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Aircraft armament – Polish traditions and achievements

Abstract: Military aviation does not serve solely for defending our own country's airspace; it is also used to ensure transport, evacuation, and rescue, also to perform protective tasks to the military as well as public and communications infrastructure of the country. The paper presents history of Polish aircraft armament development. It consists of the beginning of aviation in Poland and then development of Polish military aviation armament during interwar and postwar periods. Special attention is paid to recent developments of the Polish technological know-how in this area. Authors emphasize contribution of Polish research and industrial centers in aircraft armament new design development, existing armament modernization as well as maintenance efficiency improvement of armament systems. Future of aircraft armament in Polish Armed Forces implies necessity of replacement of post-Russian equipment by procurement of modern aircraft armament systems and development -implementation projects in order to achieve advance in Polish aircraft weaponry.

Keywords: Military aviation, Aircraft armament; History; Construction; Scientific works

Introduction

Aviation, as a relatively young field of human activity, has broken a peculiar record due to the pace of its development. We can be proud that in the history of human struggles, important achievements in the air, an important place also falls on Poles - celebrating this year the 100th anniversary of Polish aviation.

The interest in the use of aircraft for military purposes occurred around 1910, and the first to show them were communications and artillery officers, artillery and sappers. However, they had to overcome many difficulties in order to first form experimental and then combat units. The main obstacle was the reluctant attitude of the military authorities to aviation. The achievements of numerous aeroclubs and aeronautical societies, as well as the increasing interest of the public in aviation affairs, were of great importance in changing this attitude. Certainly, air transport could encourage the army with the dynamics of transport, short time of implementation and constitute an important element of support in the field of reconnaissance from the air and with time the logistical support of the fighting troops.



1. Opening ceremony of the "Awiata" club [1]

The main centers for the development of Polish aviation at the beginning of the last century became: Warsaw and Lviv. In 1910, the Warsaw Aviation Society was established (Figure 1), and with it the first Polish airplanes factory, in which Farman type aircraft were built. military type. It favored rapid progress and many important aviation achievements of Poles.

Unfortunately, the First World War seriously destroyed the Polish heritage of Poles, but it created human resources, which after its completion and regaining independence were the nucleus of the development of Polish military aviation.

The development of air weapons in Poland in the interwar period

After Poland regained its independence, in November 1918, the first Polish commander-in-chief was established in the form of the Air Navigation Section in the Technical Department of the Ministry of Military Affairs. The aviation industry in Poland at that time almost did not exist. Workshops inherited from the occupants could only be repaired. The revival of the domestic aviation industry took place around 1924. At that time, "Podlaska Wytwórnia Planów" in Biała Podlaska (fig. 2) and the "Samolot" factory in Poznań were launched.

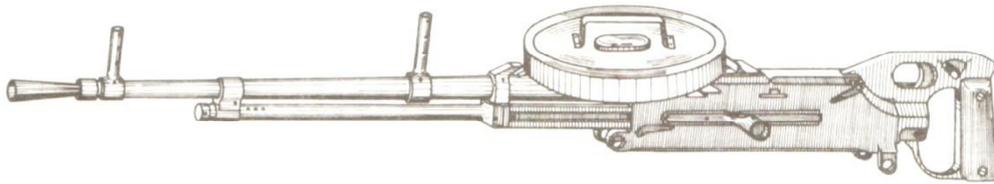


2. Aircraft plant in Biała Podlaska [2]

It should be emphasized that the Polish construction thought of this period did not lag behind more developed countries. In the 1930s, several successful versions of airplanes appeared, e.g. RWD-7, P-11 fighter, light bomber, and P-23 Karas reconnaissance plane, P-37 Łoś bomber, Lublin R-XXIII accompanying plane. It should be emphasized that in the scope of equipment, the Aviation Command strived to rely solely on native constructions and to become independent of foreign supplies. Hence, in 1927, arms production was started in its own factories, initially taking the example of foreign patterns, and then implementing their own studies. In this way, by 1936, the production of all types of air weapons and ammunition

was launched in the country. About 35 institutions, industrial plants, companies, and private factories were associated with the design, research, and production.

