PROFILE

Aircraft

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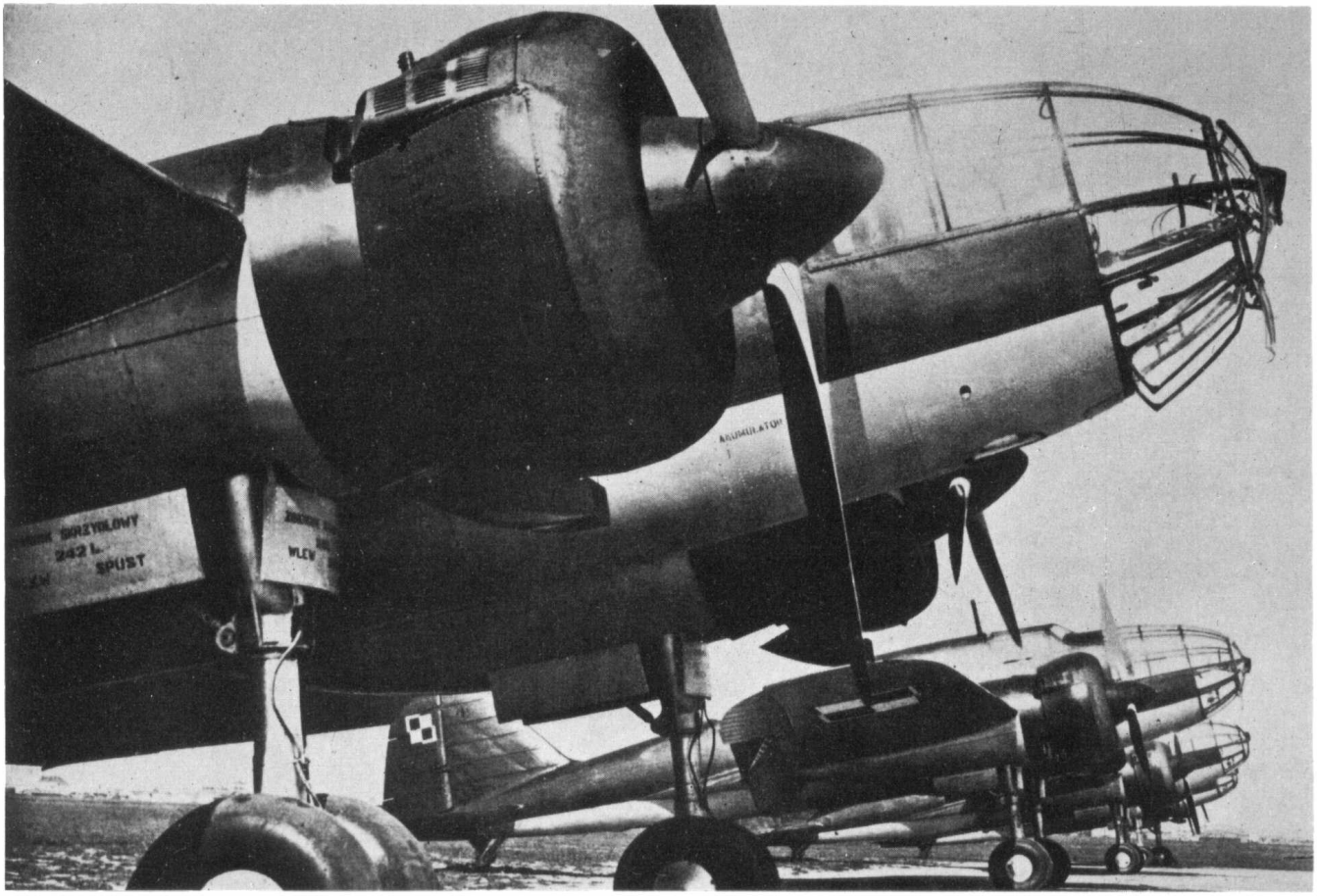
P.Z.L. P.37 Łoś by Jerzy B. Cynk



P.Z.L. P.37 Łoś by Jerzy B. Cynk

During the 1930s, two outstanding Polish designs, the P.11/P.24 fighter series and the P.37 Łoś (Elk) bomber, each symbolized the nation's lead not only in the development of combat aircraft but also in manufacturing technology. Both exercised a profound impact on the international military aviation scene and served as inspirations for foreign aircraft constructors. They were also the subjects of substantial export orders.

Whereas, by 1939, the P.11 fighter was long past its prime and vastly inferior to its adversaries, the Łoś constituted the most modern and potent weapon in the armoury of the Polish *Lotnictwo Wojskowe* **(or Military Aviation), and during the September Campaign achieved the distinction of becoming the first Allied bomber to intervene over a battlefield in direct support of forces on the ground.**

Polish bomber force beginnings

In the interwar era an air arm was regarded by architects of the Polish combat forces as an auxiliary army service of rather dubious operational value. Accordingly, it was developed mainly as a general-purpose army support tool—the organization being modelled on that of Polish land army units. Its subdued status was reflected by a complete lack of an air force doctrine and a very low budget priority, increasing to no more than 7-10% of the armament expenditure even in the years immediately preceding World War Two. Consequently formation of an effective bomber force had been neglected for a long time, and when such a force was eventually established late in the 1930s, it became the centre of controversy and the subject of bitter attacks from some high-ranking officers, who argued that Poland had no need for bombers.

The *Lotnictwo Wojskowe* came into being in 1918-19 and although during the Russo-Polish war of 1919-20 No. 4 Squadron flew Breguet 14 B2 biplane bombers, which arrived in Poland with General Haller's Polish Army from France in the late spring of 1919, this unit was primarily an army reconnaissance squadron. In the autumn of 1919 proposals were put forward to organize a specialized Breguet 14 bomber group, but these were never implemented because of lack of appreciation and understanding for the idea on the part of the army command. In April 1920, the first Polish bomber squadron, No. 21, was formed at Poznań-Ławica base. Its equipment consisted of captured ex-German aircraft, a Gotha G.IV twin-engined bomber and six A.E.G. C.IV single-engined biplanes,

An impressive line-up of P.37A bombers at Okęcie airfield in Warsaw.

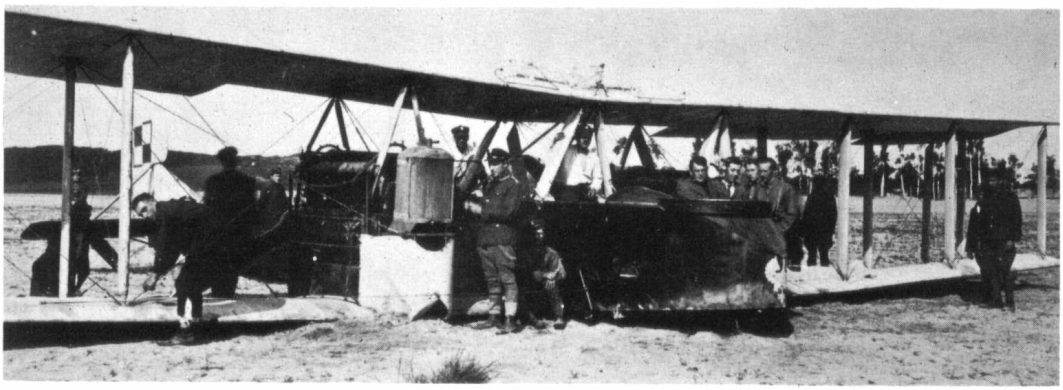
later supplemented by three twin-engined Friedrichshafens, one G.III and two G.IIIas. After the war, during reorganization of the *Lotnictwo Wojskowe* in January 1921, No. 21 Bomber Squadron was absorbed by No. 14 Reconnaissance Squadron.

