UPDATE

Aerostation: the first aeronautical experiences in Brazil

Aerostación: las primeras experiencias aeronáuticas en Brasil

Aerostação: as primeiras experiências aeronáuticas no Brasil

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ABSTRACT

Military commanders always had the need to obtain the most complete information on the terrain they will conduct their operations and about the enemy situation. One of the means used for this was to find a position high above the terrain. So, when balloons were developed, they were soon used in aerial reconnaissance, initially in France and later on in the United States and in almost all the great power. The use of balloons continued until the 1st World War. In Brazil, attempts of the use of balloons for reconnaissance were made, but without creating a specific culture for the employ of such aircraft, which is a fact discussed in the present paper.

Keywords: Aeronautic History. Balloons. Light than air flight. Aerial Reconnaissance.

RESUMEN

Los comandantes de las fuerzas armadas tuvieron la necesidad de obtener tanto como sea posible informaciones respecto del terreno donde operarán y cuanto a la situación del enemigo. Una de las formas posibles de hacer esto era obtener acceso a una posición elevada en el suelo. Con el desarrollo de los globos, pronto se emplearon para el reconocimiento aéreo, inicialmente en Francia, después en Estados Unidos y en casi todas las grandes potencias, su uso a gran escala se mantuvo hasta la Primera Guerra Mundial. En Brasil, se hicieron intentos de utilización de aerostatos para reconocimiento, pero sin generar una cultura específica del empleo de este tipo de aeronave, lo que es discutido el este artículo.

Palabras clave: *Historia de Aeronáutica. Globos. Aerostación. Reconhecimento Aéreo.*

RESUMO

Os comandantes das forças militares sempre tiveram a necessidade de obtenção da maior quantidade possível de informações sobre o terreno onde vão operar e quanto à situação do inimigo. Uma possível forma para isso seria obter o acesso a uma posição elevada sobre o terreno. Com o seu desenvolvimento, os balões logo foram empregados para reconhecimento aéreo, inicialmente na França e depois nos Estados Unidos e em quase todas as grandes potências, e seu uso em grande escala continuando até a 1ª Guerra Mundial. No Brasil, foram feitas tentativas do uso de aeróstatos para reconhecimento, mas sem gerar uma cultura específica do emprego desse tipo de aeronave, o que é discutido no presente artigo.

Palavras-chave: *História da Aeronáutica. Balões. Aerostação. Reconhecimento Aéreo.*

1 INTRODUCTION

One of the constant problems for armed forces officers is to apply the concept of military intelligence, which consists of the "set of specialized and permanent activities of search and production of knowledge of interest to the authority for decision-making and conducting its executive action"(BRASIL, 2005). Commanders must also keep track of the situation, knowing the terrain to be traveled and the enemy's situation: their strength, organization, location, battlefield layout, as well as equipment, armaments and supplies they possess.

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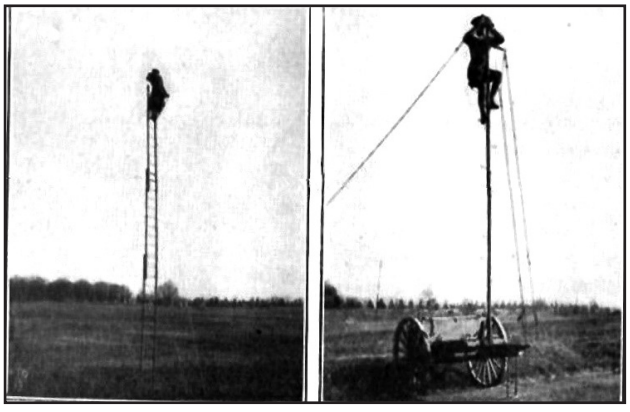
However, until very recently, the tools available for officers to collect such information were extremely limited. It was oftenoperated only with minimal knowledge about the situation, even without the exact notion of the terrain to be traversed, for lack of maps. To fill the lack of information about the battlefield, when the first major states began to emerge, cartography played an important role, as in Napoleon's general staff during the invasion of Russia, which had 66 officers, 14 of them cartographers (NAFZIGER, 2017). In Brazil, the creation of the Army Archive occurred due to the cartographic needs, not only of the armed forces, but also of the civil administration - an activity that the Army Geographic Service still performs today.

Even so, the most reliable intelligence tools available to commanders of the time were those under their direct control, often maps and information reports proved to be misleading, without realizing sudden tactical changes, such as the presence and movement of enemy troops. One of the reasons the senior officers rode horses was not linked to personal comfort, but to the advantage of being on a higher observation deck. Simple calculations let you know that a man on foot can observe up to a distance of five kilometers, while a man on horseback can see up to seven kilometers if standing on the saddle. The higher the observer's height on the ground, the farther his vision will reach. In situations where permanent surveillance of the greatest possible distance was required, observation towers were built – the *mangrulhos* of the Paraguayan war (1864-1870). Stairs were used in the artillery to observe the target (Figure 1). Some models with eleven meters high allowed the observer to watch a distance of 12.5 kilometers.

Figure 1 - Observation posts. Mobile stairs and masts used by U.S. artillery for observation in 1915.



Source: (OLMSTEAD, 1915).

In World War I, the Germans adopted a 24-meter-high observation mast with a periscope, allowing the observer to be protected behind an obstacle watching at a distance of up to 19 kilometers. This type of equipment is used to this day as part of the reconnaissance material of motorized and armored units.

However, all types of masts present a serious problem, which makes their use very difficult: the terrain of operations rarely allows an unimpeded observation. Even when the commander could put himself on the rise there was no guarantee of gathering the necessary information. Undulating terrain, the presence of dense forests or even the smoke produced by the fire from the soldiers' weapons sometimes concealed the movement of enemy forces. For centuries, the solution to the lack of adequate visibility was the use of light cavalry forces, who made the reconnaissance of the terrain and sent the information through mounted couriers. This in the absence of more effective options until this messenger system works reasonably.

2 THE ORIGIN OF THE MILITARY AIR STATION

One way to overcome the difficulties of terrain recognition would be to use aerostatic balloons, something that became possible – at least in theory – in the early eighteenth century, with the discovery of the Bartolomeu de Gusmão, who used hot air to raise a device over the ground. Gusmão's demonstrations in Lisbon in 1709 were only a "proof of concept", as the models he made had a small scale and were unable to raise a human being.

