The Austro-Hungarian hangars in Mostar - Part II

Gottfried Holzschuh
Art, construction and aviation historian, archaeologist, Vienna, Ph.D.
Curator (ret.) of the Esterházy Collections, Eisenstadt
office@flightdata.at

Abstract: The first part of the survey covers the history of the Austro-Hungarian *"Air Base"*, *"Aviation Park no. 4"* and *"Reserve Squadron 11"*, which were stationed in Mostar between 1913 and 1918. The airfield of Mostar-Rodoč, evaluated as early as in 1912, was one of the oldest in the Austro-Hungarian Monarchy. The Imperial and Royal Army Air Service used it for basic pilot training in World War I.

The second part is an expertise for the salvage, conservation and restoration of the four still existing Austro-Hungarian hangars at the former Mostar-Rodoč airfield in view of protection of historical monuments. Erected in 1917/18, these hangars are the oldest witnesses of aviation in Bosnia and Hercegovina. Because of their genuine and very efficient construction, they should be preserved as unique examples of technical and engineering architecture. One hangar of exactly the same type, restored in 2013 in Krakow, is now part of Poland's cultural heritage. Structural calculations have shown that these Austro-Hungarian hangars comply with modern EU building regulations.

All used documents and plans from the Austrian State Archives/War Archives (ÖStA/KA) in Vienna are still unpublished. The paper is therefore the first scientific analysis of Austro-Hungarian aviation and its architecture in Bosnia and Hercegovina.

Austrougarski zrakoplovni hangari u Mostaru - II. dio

Sažetak: Prvi dio studije obuhvaća povijest k.u.k. *„Zrakoplovne baze“*, *„Avijatičarskog parka br. 4“* i *„Kompanije za rezervni sastav letača 11“*, koji su između 1913. i 1918. godine bili stacionirani u Mostaru. Uzletište Mostar-Rodoč, čija je svrha ispitana već 1912., bilo je jedno od najstarijih u Monarhiji. K.u.k. avijatičarske trupe su ga koristile tijekom Prvog svjetskog rata za osnovno obrazovanje svojih pilota.

Drugi dio donosi ekspertizu spašavanja, održavanja i obnove četiri još postojeća k.u.k. hangara na nekadašnjem uzletištu Mostar-Rodoč s gledišta održavanja spomenika. Hangari izgrađeni 1917./18. predstavljaju najstarije svjedoke zrakoplovstva u Bosni i Hercegovini. Zbog svoje jedinstvene i vrlo učinkovite vrste konstrukcije trebali su se očuvati kao neponovljivi primjeri tehničko-inženjerske arhitekture. Jedan hangar potpuno iste vrste, obnovljen 2013. u Krakovu spada danas u kulturnu baštinu Poljske. Statički proračuni pokazali su da ovi k.u.k. hangari odgovaraju suvremenim građevinskim propisima EU-e.

Sav korišteni izvorni i planski materijal iz Austrijskog državnog/ratnog arhiva (ÖStA/KA) u Beču nije do danas objavljen – time rad predstavlja prvu znanstvenu analizu/raspravu o k.u.k. zrakoplovstvu i njegovoj arhitekturi u Bosni i Hercegovini.


AKTIEN-GESELLSCHAFT
R. PH. WAAGNER-L. & J. BIRÓ & A. KURZ
BRÜCKENBAU-ANSTALTEN
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UND
KESSELSCHMIEDE
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Telegramm-Adresse: WEBEKA WIEN.
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WIEN, 11. Mai 19 17.
V. Margarethenstr. 70.
An die
k. u. k. Bauleitung der Luftfahrtruppen,
Wien.

Figure 11 Letterhead of the hangar supplier Waagner, Biró & Kurz (ÖStA/KA).

4. HANGARS

At the beginning of 1916, the army air service ordered 50 pieces of iron hangars *in sizes I* (no. 3223 - 3242), *II* (no. 3311 - 3330) and *III* (no. 3411 - 3420) from the Vienna bridge construction company Waagner, Büro & Kurz AG to equip their airfields (Figure 11). This type of hangar was already proven; the same number were even erected at the Aspern Aviation Authority, at the aviation depots in Aspern and Fischamend, the equipment supplier Strasshof as well as some reserve squadrons. It was a riveted truss frame structure made of iron, the individual elements connected by screws to make the parts transportable. The flat mansard roof with truss beams was equipped on both sides with skylights at full length. Admittedly, the internal supporting structure reduced the usable area for aircraft, but the space between the girders could be used for workshops and depots. The front of the hangar could be opened almost completely by means of sliding door panels that moved inwards on rails (Figure 12).