In the middle of the 1920s, under the energetic command of General Włodzimierz Zagórski, ambitious re-equipment and expansion plans for the Polish air arm were evolved. These envisaged the formation of specialized bomber air regiments and, in 1925, no fewer than 32 Farman F. 68 BN4 Goliath twin-engined night-bombers were ordered from France to start the build-up of the anticipated bomber force. In addition, the old Friedrichshafen G.III (No. 354) was restored to airworthy condition by workshops of the 3rd Air Regiment in Poznań—being test-flown in January 1926. At about the same time, two army co-operation squadrons of the 1st Air Regiment in Warsaw, Nos. 13 and 14, were transformed into light bomber units and received Potez XV B2 biplanes.

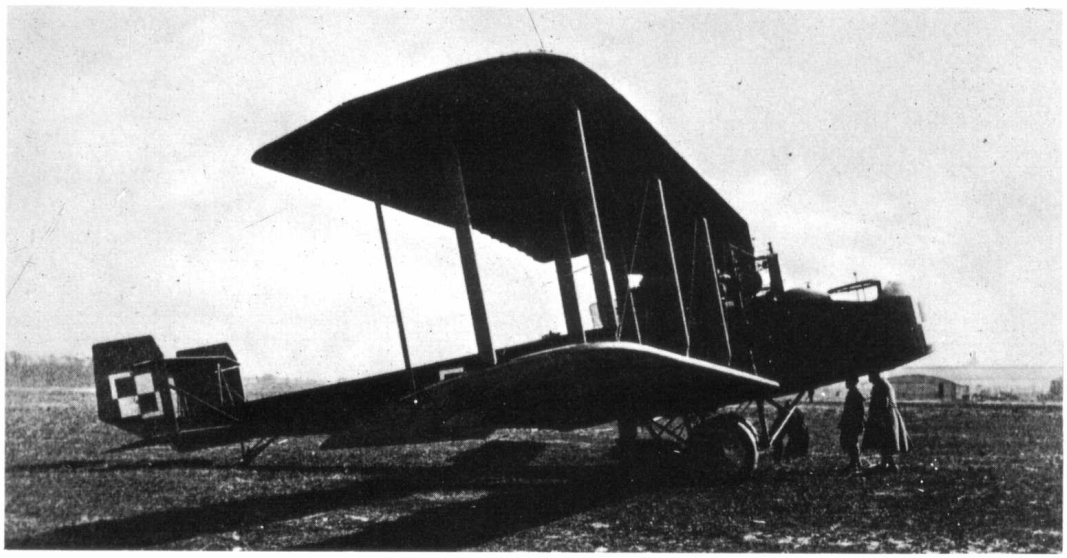
Unfortunately, with Piłsudski's *coup d'etat* and the establishment of his semi-military regime in May 1926, Zagórski's progressive ideas were abandoned and the *Lotnictwo Wojskowe* relegated again to no more than a supplementary army service. The Farman Goliaths, delivered in 1926-27 and evaluated briefly by the 1st Air Regiment, were never formed into operational units. They were used only as multi-engined and parachutists' trainers and transports, the last of them ending its flying career at Dęblin Aviation Training Centre in 1935. Thus a few single-engined biplanes adapted for bombing (Potez XV B2, XXVII B2 and XXV B2 and Breguet XIX B2) were the only first-line bombers on strength of the Polish air arm until 1930.

However, the government, guided rather by reasons of national prestige than by appreciation of the military value of bomber aircraft, concluded that Poland should possess at least a token bomber force. In 1927 the Department of Aeronautics of the Ministry of Military Affairs had authorized development of a huge single-engined reconnaissance bomber, the Lublin R-VIII, designed by Jerzy Rudlicki to carry a bomb-load of up to 1.000 kg. (2,205 lb.). Although the E. Plage & T. Laśkiewicz factory completed six flying examples of the biplane, the R-VIII never went into quantity production and four remaining R-VIIIs were eventually sold to the Polish Navy in 1932 and converted to floatplanes.

In 1928, the Department instructed the newly-established and state-owned *Państwowe Zakłady Lotnicze,* (or National Aviation Establishments) to prepare proposals for a heavy multi-engined night-bomber, and the official interest in such an aircraft resulted in a number of preliminary studies from privately-owned factories, including the M.N.2 from 'Samolot', the P.W.S. 22 and 23 and,



The first operational twin-engined bomber of the Polish air arm, a Gotha G.IV, seen here after a crash landing which signified the end of its flying career, in May 1921.
(Photo: M. Zieliński)



One of the two Friedrichshafen G.IIIa bombers serving with No. 21 Bomber Squadron in 1920. Note the Lotnictwo Wojskowe *chessboard on the nose.*
(Photo: T. Żychiewicz)

later, the Lublin R-XVIII from E. Plage & T. Laśkiewicz. These were examined by the Department, but none was approved for development.

At about the same time the Ministry of Transport —seeking a suitable passenger transport to meet the needs of the newly-created state airline, P.L.L. 'Lot'—began to show considerable interest in the Fokker F.VIIb/3m tri-motor monoplane. The possibility of adapting this aircraft for a bombing role was considered by the Department of Aeronautics with increasing enthusiasm. Encouraged by a favourable licence agreement offered by Fokker to the Polish Government, the Department asked E. Plage & T. Laśkiewicz—the company to be entrusted with the licence-manufacture of the F.VIIb/3m—to evolve a bomber version of the aircraft. In spite of strong opposition to the proposed bomber by the *Lotnictwo Wojskowe's* technical commission, which condemned it on the grounds of poor defensive armament, limited bomb-load and excessive weight, the Department placed an order for 20 F.VIIb/3m bombers (military serials 70.1 to 70.20) and one static-test specimen in September 1928. The 10 civil F.VIIb/3m transports built for P.L.L. 'Lot'—regarded by the Government as a mobilization reserve—incorporated certain fixtures permitting easy conversion to the bomber configuration (and, in consequence, these examples were allocated military serials 70.21 to 70.30).

The Fokker bombers were delivered to the 1st Air Regiment in Warsaw in late 1929 and early 1930 and were formed into a Bomber Dyon[1], comprising three squadrons, Nos. 211, 212 and 213, with a statutory strength of six aircraft each. Their limited bombing potential almost ceased to count by the middle 1930s and the aircraft were eventually relegated to transport and parachutists' training duties.