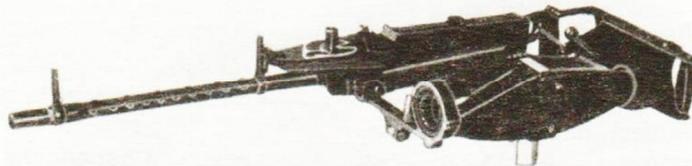
In the field of weaponry, examples of very successful constructions are Polish machine gun pilot model 33, caliber 7.9 mm and light air machine gun model 37, caliber 7.9mm, "Szczeniak" (fig. 3), which were developed by the construction office of the State Armaments Company. "Szczeniak" served as a machine gun for observers and deck shooters. The weapons were first equipped with PZL Łoś planes, followed by LWS-3 Seagull and PZL-46 Sum. The weapon was also exported. From 1930, it began to produce in the country its own mobile air defense guns for aircraft Łoś, Mewa, Karaś, Czapla. There was an electric and hydraulic drive with a follow-up control system [6].



3. Lightweight machine gun model 37, caliber 7.9mm, "Szczeniak" [6]

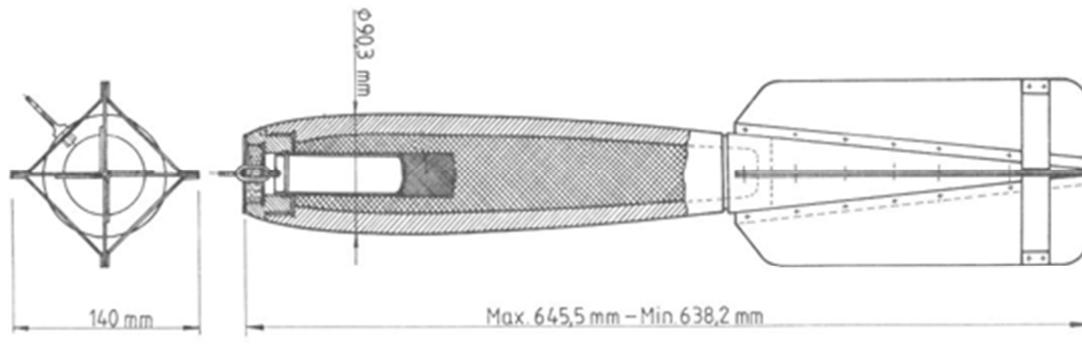
Also shooting ammunition was produced in Poland at the Ammunition Factory of the Bullet, Military Ammunition Factory in Warsaw and the Ammunition Factory in Skarżysko. Production of shooting cotton took place in Pionki. Developed in 1936, the explosive indicator projectile for machine guns exceeded the English, Belgian and Czech constructions with greater visibility. In turn, the mass-produced in Poland for the production of ammunition primers does not cause corrosion of the barrels, it was not inferior to the best foreign designs.

Due to the fact that aerial shooting was one of the most important skills of flying personnel, in 1926 the machine gun-camera produced by Polskie Zakłady Optyczne in Warsaw were used in the training. An example of this is the K-28 gun-camera (see Fig. 4) set on mobile observer stations and fixed pilots [6].