In October 2018, the still existing, internationally active steel construction company Waagner-Biro Corp. went bankrupt. Founded as a locksmith plant in Vienna in 1854, the company was able to refer to a long tradition of prestigious and award-winning large buildings as reference. These include the stage technique of the Vienna State Opera (1905), the Vienna Bridges on the Danube, the roof structure of St. Stephen's Cathedral in Vienna destroyed in 1945 (1948), the Sydney Opera House (1960), the Europa-Bridge near Innsbruck (1962), the Reichstag dome (1999) and Sony Center (2000) in Berlin, the roof above the courtyard of the British Museum (2000), the Red Bull Hangar-7 in Salzburg (2003) and finally the dome of the Louvre Abu Dhabi (2017). Liability without proper reinsurance within the projects of the Louvre Abu Dhabi and the Lakhta Center in St. Petersburg led to the financial failure of the company.

For its hangars, Waagner delivered only the iron framework to the Army Air Service. The necessary foundation works, carpentry and roofing works had to be advertised and assigned to local construction companies at each building site. The roof and walls were given wood panelling that was sealed with bituminous roofing felt on its outside. The wooden doors on lattice iron frames were impregnated instead. Additional windows, ventilation accessories, built-in storage spaces, heating, eaves or lightning rods were not part of the original catalogue of demands of the Austro-Hungarian Technical Committee but were a possible option. The complexity of construction and overall costs were considerably higher than for Lord wooden hangars of the same size, but resistance to wind pressure and snow load was greater.

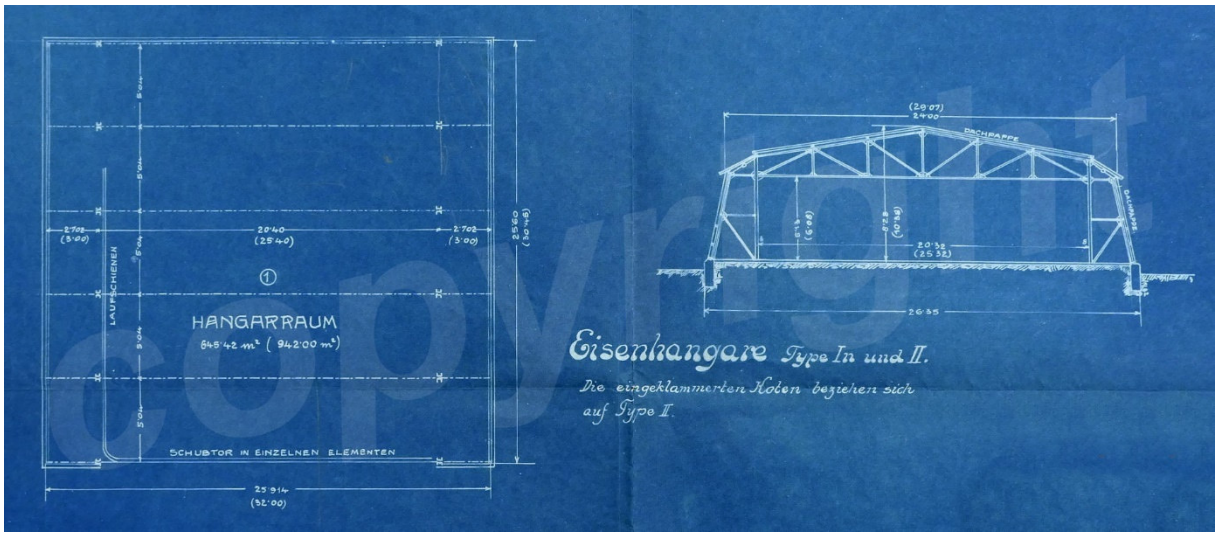

Figure 12 Waagner hangar, plan view and section with measurement data of types *In* and *II* (ÖStA/KA).