In 1766 hydrogen was discovered, a gas 14 times lighter than air, which allowed a few years later a race to perform manned flights on devices lighter than air. The French brothers Montgolfier, performed a manned flight on November 21, 1783, in a hot air balloon with 2,200 m^3, which could transport two people while another Frenchman, Jacques Charles, experienced an inflated aerostat with 380 m^3 of hydrogen, just ten days later (EGE, 1973).

The technology was not only seen as curiosity – the crew of Montgolfier's apparatus included

the Marquis d'Arlandes, infantry captain, who could not help but glimpse military possibilities in the invention. In fact, Benjamin Franklin, one of the founders of the North American nation, was present in the ascent of the two French balloons and then described in a letter the great importance of invention and highlighted such a turnaround in the affairs of humanity, arguing that "convincing the sovereigns of the folly of wars, perhaps was one of the effects of it: for it will be impractical for the most powerful of them to guard their dominions" (FRANKLIN, 1784).

Franklin in his letter reported some advantages and disadvantages of the two devices: the hot air filled faster and at lower cost, but it was very bulky, while the hydrogen took longer to fill the gas (two or three days) and used sulfuric acid poured over iron chips. Another curiosity is that Franklin called hydrogen by name as it was known at the time, *flammable air*, which already showed a problem of the gas, being highly flammable.

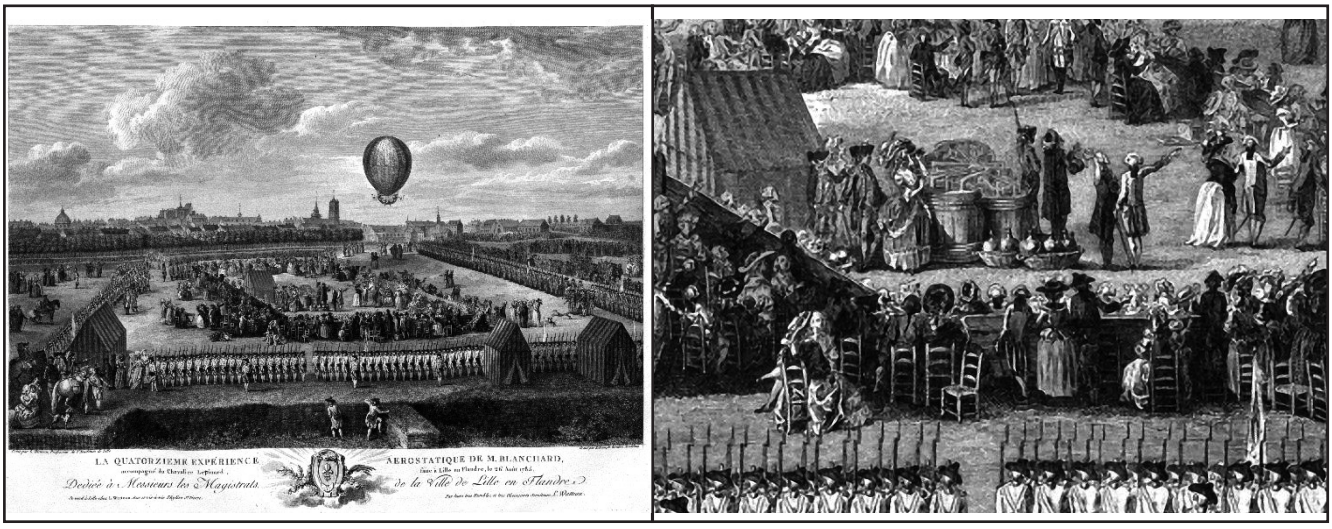
Some military points of interest were not mentioned in Benjamin Franklin's letter. The first of them related to the construction of the contrivances: the Montgolfier, made of paper, was subject to the climate, especially at the air temperature, while Charles, made of rubberized silk, made its rise in more adverse thermal conditions, including rain (KIM, 2016). On autonomy, hot air balloons had a limitation, as it would be impossible to carry enough fuel to sustain the altitude for a long time, which did not affect the hydrogen.

These first trips attracted a great deal of interest to the subject and motivated other attacks. Also, in 1783, the Ambassador of France to Piedmont organized a flight of a hot air contrivance in Turin, which was observed by members of a scientific committee created especially for the event. Among the members of the commission was then Lieutenant Carlo Antonio Napione, who would later serve in the Portuguese Army and is currently considered the patron of the Brazilian War Material Service. In September 1784, an Italian made a flight in London in a hydrogen balloon after two failed attempts by other aeronauts using hot air aircraft (KIM, 2016).

Shortly thereafter, a French enthusiast, Jean-Pierre Blanchard, was the first aeronaut to make balloon rises in Belgium, the Netherlands, Poland, the Kingdom of Bohemia (present-day Czech Republic) and the United States, having also made the first parachute jump in history. One of Blanchard's greatest achievements was crossing the English Channel in a balloon in 1784, an event that certainly caught the attention of the military authorities, taking in consideration the rivalry between the French and the English at that time.

Figure 2 shows Pierre Blanchard's 14th flight experience in Lille on August 26, 1785. In detail, it is possible to observe the barrels filled with chips and the bottles with acid, necessary for the production of hydrogen.

Figure 2 - Blanchard's ascent, in the north of France, in 1785.



Source: Helman (1785).

In the Wars of the French Revolution, the potential of the aerostats was recognized by the Public Security Committee, which ruled France. It was authorized the construction of balloons andone of them, the *L'Entrepenant*, 523 m^3, participated in the defense of Maubege in March 1794, informing about the movements of the Austrians who attacked the city. Later, the balloon was taken inflated to the fortress of Charleroi, 45 km away. In the fortress, which was occupied by the Austrians, the mere presence of the apparatus outside the walls demoralized the defenders, who surrendered.