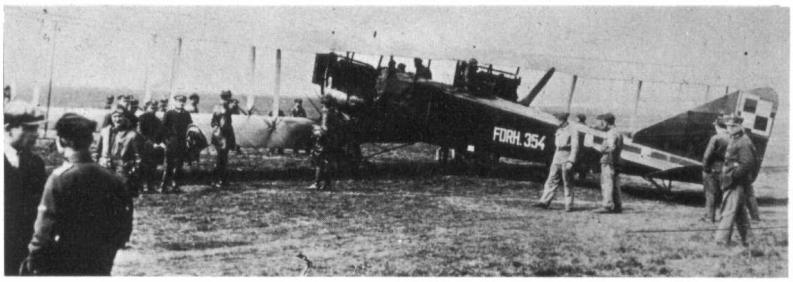
Notwithstanding the Fokker production order, the development of the P.Z.L. night-bomber continued for a time being. The study was evolved by Władysław Zalewski, whose earlier proposals for a tri-motor low-wing monoplane bomber, the W.Z.IX *Pteranodon*[2] had won outright the 1924 design contest for the best new Polish military aircraft. His latest offering, designated P.Z.L.3, was a low-wing cantilever monoplane of all-metal structure and very advanced overall concept. It was to be powered by four 500 h.p. Bristol Jupiter radials mounted in tandem pairs over a turret on each side of the fuselage. The bomb-load of 3.000 kg. (6,613 lb.) was to be stowed inside the fuselage. It was envisaged that the P.Z.L.3 would supplement or succeed the Fokkers but, because of high costs involved, construction of the prototype was postponed. Then, at the end of December 1930, P.Z.L. was instructed to stop all further work on the project on grounds of economy.

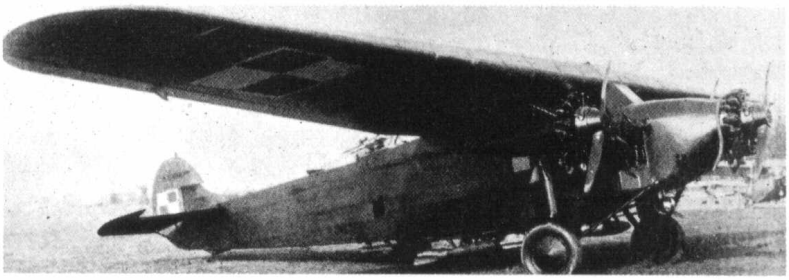
Despite the cancellation of the P.Z.L.3, Zalewski's efforts were not all in vain, for his design inspired young Polish aviation engineers with bold and progressive ideas and some traces of his bomber could be found in the later P.37 Łoś, a creation of Jerzy Dąbrowski who worked next to Zalewski's office when the promising P.Z.L.3 was taking shape.

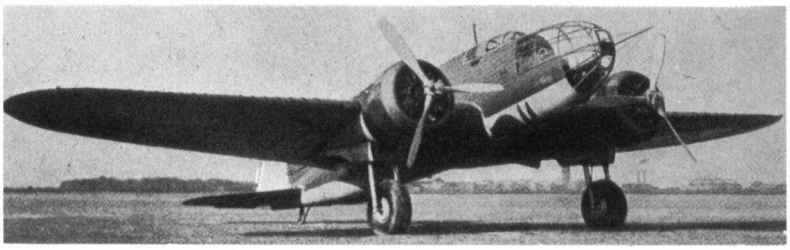
French technical personnel, residing in Poland

[1]Dyon, an abbreviation for *Dywizjon*, a larger Polish aviation unit consisting of two or three squadrons.

[2]The Latin name of one of the prehistoric giant birds of the Pterodacty family (bird-reptile).



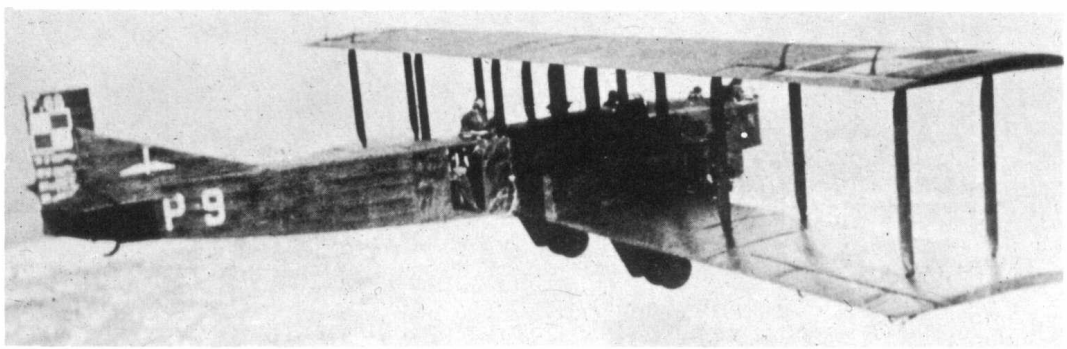




1
The Friedrichshafen G.III (No. 354) of the 3rd Air Regiment, seen at Poznań-Ławica base early in 1926, after a restoration to the flying condition.
(Photo: A. Morgala)

2
E. Plage & T. Laśkiewicz-built F.VIIb/3m bomber with external bomb-load under the fuselage. Note the bombardier's position projecting from the lower part of the forward fuselage side.
(Photo: T. Zychiewicz)

3
The P.37/I first Łoś prototype (serial 72.1), displaying a small window on the starboard fuselage side.



Farman F.68 BN4 Goliath (serial P 9) bearing the badge of Dęblin Aviation Training Centre on the fin, during parachutists' training flight in the early 1930s.
(Photo: M. Krzyżan)

in connection with the licence-manufacture of the Potez biplanes, obtained many calculations and details relating to the P.Z.L.3 and these are said to have influenced the design and structure of the Potez 41, which closely resembled the Polish bomber.

Birth of the P.37 Łoś bomber

Talks with the Industry regarding a successor to the Fokker bomber began in the early 1930s and among the submissions investigated by the Department of Aeronautics were two P.Z.L. studies. The first study was for a twin-engined monoplane of corrugated duralumin by Franciszek Misztal, while the second was a later project of composite construction by Zbysław Ciołkosz—a bomber development of the abandoned P.Z.L.30 passenger transport. Ciołkosz's project, which became known as the P.Z.L.30/L.W.S.4 Żubr (Bison), attracted a favourable attention from the *Lotnictwo Wojskowe*, but it was soon completely overshadowed by proposals put forward by Dąbrowski in the middle of 1934.

Jerzy Dąbrowski, born on September 8, 1899 in Nieborów, was unique among the Polish aircraft designers of the younger generation employed by the Industry in not having an academic degree, this being a well kept secret[1]. The untimely death of his father forced him to look after the well-being of his family. Studying at the Warsaw Technical University, he had to give private lessons to earn a living, yet he still found time and energy to design his first aeroplane, the diminutive ultralight single-seat D.1 'Cykacz' ('Ticker'), an all-wood cantilever biplane powered by 16 h.p. Blackburne Tomtit engine. The L.O.P.P. (League of Air and Anti-gas Defence) decided to finance the D.1, and the 'Cykacz', completed by C.W.L. Workshops in Warsaw, flew for the first time in February 1925.