Instead of mobile hangar tents and individual aircraft sheds, which were used by the squadrons in the field since the beginning of the war to accommodate aircraft, which were very sensitive to moisture, the reserve units used standardized prefabricated types of hangars, for which the focus was on dismantling and possibility of railway transport. Lord & Co from Budapest became the first manufacturer and supplier of wooden hangars. In order to prevent monopoly of supply by the Hungarian company Lord, the Viennese companies Johann Tröster and Wenzl Hartl, which mainly produced field hangars for the squadrons, were also authorized for orders.

In October 1916, the Waagner iron hangars were still not delivered, because the Austrian "Berg- und Hüttenwerke-Gesellschaft" could not complete the ordered rolled bars due to the lack of semi-finished products. The Army Air Service Construction Department was forced to order additional 30 wooden hangars in three sizes from Lord & Co in Budapest for 926,200 kronen.

In Mostar two existing brick built aircraft depots were used to accommodate the training aircraft. The hangar report of the Army Air Service Construction Department from 23 September 1916 do not specify any iron hangars for Mostar, but only as replacement a future wooden Lord hangars sized 25 x 25 m for five assembled aircraft. On 4 April 1917, the *Reserve Squadron no. 11* requested a Lord Company assembler to be sent to Mostar to supervise the installation of wooden hangar *no. 1206*, since it would not be possible to take over the guarantee for the stability of the structure. Parts of the hangar that were missing on delivery such as screws, nuts, flat and round iron were to be purchased on the spot and the bill for them sent directly to the Lord Company in Budapest. Furthermore, assemblers were supposed to be instructed to eliminate the defects with unsealed roof coverings. On 9 May 1917, the final

completion of the Lord hangar was reported to the Imperial and Royal Army Air Service Construction Department in Vienna.

On 6 July, in the presence of the airfield commander, Captain Erich Kahlen, a commission noted that the roof covering was still leaking after a downpour. It was determined that the simple covering with bituminous roofing felt was not adequate for the local conditions and that the Lord hangar as well as the iron hangar under construction should be double covered with roofing felt.

