils that could compensate enough torque as long as there was sufficient forward speed. In January 1935, in a letter to a Mr. Visker, the chairman of the Dutch Helicopter Society, he explains his thoughts.

Von Baumhauer had “entertained the thought to run an experiment to see if it was possible to solve or at least come closer to a solution of the helicopter problem in a relatively simple way”. He imagined that it was necessary to investigate how a lifting screw behaved when the machine had a considerable forward speed. It was possible to execute this plan with limited costs when he ignored the demand that the machine should be able to hover. The torque or turning of the machine could be compensated by way of tail surfaces and other simple devices while the whole construction was less prone to mechanical failure. Some forward speed was necessary to allow a safe take-off. He wished to use a small airplane with a giant-size propeller that was mounted as a lifting screw. It allowed experiments with high and low forward speed at safe altitudes. High forward speed for a true helicopter was, at that time, still problematic.

He continued by stating that the experiment was unlikely to generate profit or even a prize; only knowledge and insight concerning the lifting screw could be gained, at the most a nice aircraft for demonstrations. He considered taking the plan abroad, since he had been accused of making

a laughing stock of Dutch aviation with some of his plans, but a Dutch venture involving only a few men limited the expense and increased the learning possibilities.

Visker had apparently complained that without new activity the society was to be dissolved and that he had lost interest in being its chair. Von Baumhauer's letter was to relieve this concern. He even suggested to front ten thousand guilders and hoped that another person did the same; the combined costs were estimated at twenty thousand guilders. The first half was to be used for building and trying the aircraft before deciding how to proceed with the next phase. The engine of the first helicopter, which crashed in 1930, appeared to be in reasonable shape and was to be used in the new machine.

This letter was the result of earlier investigations in 1933 and 1934. He had contacted Felix Jaray, whose name he found in an article from 1921 by von Kármán. (A16 J) This Viennese rotor-expert was famous for wooden rotors of good quality and was asked to provide details and test results of his work. A similar question reached Rotier in Montrouge, Seine, in June of that year (A64 H). Fieseler-Flugzeugbau was contacted in January 1934 for a visit but Piet Six, the active secretary of the society, wanted to wait for the enquiries concerning a new patent. (A64 F) In July 1934 Phillips and Powis Aircraft Limited in Reading, England, were contacted to build a machine with a rigid propeller hub and an angle between the engine and the direction of flight that could measure between twenty and ninety degrees. (A64 H) Handley Page was asked for advice and he was to meet von Baumhauer at the Royal Aeronautical Society where de la Cierva delivered a lecture in March 1935. Another letter (A65 H) states their object once more: "What we want is to investigate up to what degree the horizontal speed of an aeroplane at a very high angle of attack may be reduced, while the propeller acts as a lifting screw and the angle between the axis and direction of flight approaches a right angle." The experimental aircraft was not a "pure-sang" helicopter. Meanwhile von Baumhauer had asked the patent agent (A64 G) to investigate the patents for flapping and blade pitch control for cases in which they were applied to a rotor that was not necessarily a lifting screw.

On 16 March 1935 the board of the Dutch Helicopter Society met to propose a new chair. Mr. Visker had not been convinced and the new chair Mr. de Boer, director of the Steam Company "Netherlands", requested further information on the new project by von Baumhauer. The latter stated that a definitive design could only be started after two important tests had been conducted. The first was to determine the most suitable shape of the wing and the second to record the torque of the screw. (A65 H) The plan did not materialize; a patent was never filed.

Leonardo Da Vinci's helicopter design is quoted extensively in works on helicopter history even though this machine was never built and the design remained unknown for almost two centuries. Patent research has uncovered other unbuilt helicopter designs that have appeared of particular relevance in helicopter history. The von Baumhauer archive shows a design that remained unbuilt and is first published here. This is not to suggest that von Baumhauer was not given enough attention, although that may be true. Alternative designs are best found in archives, such as a recent study of the helicopter designs by D'Ascanio confirmed [4], and give insight in the development and distribution of helicopter ideas in the 1920s and 1930s.

4. IMPLICATIONS FOR HELICOPTER HISTORY

Helicopter historians have concentrated on patent research and on published helicopter experiments. The von Baumhauer archive adds context. It shows that helicopter pioneers were

in contact with each other and when they applied for a patent became familiar with other work in their field. At the same time, it shows that this familiarization with other patents was not perfect and left certain countries unresearched.

The second project developed by von Baumhauer illustrates that ideas of pioneers are not limited to their patents or their published designs. The presence of other designs in individual archives allows a more detailed understanding of individual advances in helicopter research.

Patents and published designs require context that can be found in correspondence and other means of contact between individual pioneers. The individual ideas that were left in archives require attention in the future studies of helicopter history since they add to the accomplishments of the inventors and to the context in which the inventions were made. The von Baumhauer archive has shown that researching individual archives of helicopter pioneers promises new perspectives on helicopter history.

5. REFERENCES

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