Financial difficulties forced Dąbrowski to interrupt his studies and seek full-time employment in the aviation industry. He went to Lublin to work under the leadership of Jerzy Rudlicki on the R-VIII biplane. While there, he evolved with Antoni Uszacki a two-seat light biplane constructed of duralumin, the D.U.S.III 'Ptapta' ('Chuck-Chuck'), which was completed in 1928 by popular flying enthusiasts from the Lublinian Aviation Club. In 1928 he was engaged by P.Z.L. in Warsaw and teamed up with Franciszek Kott to design the P.Z.L. Ł.2 two-seat reconnaissance/liaison high-wing monoplane powered by 220 h.p. Polish Skoda Works (Wright) J-5 Whirlwind radial engine. Developed to an official requirement, the Ł.2 entered into limited production and gained international fame in the 16,000-mile African Tour carried out by Captain Stanisław Skarżyński early in 1931.

Late in 1930, Dąbrowski, working jointly with Misztal, turned his attention to a competition tourer for the 1932 *Challenge de Tourisme International,* which took the shape of the P.Z.L.19 and together with the RWD 6, the eventual winner of the 1932 *Challenge,* formed equipment of the Polish team for this important international event. Two years later he was entrusted with the overall responsibility for the design and development of the P.Z.L.26 tourer for the 1934 *Challenge*. Although the RWD 9 completely outclassed all other participants, winning the first two places in the contest, the P.Z.L.26s contributed to the overwhelming victory of the Polish team as a whole.

In the spring of 1934, Dąbrowski conceived proposals for what was destined to become the most outstanding creation of his design career and the pride of the Polish aviation industry—a very fast bomber monoplane of all-metal stressed-skin construction based upon two 800-1,200 h.p. radial engines, and manned by a crew of four. Bearing the unmistakable hallmark of Dąbrowski's hand, the fast bomber was strikingly clean, aerodynamically-speaking, and its looks were to be matched by exceptional performance, far in advance of everything else in the bomber field. The P.Z.L. Design Council, greatly impressed, instructed Dąbrowski to evolve a preliminary study and selected Polish-built Bristol Pegasus engines as the recommended powerplant. The designation P.37 was allocated to the project, which was submitted to the Department of Aeronautics in July 1934.

The results obtained from the wind-tunnel tests with a scale model of the bomber were most encouraging; so much so, that the same basic

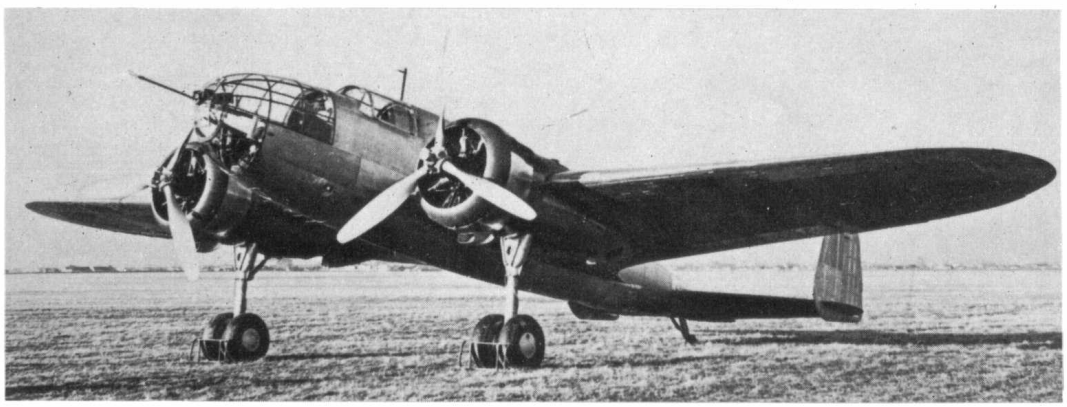
[1]Dąbrowski graduated only after World War Two, at the Polish University College in London as an external student. In the post-war years he was employed as an aircraft designer both in Britain and, from 1955 onwards, in the U.S.A. He died on September 17, 1967, at Renton, Washington, U.S.A.

The P.37/II in natural metal finish at the beginning of its trials in the autumn of 1936.

The side view of the P.37/II shows off the clean lines of Dąbrowski's bomber.

The P.37/III with Gnome-Rhone 14N07 radials, serving as a prototype for the P.37C, during a demonstration tour at Tatoi airfield, Athens, in July 1938.
(Photo: A. Morgała)

One of the first pre-production P.37A Łoś A bombers, complete and ready for tests—except for the propeller spinners.
(Photo: T. Żychiewicz)



Another view of an early production P.37A Łoś A.
(Photo: T. Żychiewicz)

The Pegasus XX-powered P.37/II second prototype introduced the novel twin-wheel undercarriage legs and twin fins and rudders.

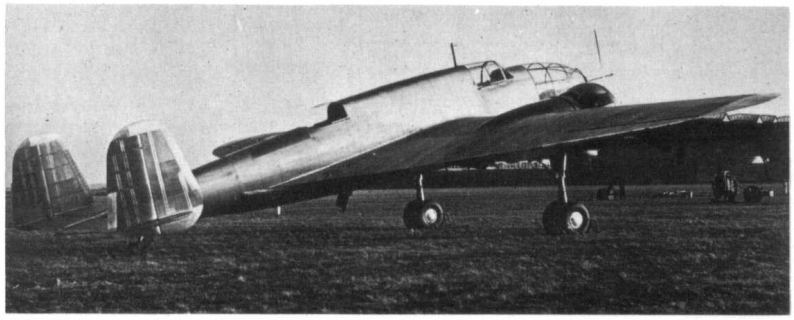
shape was also adopted for a fast twin-engined attack fighter, the P.38/P.39 (later named Wilk or Wolf), the development of which became the responsibility of Misztal. Instruction to proceed with the detail design for the P.37 were received by P.Z.L. in October 1934. After discussions with regard to armament and equipment, the Department decided to put performance first and specified single 7,7 mm. guns for all positions instead of the twin guns and 20 mm. dorsal cannon originally proposed by the designer, so that the bomber would rely mainly on its high speed for defence. The Department approved a full-scale wooden mock-up on April 14, 1935, and authorized the P.Z.L.-W.P.1 (Airframe Plant 1) in Warsaw to construct two prototypes and a static-test example. As an insurance against the possible failure of such an advanced aircraft, development of the P.Z.L.30/L.W.S.4 Żubr bomber was to proceed in parallel, and a land version of Rudlicki's Lublin R-XX/L.W.S.1 torpedo-bomber was also briefly considered in this context.

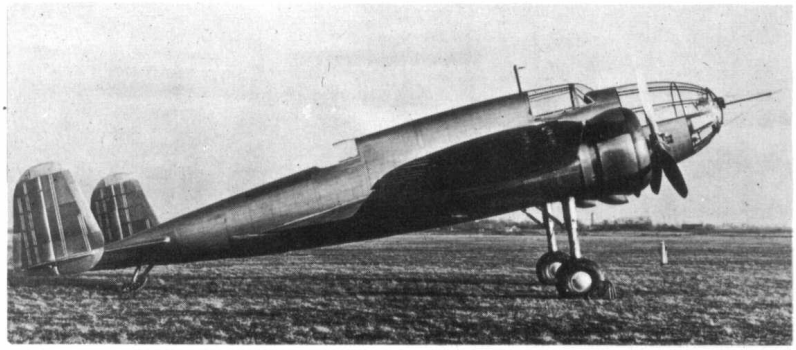
A necessity to introduce some structural changes to the airframe held up work on the well advanced first prototype, the P.37/1, for a few weeks in January 1936. Further delays occurred in April, when belated static tests led to the discovery of some weaknesses in the wing structure and the load-carrying central box of the wing had to be opened to permit reinforcements. The following month the P.37/I (serial 72.1), powered by two 873 h.p. Bristol Pegasus XII radials, began ground and taxiing trials. With these successfully completed the prototype was rolled out for its first flight on June 16. During the engine run a loud bang was heard by mechanic Laskowski and smoke began to pour from the port (left-hand) Pegasus. Flight preparations were stopped and when the engine was dismantled it was found that a riveting dolly, apparently left inside the cowling, had pierced the reduction gear and crankcase. Then, on the last day of June, the P.37/I was ready again and made its first flight with Jerzy Widawski at the controls; in all now some two months behind schedule.