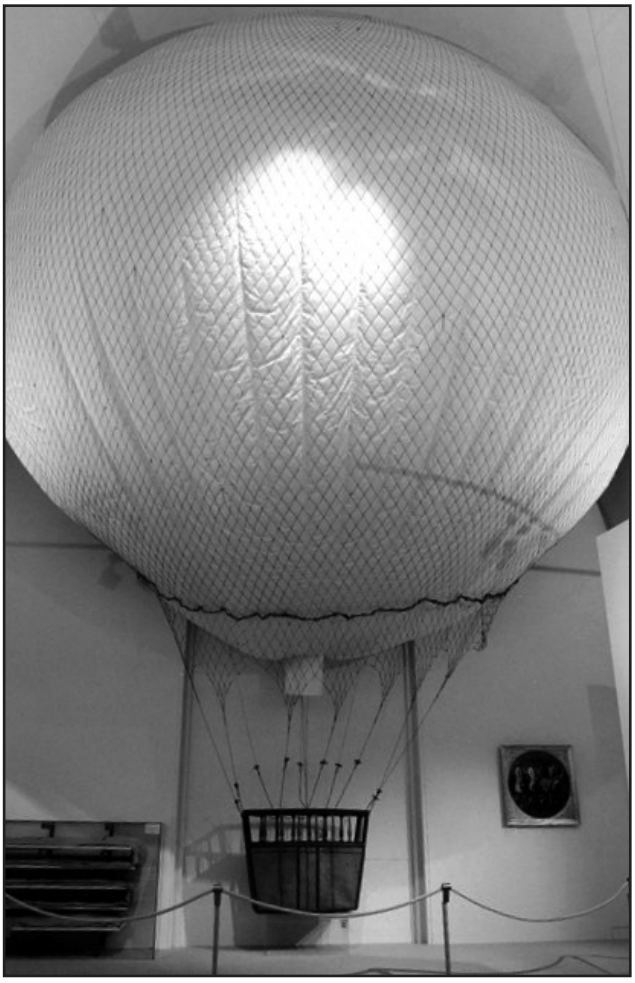
The day after the surrender, the balloon participated in the battle of Fleurus (June 26, 1794), with the crew hovering for ten hours at an altitude of 250 to 400 meters, in which it was possible to pass the information through flags and written notes, which descended through one of the ropes that kept the balloon in a fixed position. The communication of observers was admittedly paramount for the French to achieve victory on the day (LYNN, 2010).

The French formed other aerostat companies, one to accompany Napoleon's expedition to Egypt, although it was not used. It is true that the devices were not always successful, one of them, *L'Intrepid* (the Intrepid, Figure 3) was captured by the Austrians at the Battle of Würzburg (September 3, 1796), culminating in the extinction of balloon companies in 1799 by Napoleon himself (EGE, 1973).

At the siege of Venice in 1849, Austrian Franz von Uchatius designed unmanned hot air balloons carrying a 15kg bomb filled with gunpowder and lead small round bullets as a way to attack the city. The idea was to release the balloons to be carried by the wind to the city in a pre-calculated time, to then release the bomb on the site (HAYDON, 2000). The two attacks made with these balloons failed due to headwinds, but the bombing represented two milestones: it was the first use *drones* (unmanned aircraft) and the first aerial bombardment in history.

In the United States there were already some civilian balloonists before the Civil War (1861-1865), several of them volunteered to serve in the U.S. army, but Thaddeus Lowe stood out by getting an audience with President Lincoln and perform an ascent in his presence, on June 16, 1861. Lowe's balloon climbed 150 meters and communicated with the earth by telegraph – the first record of the use of telecommunications in aeronautics. After the demonstration, Lincoln decided to create the *Balloon Corps*, with several detachments, including with aeronaut brothers James and Ezra Allen.

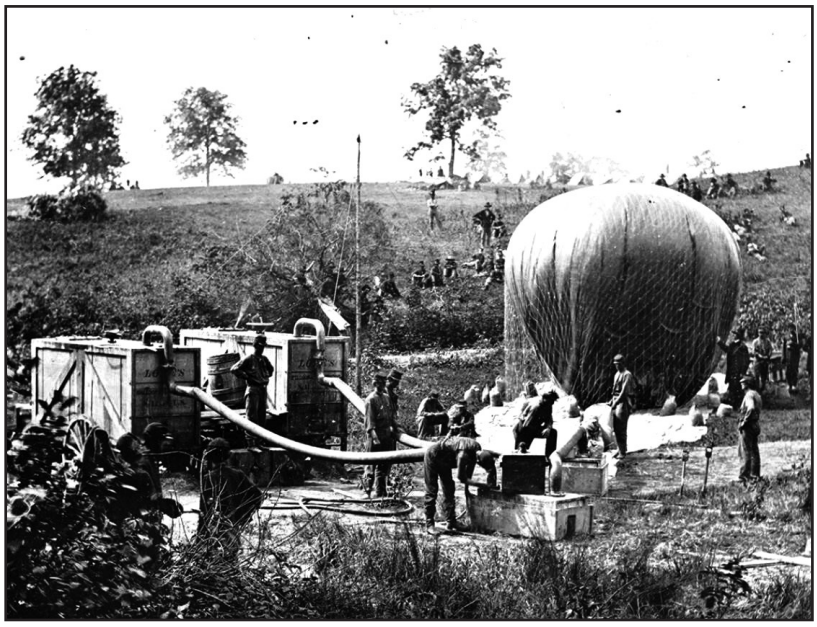
Figure 3 - *L'Intrépide*, exhibited at the Heeresgeschichtliches Museum in Vienna, is the oldest preserved aircraft in Europe.



Source: (WIKIMEDIA COMMONS CONTRIBUTORS, 2019).

The use of balloons by the Americans had a number of innovative aspects, such as the use of telegraph for communication, the adoption of specialized wagons in the production of hydrogen from sulfuric acid (Figure 4) and, more importantly, the use of aerobics to make the correction of artillery aim, all very advanced for the time. The operations of the balloons were not, however, a complete success, mainly due to the resistance of most army commanders in operation, so that the balloon body was dissolved in 1863 (HAGERMAN, 1995).

Figure 4 - Filling the *Intrepid balloon* for the Battle of Fair Oaks (May 1862). Note the hydrogen production wagons.



Source: (BRADY, 1862).

3 BALOONING IN BRASIL

News of the use of balloons in Europe and the United States regularly arrived in Brazil and in the 1850s the first rises of hydrogen balloons were made in Rio de Janeiro by aeronaut Eduardo Heill. The events took place in Campo de Santana, in front of the, latter known as the Army Headquarters, with the presence of the Emperor, on November 11, 1855 and February 2, 1856, as published by the newspaper of the time (Figure 5) (DIÁRIO DO RIO DE JANEIRO, 1856).

Figure 5 - Announcement of the second ascent in Brazil with ticket sales.

NOVA ASCENSÃO.