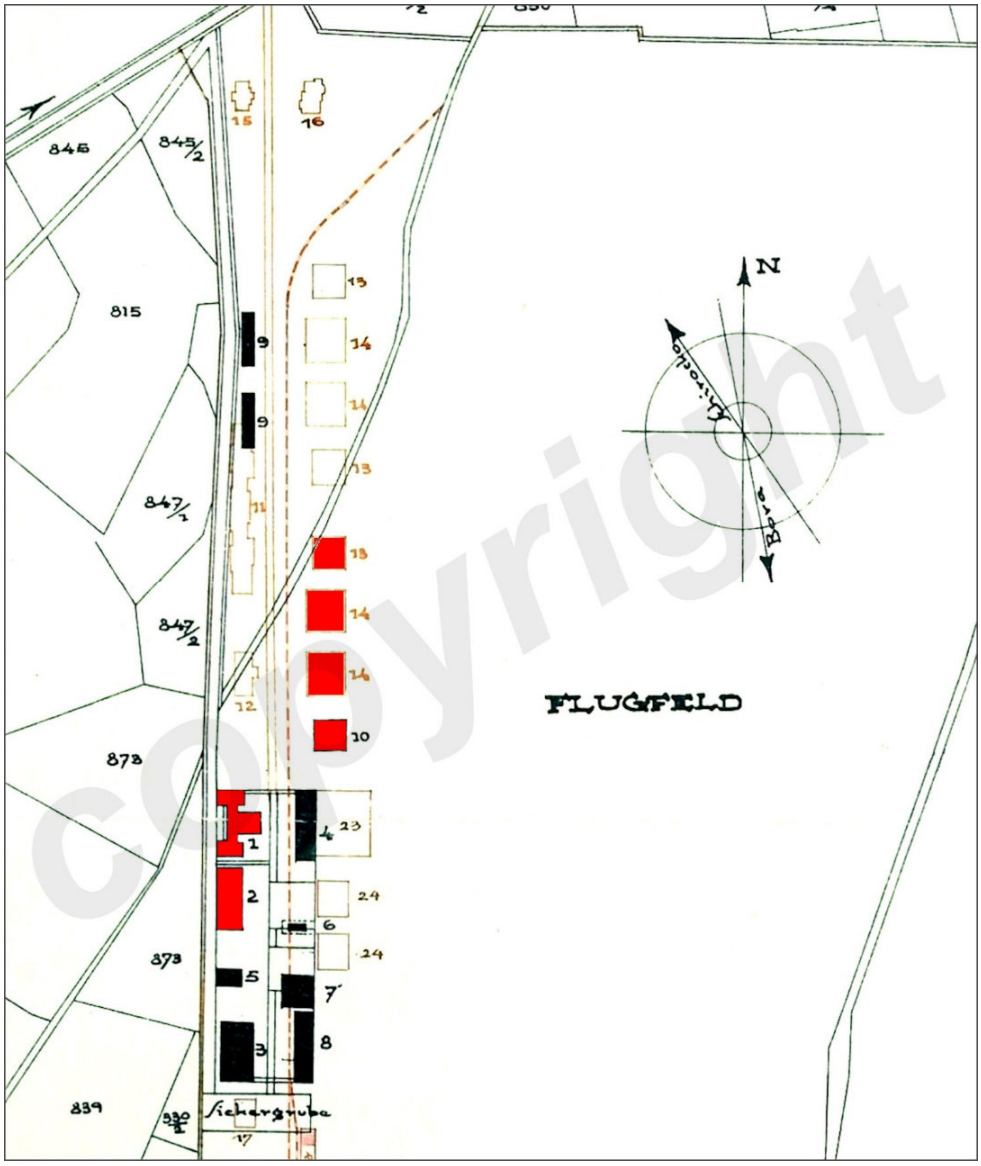

Figure 13 The Rodoč airfield with projected expansion in 1917 (section). Preserved Austro-Hungarian buildings are marked in red. In the wind rose, the predominant wind directions of *"Bora"* and *"Sirocco"* (ÖStA/KA).

Legend:

1. Residential building, 2. Workshop, 3. Material warehouse, 4/8. Aircraft depots, 5/6. Gasoline storage, 7. *Lord-hangar*, 9. Barracks for accommodation of war prisoners, 10. *Iron hanger type In*, 11. Residential barrack, 12. Expansion storage, 13. *Iron hanger type In*, 14. *Iron hangar type II*, 15. Barrack for guards and prison, 16. Accommodation of officers, 23. Workshop, 24. Test flight hangar.

A repeated inspection of 25 July found massive wind damage that led to significant deformation of the structure. Since dangerous stormy boras would occur in autumn or spring, it could not be ruled out that the hangar would collapse due to wind pressure. Therefore, the Lord & Co company was requested to strengthen the hangar as soon as possible. A new downpour of 17 August, which caused damage to the aircraft, lowered the first roof girder as much that the slide doors could only be opened by force or not at all. On 6 September, the fitter from the Lord company, who arrived again, declared that the load-bearing structure required a thorough renovation. Flek wanted to carry out the necessary roofing work at its own responsibility, aware of the risk.

When a stormy bora on September 14 tore out two door elements and damaged the front and rear wall as well, the officers of the Imperial and Royal Army Air Service Construction Department in Vienna obviously lost their patience. An instruction came on 18 September 1917 regarding the Lord hangar no. 1206 that the same was to be removed and another iron hangar would be delivered instead. In March 1918, the wooden Lord hangar was still standing, but it was to be dismantled and placed in *Aviation Park 7* in Szamosfalva near Koloszvár in Hungary. The sensitivity to wind pressure of the Lord hangars was no surprise. On 6 January 1917, bora destroyed the Lord hangar placed in Wippach (Vipava, Slovenia) completely, so the installation of two other already delivered hangars of the same type was given up.

The Austro-Hungarian hangars of Mostar-Rodoč							
Wooden Hangar **„Patent Strifler", Lord & Co, Budapest**							
model	*evidence nr.*	*door width*	*spatial depth*	*door height*	*m²*	*space**	*remarks*
II	1206	25 m	25 m		625	5 (9)	not preserved
Metal Hangars **Waagner, Biró & Kurz AG, Stadlau (Vienna)**							
In	3229, 3239	20 m	25 m	5 m	500	4 (8)	2 units
II	3315, 3316	25 m	30 m	6 m	750	5 (12)	2 units

* mounted and in brackets unmounted aircraft.