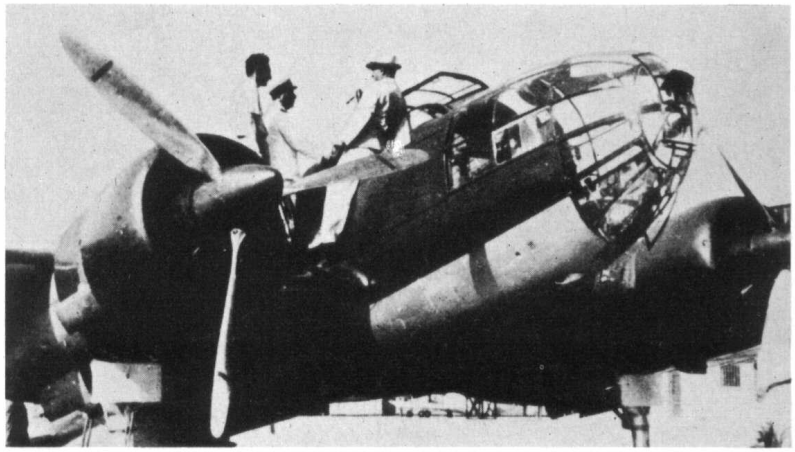
The P.37 Łoś: development and production

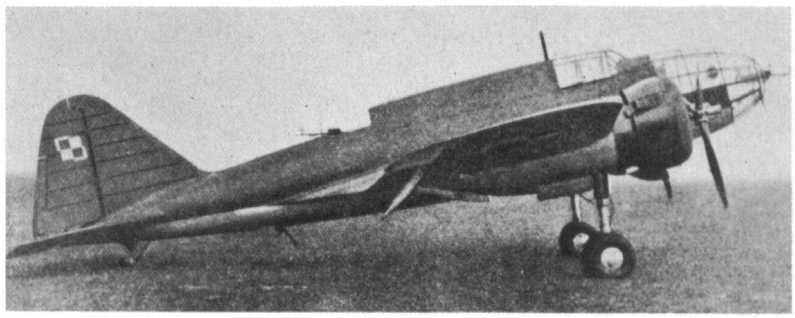
The initial factory tests were completed in August and these were followed by the official I.T.L.[1] airworthiness and service trials. Although various shortcomings were discovered—these included rear fuselage flutter, excessive vibration of the instrument panel, overheating of the cylinder heads, cracks developing in the exhaust pipes and the very confined areas of the pilot's and radio operator's cockpits—both factory and service pilots were most impressed with the aircraft and its potentialities. Modifications were put in hand and some of them were introduced to the P.37/I, while the others, more fundamental ones, were incorporated in the second, considerably revised prototype, the P.37/II (serial 72.2), which was to serve

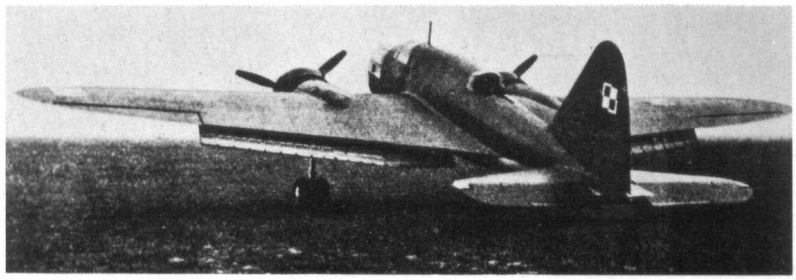
[1] I.T.L.—*Instytut Techniczny Lotnictwa*, or Technical Aviation Institute.









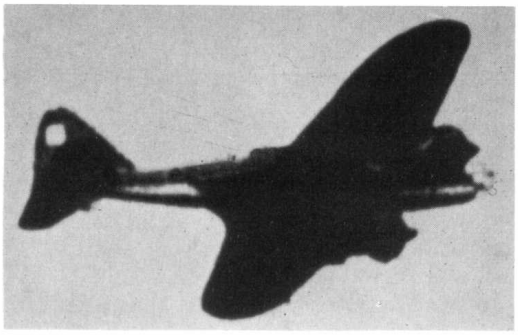


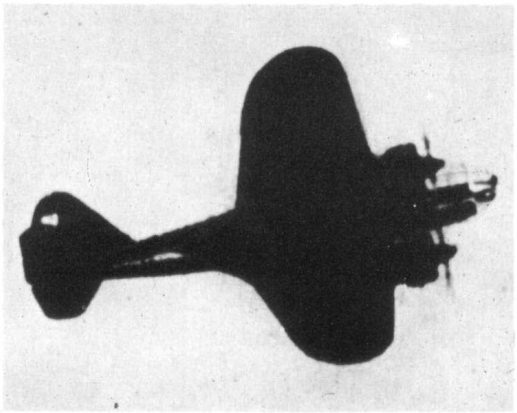
as the development aircraft for the production model.

The P.37/II received a completely new, twin fin and rudder tail assembly and extensively reworked pilot's and radio operator's compartments, which, although still restricted by the compactness of the design, were roomier and more comfortable and featured deeper glazing of the pilot's cockpit to improve visibility. The ventral gun position was fitted with a sliding cover subsequently used on all P.37s except for the nine P.37A pre-production examples; and the aircraft was provided with a revolutionary landing gear, which was approved as standard for the production model. Invented by Piotr Kubicki, who generally contributed to the design of the bomber, and patented by P.Z.L. (Polish patent No. 29090), each undercarriage unit comprised twin wheels with medium-pressure tyres, hinged on articulated joints to the P.Z.L. oleo-leg. This system, pioneered on the P.37, offered an even load on axle sockets, a greater tyre area in contact with the ground and smaller-diameter wheels, easy to accommodate in the engine nacelles. This innovation was later adopted throughout the world. The P.37/II, powered by two 925 h.p. Bristol Pegasus XX radials, the P.Z.L.-manufactured equivalent of which was specified for the major *Lotnictwo Wojskowe* variant the P.37B, flew in the autumn of 1936, and the trials indicated that the changes achieved their purpose.