BRASIL
Deus o protege

M. Eduardo Heill, tendo feito a primeira ascensão com geral applauso e mesmo com enthusiasmo dos muito numerosos espectadores que a presenciárão, sendo actualmente proprietario do BALÃO e de todos os seus accessorios, propõe-se a fazer uma nova ascensão, para a qual invoca a benignidade do publico em attenção ás muito crescidas despezas que tem de fazer, superiores ás suas forças; e anima-se a esperar que não será baldado o seu appello, afim de que possa ter lugar tão curioso e interessante divertimento.

M. Eduardo Heill tem com essa animada esperança depositado cartões de primeira ordem a 3$ e da segunda a 1$.

Nas lojas dos Srs., Paula Brito, praça da Constituição n. 64.

Laemmert, rua da Quitanda n. 77.

Fauvarque et Léon, rua do Ouvidor n. 66.

Francisco Desmarais, rua do Ouvidor n. 86.

Firmin Didot, rua do Ouvidor n. 105.

M. E. Heill tem fixado para o dia 20 de janeiro proximo futuro, dia de S. Sebastião, a sua segunda ascensão.

Source: (DIÁRIO DO RIO DE JANEIRO, 1856).

A third attempt at ascension, made by Elias Bernardi, failed when his balloon caught fire on July 20, 1862 (JORNAL DO COMMERCIO, 1862). Finally, in 1864 it was announced (Figure 6) several flights in the balloon "Imperial Princess", piloted by an American and Isabel Case, the first aeronaut in Brazil.

Technical knowledge of what happened in the wars in Europe led the Brazilian army to seek to improve the functioning of the armed forces when the Paraguayan War began. The solutions found made the most of the available technology: battleships were purchased and, at the request of the Marquis of Caxias, were acquired backload and repetition weapons, something very advanced.

The military intelligence system also needed to be improved: when the army landed in Paraguay in April 1866, it did not have maps of the interior of that country and the officers did not know the territory of the operations. Not to mention the need to identify the extensive work of fortifications done by the Paraguayans. Thus, already on October 21 of that year, the Minister of War, authorized the expenditure of six "contos de réis" – which corresponds to current US$115,000 – for the manufacture of a balloon, under the responsibility of Frenchman Louis Doyen, resident in Rio de Janeiro. The construction should not have been easy, as there was a shortage of material and the War Arsenal had to buy 1,404 meters of silk, of various types. The amount of fabric was so much that this item alone corresponded to an expenditure of 11,240 "contos de réis", almost double the initial budget foreseen for the entire aircraft. The main balloon and experience balloons were made by Antônio Roux and the sewing work was directed by *Mademoiselle* Canus (ARSENAL..., 1866).

For the construction of the aircraft and test balloons, the War Arsenal only made the disbursements to make the Doyen project, not participating in the manufacture, which may have been the origin of the problem of the aircraft: the pilot provided the varnish formula, made by C.J. Cavalier and Cia, used to waterproof the silk. When varnishing the aerostat in Paraguay in October, the varnish went into combustion, making the device useless before the ascent (LAVENÈRE-WANDERLEY, 2017).

Despite the failure, it is interesting to reproduce a letter from Caxias to the Minister of War, of February 13, 1867, about his desire to have balloons for recognition:

Figure 6 - Announcement of the operations of the Imperial Princess balloon.

ASCENSÕES AEROSTATICAS

DOMINGO 20 DO CORRENTE

(CASO NÃO CHOVA OU NÃO HAJA VENTO FORTE.)

27 RUA DE M[illegible]TA CAVALLOS 27

FABRICA DE CERVEJA.

PRINCEZA IMPERIAL

O magnifico balão **Princeza Imperial**, dirigido pelo intrepido aeronauta o Sr. Wells, fara neste dia duas ascensões, da maneira seguinte:

PRIMEIRA ASCENSÃO

DAS 9 A'S 10 HORAS DA MANHÃ.

A intrepida Miss Isabel Case, que domingo proximo passado arrostrou todos os perigos, subirá pela terceira vez neste balão.

SEGUNDA ASCENSÃO

DAS 5 ½ A'S 6 ½ DA TARDE.

O Sr. Wells subirá no balão só ou com alguma pessoa que o queira acompanhar.

Em seguida Miss Isabel Case subirá de novo só, e após ella um intrepido Brazileiro cujo nome se publicará domingo.

O Sr. Wells alugou para este dia o estabelecimento acima; para commodidade do publico, e para que todos possão de perto gozar da ascensão do balão, reduzio as entradas ao baixo preço de 500 rs. por pessoa, indistinctamente, tanto para os caramanchões como para o morro e lugar da ascensão, havendo lugares commodos para o publico e particulares para familias.

O Sr. Wells conta com a benevolencia do publico, e o mesmo faz Miss Isabel Case, estando esta summamente reconhecida pelo interesse que tomárão pela sua pessoa no domingo proximo passado.

Tanto de tarde como de manhã, tocará neste estabelecimento uma banda de musica variadas e escolhidas peças.

Source: (JORNAL DO COMMERCIO, 1864).

> As for what Your Excellency tells me about Mr. Doyen's balloon, I must declare that if the balloon could arrive on time, it would be of great use; for to this day it has not been possible to make a reconnaissance of the enemy fortifications, which inspires complete confidence: and there is nothing more difficult for a General than to plan and operate in a terrain that is uncharted entirely, and so full of isolated forests, that cover up all the works, beyond the first line of defense. But will Mr. Doyen conclude his work? It's a problem I can't solve for lack of data; as much as I am sorry to see, after so much expense has been made, to lose this advantage by not making another attempt. (LAVENÈRE-WANDERLEY, 2017, p. 36).

That is, Doyen, who had returned to Rio de Janeiro, was supposed to make another attempt to manufacture another balloon, but this did not occur – in June 1867, the balloonist returned to Europe. The Army's alternative was later more cautious, determining to the Brazilian diplomatic representative in the United States to purchase a ready-made balloon in order to avoid the problems of possible failures to manufacture a device in Brazil.

The diplomat bought a balloon with hydrogen production equipment for US$7,500 at the time, about US$130,000 today. Along with the artifact came a second reserve balloon and the hiring of the Allen brothers, James and Ezra as pilots. The equipment arrived in Brazil in March 1867. (LAVENÈRE-WANDERLEY, 2017). The American balloonists arrived in Rio de Janeiro in early April and stayed in the city for only four days, long enough to prepare a test ascent at the Army Headquarters, where the current Duque de Caxias Palace is located (MELLO, 1867a).