All iron material for the first iron hangar no. 3229 - except skylights, sheet metal and glass materials - was dispatched by the Waagner, Biró & Kurz company between 19 December 1916 and 17 February 1917, split in five parts on one railway carriage each from Vienna. On 14 April 1917, the construction supervisor in Mostar requested complete plans of the *type I* Waagner iron hangar, because the documents submitted for carpentry were completely insufficient. On 15 May the advised Waagner company assembler did not arrive yet and on 10 June some iron parts were still missing. However, the iron structure was to be largely completed by the end of May, and on 23 July, the assembly of the glass skylights could begin.

In September, the Mostar Construction Administration asked how the second *In type* hangar should be placed. Like at most other sites with iron hangars from Waagner, they should be placed in Rodoč in groups of four, with two large *type II* hangars in the middle, and a small *type In* on each side (see Figure 13). When the iron material, sent off on 24 September, arrived at Mostar railway station in the beginning of October, the local Construction Administration called by telegraph for its own truck to be sent, because the existing *Flek's* truck was not strong enough. In early November, the Franz Scheidig company from Sarajevo, which was entrusted with the construction, had not yet completed the foundations for the second hangar 3239. The delivery of two larger *type II* hangars was also announced for October by the Army Air Service Construction Department in Vienna, and the Scheidig company was again designated to execute the work.

The further expansion plan anticipated two reserve squadrons with eight iron hangars to be set up at larger airfields due to the acute need for pilots. That is why in March 1918 the basic training in Mostar was extended to training of the advanced category II, and old training aircraft *Oeffag C.I series 51* with 160 HP Daimler engine were delivered for this purpose. On 20 January the Construction Department urged the Command of the Army Air Service to speed up construction of hangars designated for Mostar, since "this airfield, although it is one of the oldest ones, is the most underdeveloped in terms of hangar space." Out of a total of eight planned iron hangars, only one was set up, and three others were under construction (Figure 13).

On 31 October 1918, during the general withdrawal, the Chief of Aviation ordered the Command of the Army Air Reserve Troops, to move reserve squadron *Flek 11* from Mostar as soon as possible to Arad (then Hungary, today Romania) and *Flek 14* from Sarajevo-Rajlovac to Újvidék (today Novi Sad, Serbia). Four Air Reserve Battalions were under the command of the Army Air Reserve Troops at that time. *Flek 11* in Mostar belonged with *Flek 1* in Újvidék, *Flek 14* in Rajlovac and Aviation Park Újvidék to the 4th Air Reserve Battalion based in Újvidék. The planned development of the Army Air Reserve Troops with two *Fleks* per site was not realized. Four iron hangars remained in Rodoč, which survived the end of the war and the later expansion of the airfield.

Mostar Airfield was taken over by the military forces from the newly formed "State of Slovenes, Croats and Serbs", later the "South Slavic Kingdom". The pilot school with the former Austro-Hungarian personnel and aircraft type *Hansa-Brandenburg B.I* and *C.I* as well as with several *Oeffag's D.III* was retained and flight operations resumed. Nevertheless, the airfield name was changed from Rodoč to Jasenica near Mostar.

The exact calculation of costs of state buildings erected on the airfields of the former Monarchy from February 1919 shows the total amount of 3,938,950 kronen for the sites of Sarajevo and Mostar in Bosnia and Herzegovina. For the Mostar-Rodoč airfield, 1,658,798 kronen were spent for permanent buildings, 335,832 kronen for hangars and 24,775 kronen for temporary structures (barracks). Contrary to this total amount of 2,019,405 kronen, there was a relatively small claim of the Mostar department for military construction of 25,547 kronen and 75 hellers.