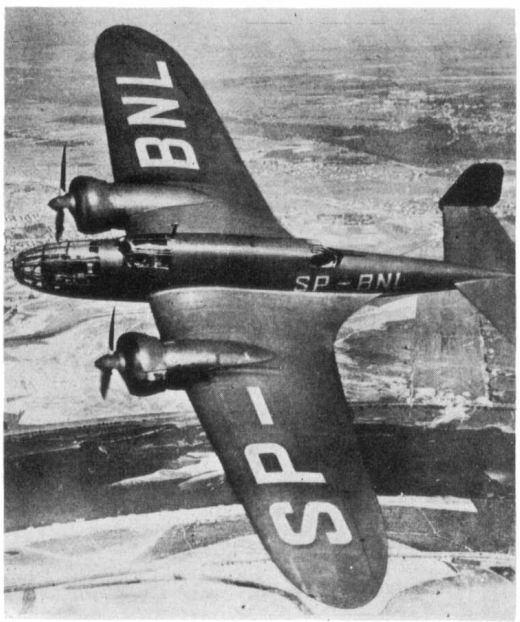
In the meantime, a pre-production contract for ten P.Z.L. Pegasus XIIB-powered P.37A bombers (serials 72.3 to 72.12) priced at 280,000 zloty (approximately £11,700) each, was placed with the factory, and the name Łoś (Elk) was approved for the type. This initial order was soon revised to include in the first ten airframes an additional (third) prototype, the P.37/III, which was intended to assist in the development of the proposed export versions, the P.37C and P.37D. At the same time the number of aircraft to be produced was increased by further 20 P.Z.L. Pegasus XIIB-powered examples (serials 72.13 to 72.32) of the P.37Abis Łoś Abis variant. Apart from the powerplant, the Łoś Abis was generally similar to the P.37/II, while the Łoś A retained the single fin and rudder tail assembly and permanently open gun cut-out in the fuselage underbelly as those seen on the first prototype.

Production of the Łoś began at the P.Z.L.-W.P.1 in the winter of 1936-37. The P.37/III prototype, powered by two 970 h.p. Gnome-Rhone 14N07 radials, specified for the Łoś C export model, began flight trials in the early autumn of 1937. The P.37/III was officially credited by I.T.L. with a maximum speed of 453 km/h. (280·5 m.p.h.) at 4.250 m. (13,943 ft.). Later, two 1,030 h.p. Gnome-Rhone 14N21s, the proposed powerplant for the Łoś D, were temporarily fitted for comparative tests, during which speeds of almost 500 km/h. (310 m.p.h.) were recorded in level flight, making the Łoś by far the fastest aircraft in Poland at that time. An extensive evaluation programme covering a wide range of radial engines was devised, the powerplants selected including among others the French 1,020 h.p. Renault 14T and the Italian 1,030 h.p. Fiat A.80 RC41, which were supplied by the manufacturers as samples. However, in view of pressing enquiries from prospective customers who wanted to examine the Łoś, this programme was never completed. The P.37/III was brought up to the standards of Łoś C in preparation for a demonstration tour. In July 1938, it was flown to Greece and then on to Turkey where it eventually crashed while landing by mistake on an unprepared part of Ankara military airfield, then still under construction.





Flying views of Łoś A are extremely rare. These two pictures are 'stills' from a Polish newsreel.
(Photos: A. Morgała)



The SP-BNL over the river Vistula near Warsaw, showing to advantage its low-aspect-ratio wings, which bestowed on the bomber exceptional load-carrying capabilities.

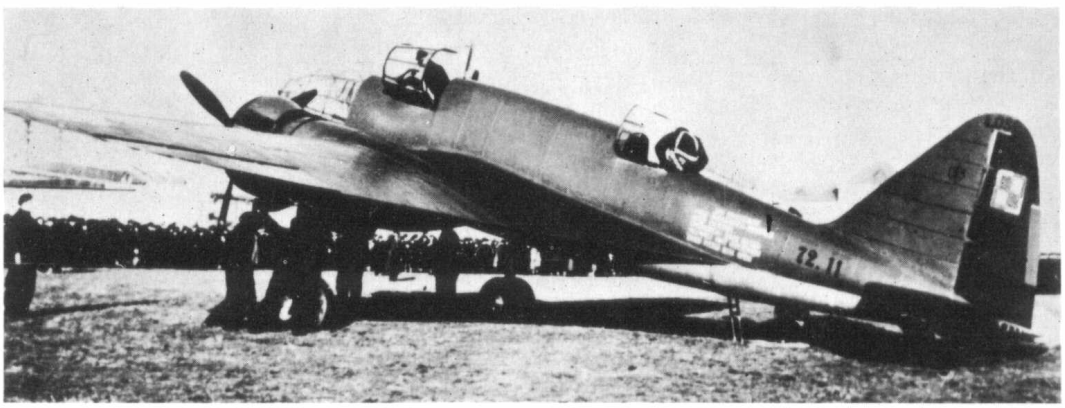
The pre-production P.37A Łoś A bombers were finished in late 1937 (first batch of four, followed by a batch of five), one of which (serial 72.11) was funded by employees of Polish banks and bore the names of the banks involved on the port side of the fuselage. The 20 P.37Abis Łoś Abis examples, completed in batches of five at the rate of one batch per month, were delivered in the first half of 1938. One of these was provided with 918 h.p. P.Z.L. Pegasus XX radials and specially prepared as an exhibition aircraft for the Belgrade Aero Show. Bearing the Polish civil registration SP-BNL, it was flown to Yugoslavia in May 1938. Then, towards the end of that year, it was painted with the white-and-red *Lotnictwo Wojskowe* chessboards, and displayed at the Paris *Salon de l'Aéronautique*, being acclaimed as one of the most outstanding designs at both these exhibitions.

In 1937 the Polish Government's tentative orders for the Łoś were increased to 180 aircraft to meet the demands of the *Lotnictwo Wojskowe* expansion programme. The first 30 bombers of the A/Abis series were to be followed by 150 P.Z.L. Pegasus XX-powered P.37Bs, with 50 to be completed by December 31, 1938, and next 44 (or 124 in all) by the end of the 1938-39 budget year, that is, March 31, 1939.

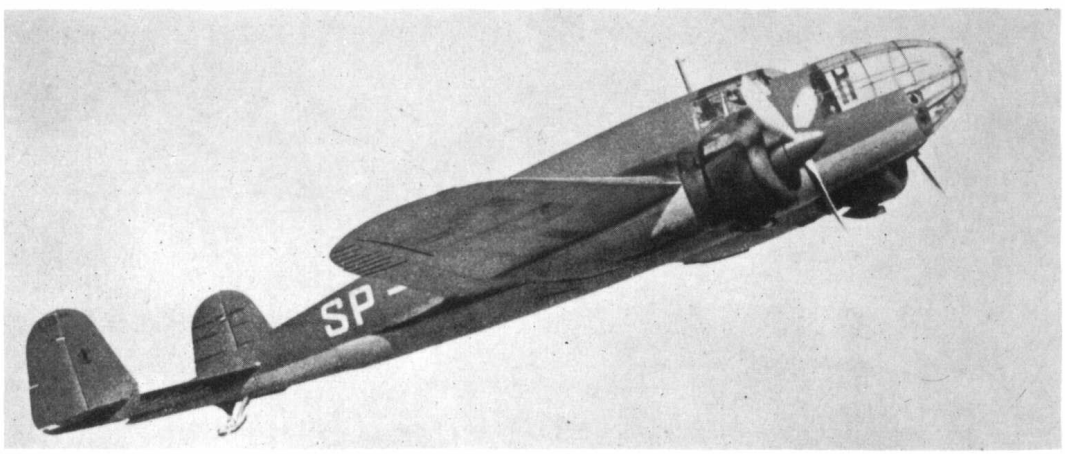
Unfortunately, no complete record of the later Łoś serials is available. The Polish military serials consisted of two sets of figures, the first denoting a model (bombers starting with 70. for the Fokkers, and continuing with 71. for the L.W.S.4 Żubr and 72. for the P.37 Łoś) and the second indicating the consecutive aircraft produced. This system was easy to decode and by studying the serials, foreign intelligence agents could establish accurately how many examples of a given type were in service with the Polish air arm. To remove this obvious security risk, in the case of Łoś B, and presumably also the Łoś Abis[1], random blocks of numbers were omitted from the sequences allocated to the bombers, the highest Łoś B serial mentioned in existing records being 72.210.