Auxiliary equipment was also ordered for the operation of the aircraft: on April 22, 1867, after the departure of the aeronauts, the War Arsenal was ordered to urgently prepare 25 mm cables and "moitões" (pulleys) to control the ascents. In addition, fabric was requested to extend and varnish a balloon and hooks to secure the net, indicating that the smaller contrivance was not in a position to operate (MELLO, 1867b). Finally, it was ordered the purchase of 2,750 kg of sulfuric acid and iron chips for the production of hydrogen (MELLO, 1867c).

For more details on the operations of the balloons during the conflict, the book of Brigadier Lavenère-Wanderley is recommended. However, a caveat is necessary, according to the excerpt from the Ministry of War report of 1868:

> In one of the ascents it became known to find in better condition the terrain that was extensive on the left flank of the enemy: there were more spacious and less soggy fields being, therefore, well appropriate for the operations to start. (PARANAGUÁ, 1868, p. 54).

Such a passage, although small, reveals the importance that air reconnaissance would bring to the intelligence system. Until that time the operations against Paraguay were concentrated on the right flank of the enemy, because there the forces could be supported by the Brazilian Navy. However, it was an extremely fortified site, which required the attack of successive fortification lines: those of Curuzu, Curupaiti and, finally, the main fortress in Humaitá, a strategy that gave great advantages to the Paraguayans – just remember the disaster of the battle of Curupaiti, in which the allies lost more than 5,000 men, not gaining anything. Changing the axis of operations to the Paraguayan left flank allowed the main enemy fortifications to be circumvented, enabling, together with operations on the opposite bank of the Paraguay River, to complete the siege of the fortress of Humaitá.

Although the balloon operation was successful, it did not reach all the expected results. There was the problem of hydrogen production, and there was not enough chips and sulfuric acid, having to use the material left by Doyen, in Corrientes. The material needs were astronomical, James Allen even asked for no less than 4.5 tons of chips.

Even with all the difficulties they were made more than 20 rises in the smaller balloon, with the participation of Argentine officers and Paraguayan guides, with emphasis on the presence of Captain Francisco Cezar da Silva Amaral and First Lieutenant Manoel Peixoto Cursino do Amarante, the first two aeronauts of the Brazilian armed forces. The balloon raids allowed the recognition of the terrain and fortifications around Humaitá, including the Army Gazette reported an ascent on July 15, 1867:

> The aerostatic balloon, which had stayed in the Ipohy Pass, had already been sent for in a hurry; and, when it arrived at 10 o'clock to the aforementioned village [of Tuiuti], an ascent was made rising, as an observer, Captain Amaral and, as a practical of the places, the Paraguayan lieutenant Cespedes. All the positions of the enemy were discovered, Humaitá, Curupaití, the Paraguay River, Curuzú as well as our camp of Tuiuti and the Paraná River. The enemy trenches on the land side were perfectly discovered, and their extensions were verified, from Tuiuti to Humaitá, interrupted only in some spaces, by the wetlands and river estuary inlets (DAILY ..., 1867, p. 27).

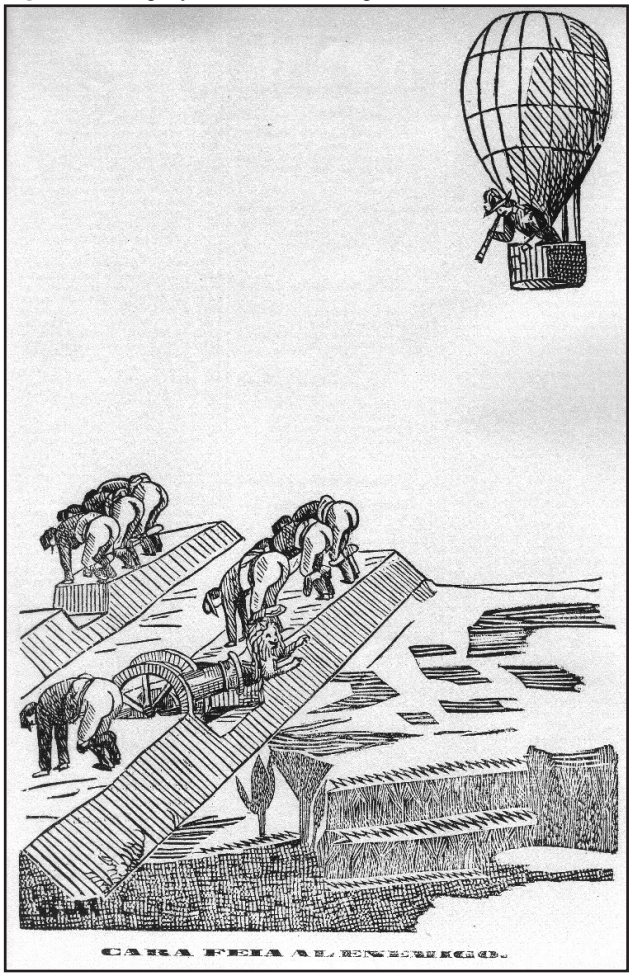
There were other extra advantages in the use of the balloon, the operations had a strong psychological impact on the Paraguayan forces, which were faced with a technology, so far, only known by more educated

officers, and without conditions of reproduction in the context of that time. To prevent the observations, they tried various means, such as firing cannons at the aerostat and burning straw, in an attempt – failed – to create smokescreen. Without success in defense, the Paraguayan command tried to harm operations in other ways,

> Driving intense fire over the squares holding the support ropes of the balloon. However, this intent was not successful and, on the contrary, this procedure came to establish the conviction that, by his constancy, by his dedication in the performance of duty, the Brazilian soldier never retreats from his post, no matter how risky it is. (PARANAGUÁ, 1868, p. 54).

Failing in all ways to prevent the operations of the Brazilian balloon, the Paraguayans were left with the use of propaganda (Figure 7) to reestablish the morale of their soldiers, which they did with repeated publications in newspapers distributed to the troops, trying to diminish the importance of the aerostat.

Figure 7 - Paraguayan cartoon ridiculing Brazilian observations.



Source: (EL CENTINELA, 1867).

The problem of air reconnaissance for Paraguay, in practice, was solved with the difficulties of operating the aircraft. The Army Journal of 1868 narrated the last action of the balloon on September 25, stating that the fog and then the wind, as well as the loss of hydrogen caused by the permeability of the aerobic tissue, prevented its elevation to great height.