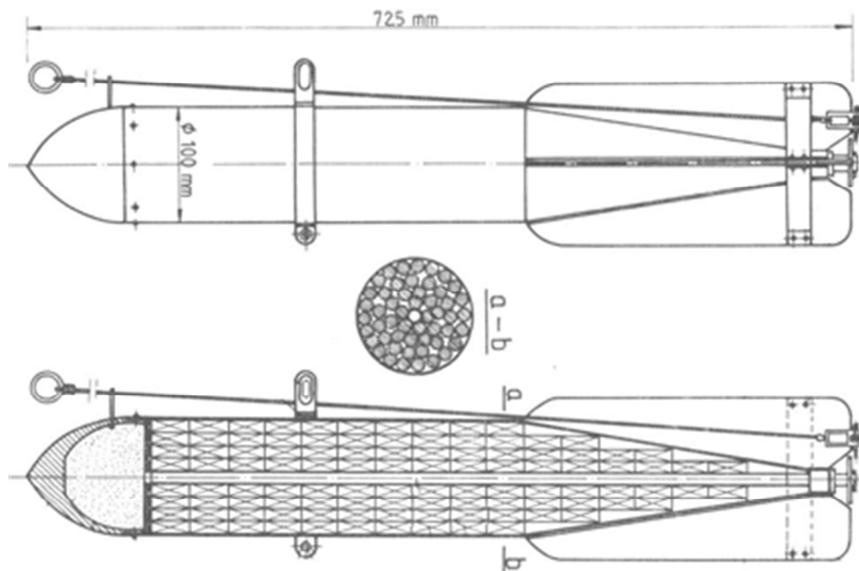


4. K-28 machine gun-camera coupled with the observer's km [6]

Among the Bombardier weapons in Poland in 1939, all types of bombs needed for aviation were in production and research, for example: a fragmentation bomb 12 kg model 27 - equipped with the Polish igniter model PG-27; Fragmentation bomb 12 kg FA model 35 and 36 (Fig. 5) - armed with 48/60 FA detonator with ignition pattern model 35 (produced at the Ammunition Factory No. 1 in Skarżysko); storm bombs 50 kg model 29 and 100kg wz31 - produced in the Starachowice Society of Zakłady Górniczo-Hutnicze, SA; incendiary bomb 12 kg model 38 (Fig. 6) - developed in the Construction Office of Zakłady "Granat", SA in Kielce; or smoke bombs 10 and 50 kg G model34 - produced at the No. 1 Ammunition Factory in Skarżysko [6].

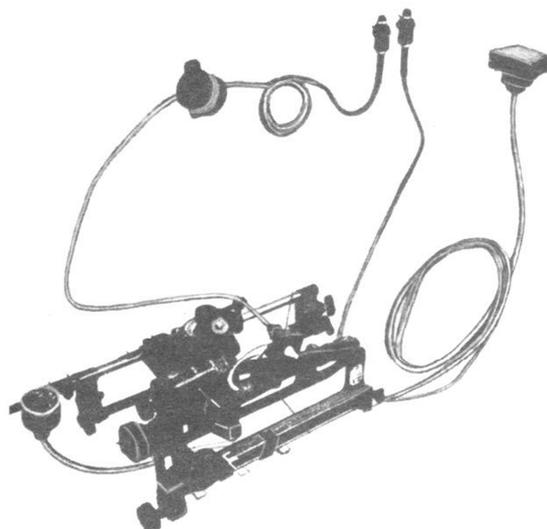


5. Fragmentation bomb 12 kg FA model 35 [6]



6. Incendiary bomb 12 kg model 38 [6]

The elements of air weapons, which were the first to be manufactured in the country based on their own studies, include bomb ejectors. The bombardier unit was connected to the ejector unit, providing bomb drop-offs individually and series with specified time intervals. In order to ensure high effectiveness of bombing, a Polish bombardier sight model was developed and produced at Optical Works in Warsaw. RH-32 (Fig. 7). It included ten parameters affecting the accuracy of the bombardment [6].



7. Bombardier sighting model RH-32 [6]

The development of air weapons in Poland after the Second World War

After the Second World War, aviation was rearmed in Poland based on Soviet equipment. Significant material resources laid in the construction of aircraft factories and modernization of their equipment meant that in the mid-fifties the aviation industry could take serial production of jet fighter jets under the Soviet license: Lim-1, (license MiG-15), Lim-2 (MiG-15 bis) followed by Lim-5 (MiG-17). Thus, a base was created allowing Polish military airforce to systematically replenish its aircraft with airplanes with better parameters. The greatest achievement of Polish aviation thought of that period was the construction under the guidance of doc. inż. Tadeusz Sołtyk, a training-jet aircraft with a jet propulsion type TS-11 "Iskra", which entered aviation equipment in 1964. It is equipped with one 23mm caliber gun, four knots of suspensions that allow carrying 100 kg of bombs each or moving containers with machine guns "Zeus-1" and launchers of unguided Mars-4 missiles, or ZR-8 trays with fragmentation bombs.