Because of a number of factors, the specified delivery dates were not met. Service debut of the Łoś was marred by accidents. In June 1938 a Łoś A flown by N.C.O. Macek lost its port wing during violent aerobatic manoeuvres at full power. All the aircraft were grounded and additional static tests ordered. These revealed deficient riveting of the vital elements of the wing and modifications were introduced to all P.37s to rectify the fault. When the Łoś returned to service a series of mysterious crashes, resulting apparently from loss of control in the air, caused widespread concern. Eight bombers, most of them of the twin fins and rudders variety, were lost. Although during official investigations some of the accidents were attributed to the pilot error, no satisfactory explanation could be offered for the others.

[1] The indications are that the consecutive serials 72.13 to 72.32 originally reserved for the Łoś Abis were changed before the aircraft were delivered—Author.



The Łoś A presentation aircraft (serial 72.11) with the inscription: 'Gift from employees . . .' followed by the names of five Polish banks involved, during the official handing over ceremony at Okęcie in 1938. (Photo: J. Ostrowski)



A well-known view of the Pegasus XX-powered P.37 Abis Łoś Abis demonstrator, bearing the civil registration SP-BNL for the flight to the Belgrade Aero Show.

Sabotage was suspected and stringent security measures were introduced. Then Sgt. Józef Siwik, applying full rudder under considerable power during taxiing, suddenly found the rudder blocked solid. This led to the discovery that the twin rudders suffered from serious aerodynamic overbalancing, and when a certain rudder angle was exceeded at full power, the surfaces locked firmly. All aircraft were grounded again and simple modifications resolved the trouble.

Comprehensive armament trials were conducted only towards the end of 1938 and the specified home-produced KM Wz 37 guns did not become available in quantity until the beginning of 1939. The 918 h.p. P.Z.L. Pegasus XX engines for the Łoś B were not ready in time either, and these initial difficulties put the Łoś production programme some six months behind schedule. Consequently, when in a bid to impress Count Galeazzo Ciano, Italian Foreign Minister, and to deter the Germans, 54 Łoś bombers (in three rows of 18) were assembled at Okęcie airfield during his official visit to Warsaw at the end of February 1939, several of the bombers were wheeled out from the factory without engines, their cowlings and propellers being only temporarily fixed. This exercise, combined with the introduction of the non-consecutive serials, considerably confused the German Intelligence which, in the summer of 1939, had put the number of Łoś bombers on equipment of the Polish first-line squadrons at 'about 150', or four times the true figure.

In fact, out of 124 aircraft to be delivered by April 1939, only 85 bombers of all variants were received by the *Lotnictwo Wojskowe* (including nine lost in accidents) by the end of June 1939, with the next 21 completed but not fully equipped at the P.Z.L. Warsaw and Mielec plants and a further 18 in the final assembly stage. In the spring of 1939, a vast new P.Z.L. establishment, the P.Z.L.-W.P.2 (Airframe Plant 2) at Mielec, was preparing to begin production, and in May parts and sub-assemblies for 10 Łoś B bombers were transferred there for assembly to provide initial work for the plant. The first Mielec-completed example took to the air in August and four further bombers flew at Mielec by September. The W.P.2 also undertook some experiments, which included the development of mass-balanced rudders for the Łoś, but trial installation of these was prevented by the onset of war.

As the Łoś B became available in quantity, so all the early aircraft of the A/Abis series were transferred to the Łoś conversion training and provided with dual controls. Apart from the more powerful engines, various minor refinements were introduced to the Łoś B. Improved, optically-flat glass panels were fitted to the somewhat revised lower section of the navigator/bomb-aimer's nose compartment, the ventral gun position was made more comfortable, the radio mast modified, the propeller spinners reshaped slightly and the exhaust system simplified. From results obtained using a new dynamic test rig for undercarriages, modifications were also introduced to the Łoś landing gear, which was prone to collapse during operations from semi-prepared grass fields. The outbreak of war also prevented the retrospective application of this improvement to existing aircraft. Once the teething troubles were overcome and the bomber established in service, the Łoś achieved an excellent serviceability record. Between March and September 1939, only nine complaints were received by the manufacturer, eight concerning air leaks and one faulty instruments.

With its appearance at various international shows, the Łoś attracted considerable interest, and several of the numerous export enquiries progressed to the stage of final negotiations and firm orders in 1939. Two versions, the P.37C, with 970 h.p. Gnome-Rhone 14N07s and the guaranteed maximum speed of 460 km/h. (285.8 m.p.h.) at 4.000 m. (13,123 ft.), and the P.37D, with 1,030/1,050 h.p. Gnome-Rhone 14N20/21s and the guaranteed maximum speed of 490 km/h. (304.4 m.p.h.) at 5.100 m. (16,732 ft.), were offered for export. Except

Key to colour views

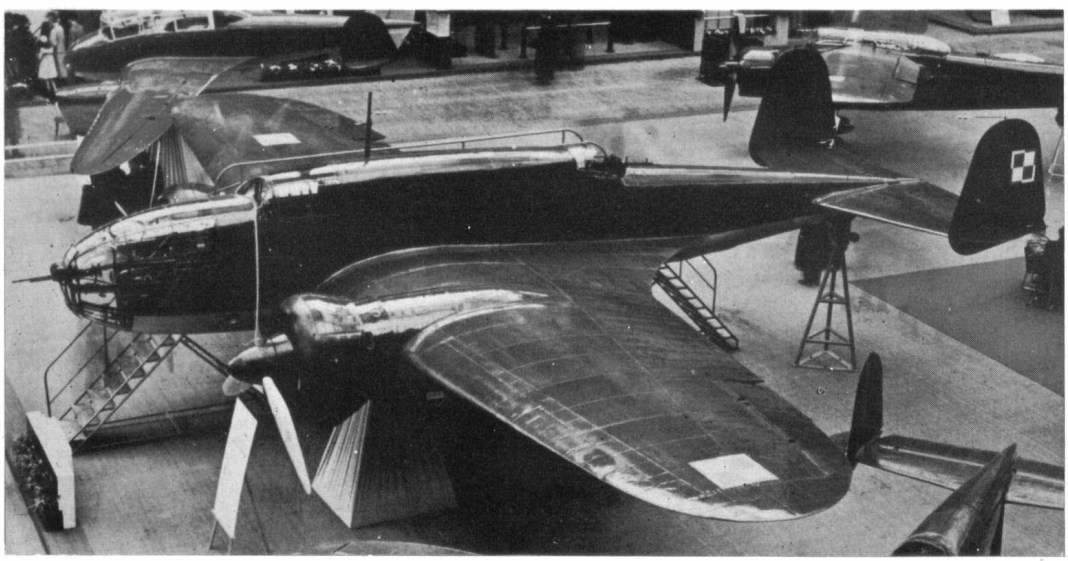
1 *P.37/I prototype (Bristol Pegasus XII), serial 72.1, in its final form, Warsaw-Okęcie, 1937.*