> These setbacks have shown little advantage, which could be expected from this kind of observatory, indeed so expensive and, therefore, it gave Your Excellency [Caxias] the order to return the balloon to the Passo da Patria the next day, demonstrating that he would not count from that day on, with this aid for operations. (DIÁRIO ..., 1867, p. 47).

The aircraft was sent back to Rio de Janeiro in December 1867, so operations were again guided by traditional reconnaissance means.

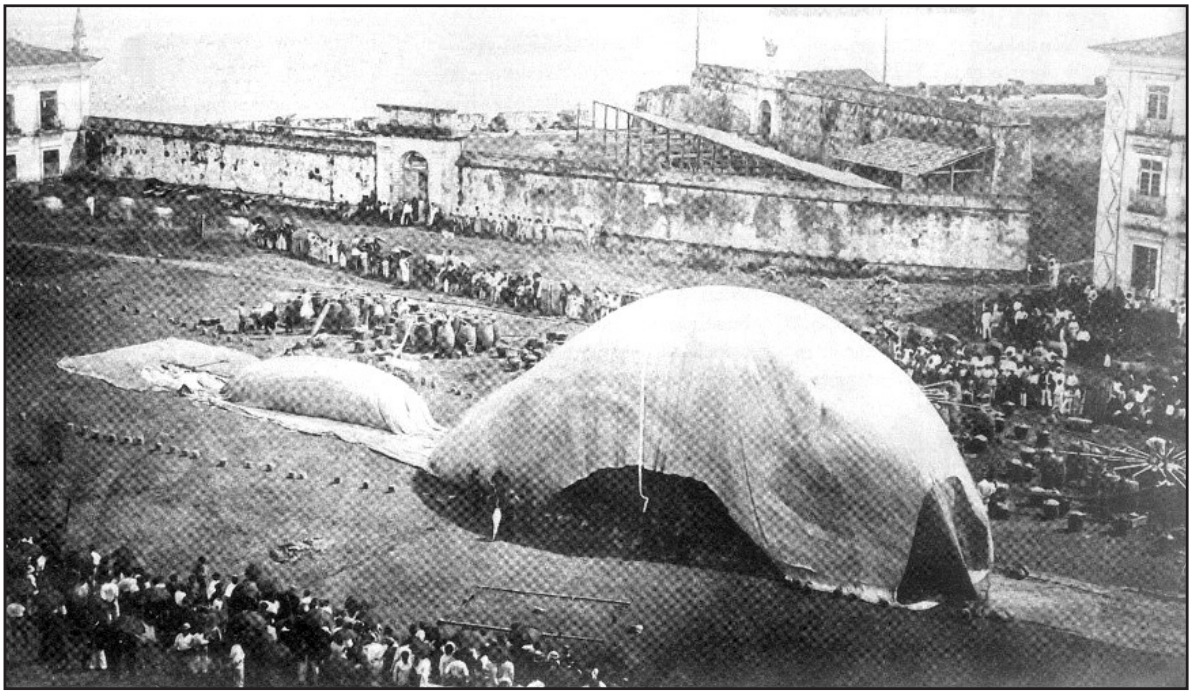
4 AN INTERREGNUM

After the Paraguayan War, the Brazilian Army abandoned the use of balloons for a long period. One of the lessons learned in the conflict was the issue of mobility, because the heavy artillery material could not keep up with the offensive operations when they were resumed in Paraguay. Certainly, the apparatus needed to produce hydrogen, weighing several tons, was not very suitable for Brazil, a country with few wagonable roads, so one understands the reluctance to use this type of equipment. Even so, the study of the Aerostation became part of the curriculum of the Military Academy since 1870 (MILITARY SCHOOL, 1871), consisting of the subjects taught until the advent of the Republic.

The Army followed the experiments with devices lighter than air, such as that performed by Júlio César Ribeiro de Sousa, in Rio de Janeiro, on March 29, 1882, in the presence of the Emperor. In his second attempt with the aerostat *Santa Maria de Belém* (Figure 8), made on July 12, 1884, in the capital of Pará, in front of the War Arsenal of the province, Júlio Caesar had hi device damaged and failed in the attempt .

Later, the army examined proposals of aerostats almost continuously in the early years of the twentieth century, certainly motivated by the success of Santos Dumont in his activities in France.

Figure 8 - Júlio César Ribeiro de Sousa's airship balloon.



Source: (AUTHOR'S COLLECTION).

The Brazilian military interest had reason to be accentuated, as several countries had founded bodies of observers with balloons. During the siege of Paris (1870 - 1871), the French launched 66 balloons from the capital, carrying 102 passengers and mail – the aerostats carried no less than 2.5million letters. The French Prime Minister himself, Léon Gambetta, escaped the city in a balloon (EGE, 1973). In 1877 France created the *Établissement Central d'Aéronautique Militaire*(Central Establishment of Military Aeronautics)and the French were soon copied. The British began training their military in the use of balloons in 1880 and used aerostats in the campaigns in Africa in 1885. In the Boers War (1899-1902), Germany established its *Ballontruppe* (Balloon Unit) in 1884, followed by other powers; the Italians employed balloons, airships and airplanes in the invasion of Libya in 1911 (RICHTER, 2013). Santos Dumont himself offered his airships to the French army in case of war (JORNAL DO BRASIL, 1903).