In 1976 at the Warsaw Institute of Aviation, work began on the design of the aircraft to replace the TS-11 Iskra. In 1992, the first version of the Iryda M93K aircraft was tested. The fixed weapon of the I-22 aircraft was a 23-mm double-caliber gun with a supply of 200 rounds of ammunition. Under the wings, the plane had four beams with a load capacity of 500 kg each. The air-to-air missiles (R-3S and R-60), launchers of unguided missiles eight, sixteen and thirty-five barrels (S-5 - Mars-2 (4), Mars-4 (8), UB-16) could be suspended (16) or UB-32 (32 NPR), NPR S-8 - B-8M (20 NPR), airborne bombs from 50 to 500kg, shooting tanks with GSz-23 (UPK-23-250) cannons or with a rifle. It was noteworthy that the armored reconnaissance system developed in Poland used digital technology and enabled cooperation with the ground control and diagnostic system. Experience from the Iryda program became a milestone towards the construction of integrated systems. control systems for arming consecutive Polish structures, such as the W-3PL helicopter Głuszec, which was created as a result of the modernization of the military version of the W-3WA helicopter, which is the most modern combat version of the multi-purpose Falcon cutting includes: unguided and directed rocket launchers, mine launchers, 23 mm cannon in the tank, 12,7 mm machine gun with rotating turret.

The Głuszec has integrated avionics, based on a modular mission computer that manages systems via the MIL-STD 1553B data bus. Navigation devices include: INS, GPS, TACAN, VOR / ILS, DME, digital maps integrated with multifunctional monitors. The integrated observation and sighting system increases the possibilities of detecting, tracking and

identifying targets, as well as the effectiveness of the use of on-board weapons. The Głuszc is also equipped with self-defense systems, IFF type (alien identification system), and RWR (warning against radar determination) and passive interference system.

The experience gathered in the field of integrated "Attack Avionics" systems has resulted in the development of a concept for the modernization of the PZL-130 Orlik aircraft to the TC-III version, called the "Glass Cockpit". It assumed the installation of a new avionics with a mission computer, which was supposed to operate in analogous modes and have the same designations as in Polish F-16 fighters, which would allow a smooth transition of crews to M-346 Master and F-16 jet planes, but it was not introduced for service.

Contemporary development of aircraft armament in Poland

Currently, the development of air weapons in Poland also includes aviation combat assets. And so in the field of bombardier weapons in recent years, a Polish air cluster bomb - ZK-300 (Fig. 8) was developed by the Air Force Institute of Technology (ITWL) and Zakłady Metalowe "Dezamet" Spółka Akcyjna. After the bomb dropping, 315 fragments of LBOK-1 bombs are released, with a total mass of 252 kg. The submunition field creates a rectangle with dimensions of 200x1500 m.



8. Polish aviation cluster bomb - ZK-300 (source: ITWL own materials)

Another example is the Polish airborne cluster bomb LBKas-250, with a weight of 250 kg, elaborated with small-scale bombs of domestic production resulting from cooperation: ITWL, Enterprises Prexer - Lodz and the Institute of Aviation.

Zakłady Metalowe "Dezamet" Spółka Akcyjna also has in its offer the aviation training bomb LBĆw-10 (Fig. 9), whose flight tests were carried out with the use of TS-11, Su-22 and MiG-29 aircraft as well as the Mi-14 helicopter and Mi-24.



9. Air training bomb LBĆw-10 (source: ITWL own materials)

In the area of flight fuses, PREXER developed and ITWL tested a telescopic igniter ZT-3 (Fig.10.) Designed to initiate overhead explosion of air-explosive bombs of up to 250 kg.



10. Telescopic igniter ZT-3 (source: ITWL own materials)

A very valuable development of ITWL supporting flight research is the LZR-1 air tank recording (Fig.11), which enables, among others, registration of the departing and initial flight path of the combat agent, using two fast video cameras (1000 fps). It can be suspended on any type of aircraft.

In the non-guided weapon sector, Mesko Spółka Akcyjna in cooperation with ITWL has developed a system of unguided 70 mm missile aircraft, containing a non-guiding rocket launcher WW-15, from which NLPR - 70 non-guided missiles are fired.