5. SALVATION AND RESTORATION

At first impression, the present condition of the four hangars is poor. There is damage from the Bosnian and Herzegovinian war primarily to the wooden panelling of roofs, walls and doors. But the iron truss structure appears to be still intact to a large extent (Figures 1, 14, 16). It was only supplemented by masonry walls on their backside (Figure 18). The typical skylights were covered at some point with wooden panels, and the whole buildings with corrugated sheets of cement fiber. Reconstruction of the wooden parts is easily possible, as from the identical Waagner hangars presently standing at the old airport in Innsbruck, Austria, detailed estimates with data on the dimensions of roof purlins and rafters, squared timber and panelling have been preserved.

The model for proper restoration is beyond doubt the *type In* Waagner hangar in Krakow. It is located on a site of barracks of the former Krakow-Rakowice airfield, the original base of *Flek 10* in the northeast of the city. Its exceptional value as the last preserved on-site Austro-Hungarian hangar (Figures 15, 17) was recognized as part of a large survey of historic buildings (Figure 19) located there. According to the stamps on the iron support columns, the load-bearing structure was produced in 1916 in the Bohemian (Czech) steel plant Kladen (Kladno).

Figure 14 *Type II* Waagner hangar (no. 5) in Mostar (M. Martinović).

Figure 15 Immaculate restored *type In* specimen in Krakow. The eaves gutter with drainpipe and lightning rod are modern, but "accessories" that make sense.

The restoration was financed from the resources of the Polish Ministry of Defense and the National Fund for Historical Monuments of the City of Krakow. The main works that were performed from July to November 2013 consisted in restoring the structure to its original technical condition and protecting it from microbiological risks and harmful environmental impacts. The iron parts were cleaned of corrosion and protected with anti-rust agent.

The structural calculation of truss girders proved to be completely sufficient according to present-day construction standards in terms of wind pressure and possible snow load, taking into account the prestressed structure. The restoration of the rope tensioning system could not only re-establish prestressing, but also the overall structure. This had completely lost shape when hit by a German air force bomb on 1 September 1939. The readjustment enabled the new setting of the valuable sliding door mechanism that allows efficient opening of the hangar doors, almost without effort.

Figure 16 *Type In* hangar (no. 3) in Mostar: the iron frames and rails for the sliding door elements are intact (M. Martinović).

Figure 17 Vision for the re-establishment of the Mostar hangars. The Krakow hangar still lacks a wooden floor, so the door rails raise over the floor horizon.

Figure 18 Hangar no. 3 with shell hit. The brick-built back wall does not belong to the original hangar construction (M. Martinović).