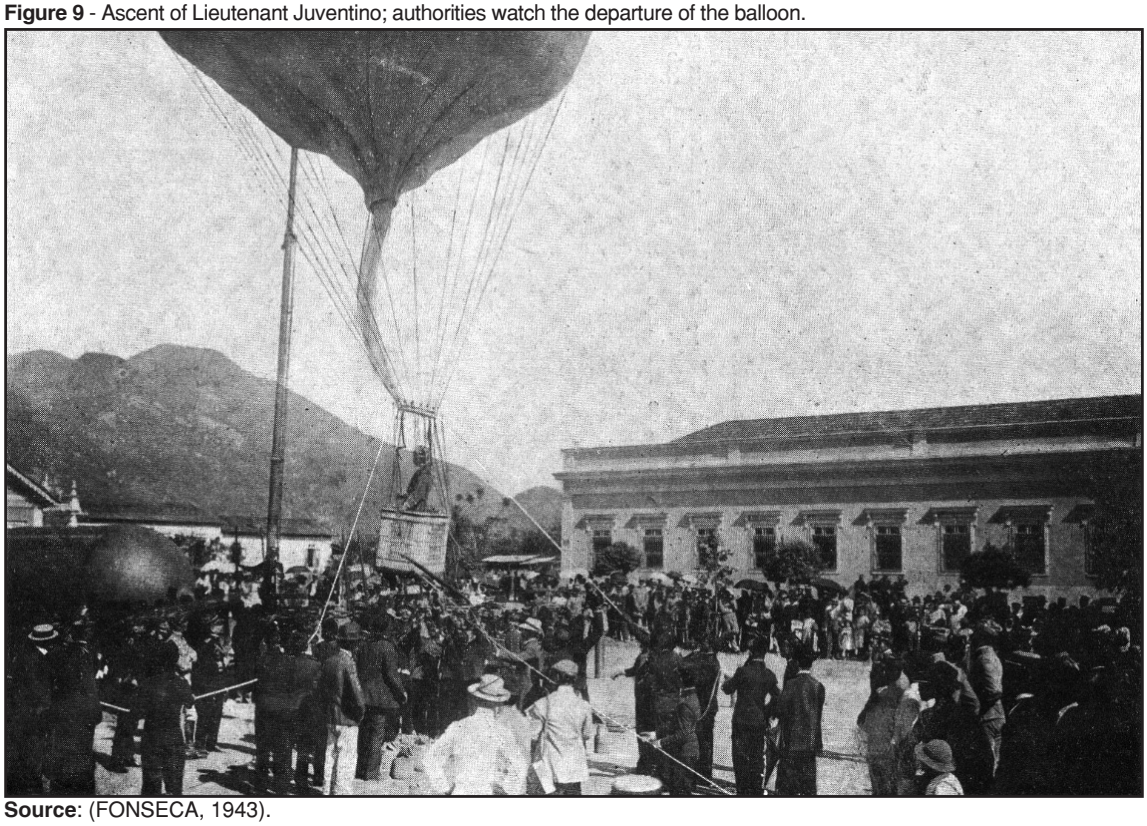
5 THE RESUMPTION OF MILITARY AEROSTATION IN BRAZIL

Considering the interest on the subject, in 1907, the First Lieutenant of Cavalry, Juventino Fernandes da Fonseca, was sent to Paris with the objective of buying two aerostation parks, each consisting of two *avant-garde balloons*, of 250 m^3 each (TERMO..., 1910). The purpose was to verify the feasibility of adoption of air observation material by the Army. The acquired aerostats were from the French military model, spherical, a type that generated stability problems when the winds were above 30 km/h.

Juventino made two ascents in France (Figure 9) and a third in Belgium flying the balloon, which is why he was greeted with a "Hurray to Brazil" by King Leopold of Belgium (FONSECA, 1943, p. 80). Returning to Brazil, he spent some time building a hangar and assembling the park equipment next to the School of Artillery and Engineering, in Realengo.

On May 20, 1908, Lieutenant Juventino made an ascent in front of the Military Academy in the presence of the Minister of War, General Hermes da Fonseca. Lieutenant Kirk was also due to go up, but did not take part in the flight, reportedly at the request of Juventino, who was afraid that there would be a problem with the balloon. And a disaster actually occurred: the artifact came out of the mooring cable, rising uncontrollably; when Juventino activated the gas escape valve, it braked in the open position, causing abrupt hydrogen leakage, with the consequent fall of the device and death of the pilot (MEMORIAL..., 1908).

Figure 9 - Ascent of Lieutenant Juventino; authorities watch the departure of the balloon.



Source: (FONSECA, 1943).

The setback led the army to temporarily stop attempting to assemble aerial observation corps. All the material purchased by Juventino was abandoned in a warehouse, having suffered much damage, which did not allow its reuse when the Army tried to restore the aerostation service (TERMO..., 1910).

Even with mishaps, there were still other attempts to create an observation system with devices lighter than air. In the same year of the misfortune with the lieutenant, General Hermes da Fonseca, Minister of War, visiting Europe, made a flight in a German airship *Parseval*, in which other officers also flew the following year. (FONSECA, 1943).

In 1910, the Army bought another balloon and even printed 500 copies of the *Instructions for Balloon Pilots* manual the following year, a text that was never distributed (BARRETO, 1911). The device purchased in Germany was *of the Drachen* type, cylindrical and more stable than the old spherical balloons, and could operate with winds of up to 50 km/h. Despite this acquisition, no information was found regarding the effective use of this observation balloon.

Still, the Field Artillery Firing Regulation of 1914 already contained instructions for firing against aerostats, airships and airplanes. In the same year, the Army employed planes for observation missions with the aforementioned *Lieutenant Kirk*, who also made an ascent in Brazil in a civilian balloon. This soldier died in 1915, flying a plane in operations in the Contestado.

Abroad, World War I had promoted a great use of observation balloons, by all countries: in October, 1918, the German army had 56 *LuftshifferAbteilungsstäbe* (balloon detachments), the English had 37 sections of balloons and the French and Belgians had 100 more. The Americans had 6 organized balloon companies, plus 70 in training in the United States (RICHTER, 2013).

In turn, aerostats, although very efficient in the reconnaissance function, had been shown to be vulnerable to artillery fire and, mainly, to the action of fighter aircraft. The Germans lost 241 balloons during the war and, in fact, the creation of the aforementioned observation mast was a way to reduce the risks to observers.

6 FINAL CONSIDERATIONS

Brazil could not follow the line of use of observation balloons, because the moratorium of 1914 and then the beginning of hostilities in Europe prevented purchases of war material. Still, Decree 12.008/1916 provided that in Engineering there would be an Aeronautics Park, with soldiers trained in activities related to aerostats. In 1919, Decree 13,651 created an Aerostation Company, which was to wear a specific badge, a silver metal spherical balloon.

In practice, the prediction of a unit did not result in anything, as it was not organized and the army concentrated its efforts on military aviation, which prioritized the planes. In 1933, a new attempt was made to leverage the aerostation, with the creation of two battalions and three Aerostation and Observation Companies (MONTEIRO, 1939), but the units again were not formed.

During World War II, both Germans and Soviets still employed observation balloons, but other countries preferred to use airplanes exclusively. One last attempt to use aerostats in Brazil occurred in the conflict in which the United States parked airship squadrons in the country to act against submarines. The Brazilian Air Force was supposed to receive a squadron of these devices, but the end of the war made this proposal unnecessary.