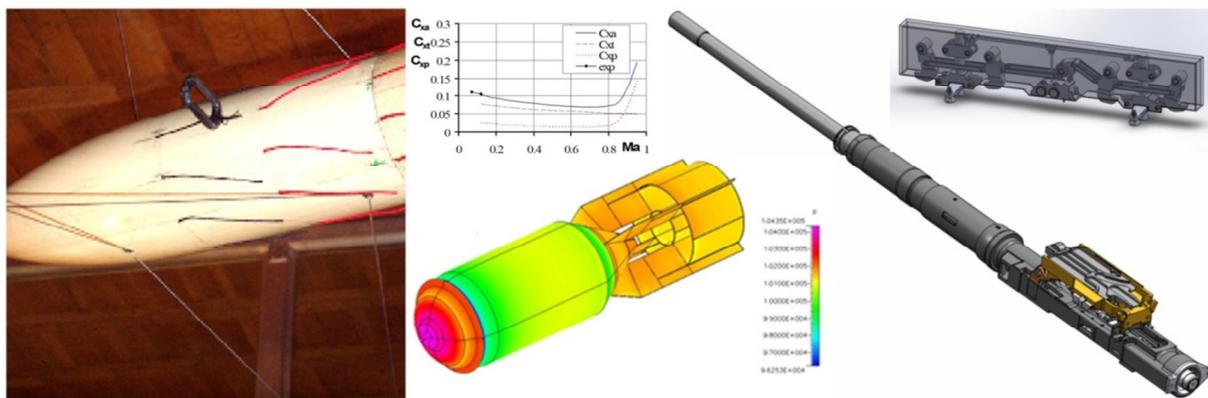
11. The aviation recording container LZR-1 (source: ITWL own materials)

An example of the achievements of the Polish industry in the field of weaponry is the air-gun magazine LZS-12,7, manufactured by Zakłady Mechaniczne Tarnów S.A. It is an integral container for suspending on typical carrier beams of airplanes and helicopters. It can be armed with a large-caliber machine gun or a 12.7 mm multi-barrel machine gun.

Air weapons are also included in aerial weapons. In this area, the ITWL achieves great achievements by developing airborne missile targets: SRCP-WR based on the RS2US projectile, RIM-R3 missile for air target based on the R3R projectile, and ICP-1 imitation air target based on a non-guided S-5 missile. These targets allow you to track and fire through artillery and rocket sets. The CP-100M-R parachute air target developed by Zakłady Chemiczne "Boryszew -ERG" is designed for training in launching air-to-air missiles equipped with radiolocation or thermal homing heads. The latest solution in this area is a jet air target with a programmable JET-2 flight path (Fig. 12) reaching a speed of over 150 m / s and a ceiling of 5000 m. It was developed as part of the NCBR project by a consortium including the Air Force Institute of Technology, MSP Marcin Szender, Warsaw Polytechnic and Military University of Technology.



12. Jet air target with programmed JET-2 flight path (source: ITWL own materials)



13. Experimental and numerical tests of aircraft armament components [4, 5]

In the research and development for aviation equipment, the Military University of Technology also actively participates, along with many national centers, by conducting experimental and numerical tests of new constructions as well as assisting in the operation and analysis of optimal and safe use of aviation equipment (Fig. 13) [4, 5].

In addition, the Academy plays a very important role in the training process of both young staff of the engineering and air service personnel, as well as organizing refresher courses and post-graduate studies for Air Force officers.

Summary

The use of modern military aviation is universal and apart from the defense of the airspace of its own country, it also serves to provide transport, evacuation, and rescue. It also performs shielding tasks of its own troops as well as the population and infrastructure of the country, including land and sea communication.

To sum up the 100th anniversary of the Polish aircraft armaments we can say that the Poles were not passive witnesses of its development, taking an active part in the research, construction, and production of all types of aviation weapons.

Currently, the development of aviation equipment in Poland is provided by the national arms industry supported in the field of research by, among others, the Air Force Institute of Technology and the Institute of Aeronautical Engineering of the Faculty of Mechatronics and Aviation of the Military University of Technology, through the development of new structures, modernization of the existing weaponry and improvement of its operation efficiency.

The future of aeronautical equipment in the Polish Armed Forces is a necessity to exchange post-Soviet equipment by acquiring modern aviation weapon systems and the need to participate in Polish scientific and industrial centers in the implementation of development and implementation research in the field of Polish aviation weapons.

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