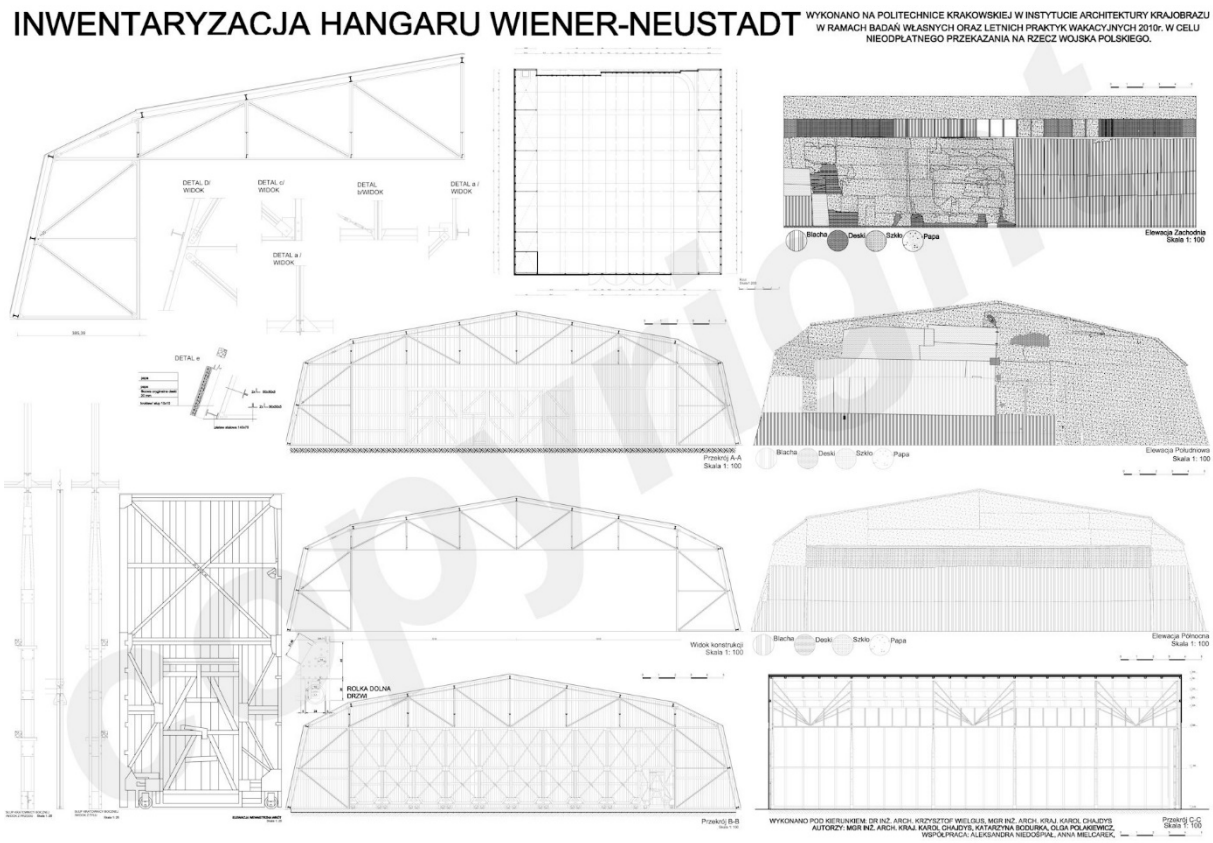

Figure 19 Construction drawing with details of the Waagner hangar structure in Krakow, the type designation *"Wiener Neustadt"* is misleading (K. Wielgus).

After impregnation, the mostly reused old wood panelling was given again its original insulation made of *"asphalt felt boards"*, of which less than 25% had to be replaced. Again, the double-lined roofing felt makes the covering on the outside.

Poland's oldest hangar could be presented to the public as part of the *European Heritage Days*. In its 'skilful' and very efficient structure, it is considered to be a unique example of historical engineering architecture and is therefore under monument protection. Unfortunately, it is still located on military grounds like before, inaccessible to the public. Exactly this circumstance has kept it from falling victim to the greed of city developers in the past.

From the viewpoint of preservation, the identically constructed Austro-Hungarian hangars in Mostar should be preserved due to their cultural and historical value as the oldest witnesses of the region's aviation. Before all, they would have to be reused in order to guarantee their continued existence. Younger undamaged hangars of the site are used by the University as places for free time and sports already. Another one serves the Mountain Rescue Service as a training ground. But it would also be possible to use them as storage depots, fair, exhibition or museum halls. Certainly, they should stay together at their place of erection, the former Imperial and Royal Airfield Rodoč, as an ensemble of buildings worthy of protection. Without adequate financial resources, possibly supported by EU subventions, neither proper restoration nor careful adaptation to a new purpose will succeed.

An alternative solution would be to move the hangars to an area of barracks that is still in use or even to the nearby Mostar-Ortiješ airport where they could be brought back to their original purpose. The new site would be justified from the viewpoint of monument preservation because these hangars were constructed as demountable and transportable buildings. The models would be both *In type* Wagner hangars at the old Innsbruck Airport which are under monument protection and were originally built for *Flek 3* in Graz-Thalerhof. After World War II they were moved to their present location and are used to house small aircraft of the local flying club.

If the armed forces would withdraw from their site in Mostar, and the Wagner hangars would be threaten with demolition, then if they would be "available" or "tradeable", it would be necessary to consider "returning" one or the other specimen for museum purposes to Austria. The Austrian Air Force Museum in Zeltweg suffers from lack of space, and the Aviaticum in Wiener Neustadt, the most important collection of gliders in Europe, only recently had to move to a very small workshop. However, a possible sponsor for such a project - the Waagner-Biro Corp. - dropped out (Figure 20).

Figure 20 Waagner-Biro built the last hangars in 2003 for Red Bull in Salzburg. The reputable steel construction company that erected the domed roof of the Louvre Abu Dhabi went bankrupt in 2018 (Flying Bulls).

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