This is how the military aerostation activity in Brazil was ended. Finally, we highlight two points: The first, less relevant, is the fact that the Army attaches great importance to Lieutenant Kirk, as the first aviator in the country, which is correct. However, it is not the complete story; the first aeronauts of the Army were those officers who climbed Allen's balloon in Paraguay, Captain Amaral and Lieutenant Cursino, without forgetting Lieutenant Juventino, the first pilot to give his life in the service of Brazilian aeronautics. The second issue, which still affects Brazil today, is that with the introduction of a new technology, where there are always high chances of complications, because only experience is able to reduce problems. This is what happened to Allen'sballoon, the modern weapons of the beginning of the Paraguayan War, abandoned by malfunctions, and the aerostats of the early days of the Republic.

Unfortunately, the successive failures of attempts to introduce the new aeronautical technology have led to its complete abandonment. In principle, it would not be a serious setback, since the progress of the observation balloons did not, in practice, represent a long-term success; however, the withdrawal does not allow us to know whether perseverance at that time would promote good results later. What can be said, however, is that the creation of an aeronautical mentality in Brazil took a long time to bear fruit, and it can be said that this occurred with the creation of the Military Aviation School 100 years ago. This could have happened long before, perhaps if the country persevered on the initial path. A lesson that should still be present in Brazil, when thinking about some technologies, such as space.

REFERENCES

ARSENAL de Guerra. Relação das contas das despesas feitas com o balão aerósta-to. Secretaria do Arsenal de Guerra, 7 de dezembro de 1866. Mss. Arquivo Nacional.

BARRETO, E. D. **Relatório do Ministério da Guerra**. Rio de Janeiro: Imprensa Militar, 1911.

BRASIL. Exército Brasileiro. Biblioteca do Exército. **Dicionário militar brasileiro**. Rio de Janeiro: Bibliex, 2005.

BRADY, M. **Federal observation balloon Intrepid being inflated**. Battle of Fair Oaks, Va., May 1862. National Archives.

DIÁRIO do Exército em operações sob o comando do Marquês de Caxias. In: PA-RANAGUÁ, J. L.C. **Relatório do Ministério da Guerra**. Rio de Janeiro: Tipografia Nacional, 1868.

DIÁRIO DO RIO DE JANEIRO, ano 35, n. 34, 3 de fevereiro de 1856.

EGE, L. **Balloons and Airships**. London: Blandford, 1973.

EL CENTINELA, ano 1, n. 16, 8 de agosto de 1867.

ESCOLA MILITAR. Programa das Lições das diferentes cadeiras e aulas desta Escola em 1870. Aprovado por aviso do Ministério da Guerra de 7 de maio de 1870. In: VISCONDE DO RIO BRANCO. **Relatório do Ministério da Guerra**. Rio de Janeiro: Laemmert, 1871, p. 8.

FONSECA, M. H.; ESCOBAR, I. **Primórdios da organização da Defesa Nacional**. Rio de Janeiro: Glória Pinho & Manes, 1943.

FRANKLIN, B. **Carta de Benjamin Franklin para o Dr. Ingenhauss, médico de sua majestade, o imperador da Áustria, 16 de janeiro de 1784**. Disponível em: https://tinyurl.com/y6xurn7k. Acesso em: mar. 2019.

HAGERMAN, E. **The American Civil War and the Origins of Modern Warfare**: ideas, organization, and field command. Bloomington, Indiana University Press, 1995.

HAYDON, F. S. **Military Ballooning during the Early Civil War**. Baltimore: John Hopkins, 2000.

HELMAN, Isidore-Stanislas. **La quatorzieme expérience aerostatique de M. Blanchard accompagné du Chevalier Lepinard faite à Lille en Flandre**. 26 out 1785. Dedicado aos *Messieurs* magistrados da cidade de Lille, Flandres. Pintado por L. Watteau, professor da Academia de Lille. Gravado por Helman, da mesma Academia.

JORNAL DO BRASIL, ano 13, n. 304, 31 de outubro de 1903, p. 1.

JORNAL DO COMMERCIO, ano 37, n. 200, 21 de julho de 1862.

JORNAL DO COMMERCIO, ano 40, n. 322, 19 de novembro de 1864.

JORNAL DO COMMERCIO, ano 46, n. 13, 13 de janeiro de 1867.

KIM, M. G. **The imagined empire balloon**: Enlightenments in Revolutionary Europe. Pittsburgh: University of Pittsburgh, 2016.

LAVENÈRE-WANDERLEY, N. F. **Os Balões de Observação na Guerra do Paraguai**. Rio de Janeiro: Instituto Cultural da Aeronáutica, 2017.

LYNN, M. R. **The sublime invention**: ballooning in Europe, 1783–1820. London: Pickering & Chatto, 2010.

MELLO, A. M. **Ofício da Repartição do Quartel Mestre General, 3ª Seção, ao diretor do Arsenal de Guerra**. Rio de Janeiro, 13 de abril de 1867a. Mss. Arquivo Nacional.

MELLO, A. M. **Ofício da Repartição do Quartel Mestre General, 3ª Seção, ao diretor do Arsenal de Guerra**. Rio de Janeiro, 22 de abril de 1867b. Mss. Arquivo Nacional.

MELLO, A. M. **Ofício da Repartição do Quartel Mestre General, 3ª Seção, ao diretor do Arsenal de Guerra**. Rio de Janeiro, 24 de abril de 1867c. Mss. Arquivo Nacional.

MEMORIAL para a construção de um monumento em memória do Tenente Juventino Fernandes Távora, Vítima da Aviação militar no Realengo. 1908. Mss. Arquivo Nacional.

MONTEIRO, J. R. **O Exército Brasileiro**. Rio de Janeiro: Biblioteca Militar, 1939.

NAFZIGER, G. **Imperial bayonets**: tactics of the Napoleonic battery, battalion and brigade as found in contemporary regulations. Solihull: Helion, 2017.

OLMSTEAD, D. Observation Masts and Ladders. **The Field Artillery Journal**. January-March, 1915.

PARANAGUÁ, J. L. C. **Relatório do Ministério da Guerra**. Rio de Janeiro: Tipografia Nacional, 1868.

RICHTER, O. **Feldluftshchiffer**: the German Ballon Corps and Aerial Reconnaissance. Erlagen: Tankograd, 2013.

TERMO de Exame do Parque Aerostático a cargo da Escola de Artilharia e Engenharia. 27 de agosto de 1910. Mss. Arquivo Nacional.

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