2 *P.37/II prototype (Bristol Pegasus XX), Warsaw-Okęcie, the winter of 1936/37.*

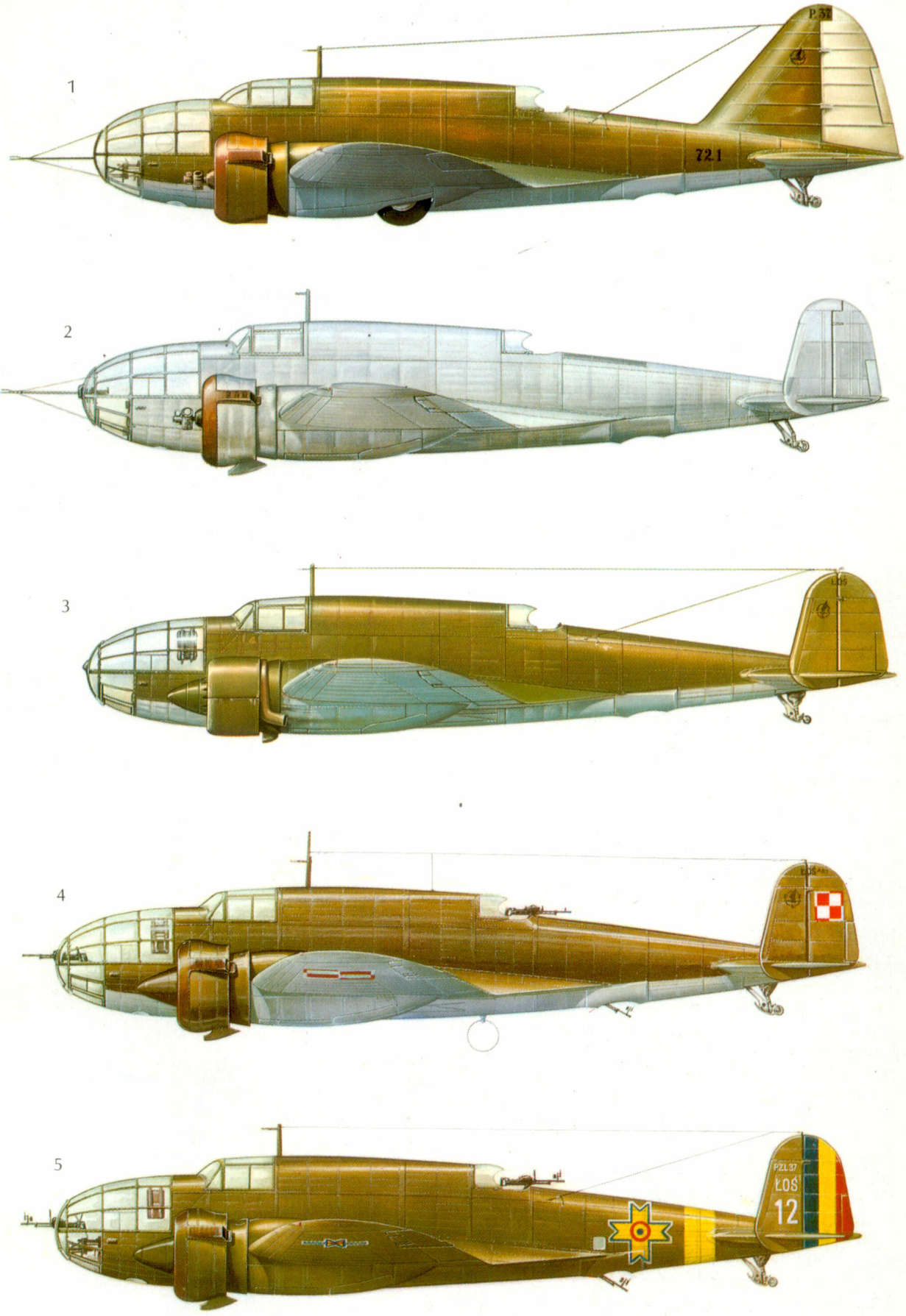
3 *P.37/III prototype (Gnome-Rhone 14N07), Warsaw-Okęcie, the early summer of 1938.*

4 *P.37 Abis Łos Abis (P.Z.L. Pegasus XX), Salon de l'Aeronautique, Paris, December, 1938.*

5 *P.37B Łos B (P.Z.L. Pegasus XX), Rumanian Air Force, Ukrainian Front, the late summer of 1941.*



The Łoś Abis demonstration aircraft at the 1938 Salon de l'Aéronautique in Paris. Note the new, repositioned radio mast.



for the powerplant and certain equipment specified by customers, both models were similar to the Łoś B.

In the summer of 1939, 20 P.37C bombers were ordered by Yugoslavia and 15 by Bulgaria, with deliveries promised by June 1940. Rumania bought 30 P.37Ds, paying for the first five at the time of signing the order and undertaking to pay for the next ten in advance by the end of 1939, and for the remaining 15 over the next three years. Turkey purchased 10 P.37Ds as well as raw materials and semi-prepared parts for a further 25 and a licence for the type, which was to be put into production in Turkey with the help of P.Z.L. technical staff. The Royal Hellenic Air Force was finalizing an agreement for 12 P.37D bombers, and discussions with Denmark, Estonia and Finland were in progress. The Belgian company Constructions Aéronautiques G. Renard was negotiating for the licence rights to the P.37. In this respect, seven Polish Łoś bombers were to appear at a big display staged at Brussels' Evere aerodrome in July 1939, but the political implications of a flight of the Łoś formation via Denmark close to the German coastline, combined with bad weather, led to cancellation of the Polish participation.

Future plans and policy reverses

When preparations for the quantity manufacture of the Łoś were well in hand, Dąbrowski began preliminary work on its successor, the P.49 Miś (Teddy Bear). The detailed design for the aircraft, stressed for radial engines of 1,200-1,600 h.p., was evolved in the years 1937-38, and both the 1,375 h.p. Bristol/P.Z.L. Hercules and the 1,400 h.p. Gnome-Rhone 14N50/51 series engines were envisaged as the possible standard powerplant. The wooden mock-up was approved and prototype construction began in the winter of 1938-39. By September 1939, the wings of the first prototype, the P.49/I, were ready and the fuselage, in sections, was awaiting assembly. The prototype was destroyed, and all drawings were burned by the designer's wife in the ovens of a Warsaw bakery, when the Germans besieged the city.

The P.49 Miś was essentially a progressive development of the Łoś, employing a similar basic structure and utilizing several components of its predecessor. Its wing, without streamlined fairings between the trailing edge and the rear fuselage, was provided with integral fuel tankage offering increased capacity, but retained a similar overall span and area, while its fuselage was increased in length to 14,3 m. (46 ft. 11 in.) to accommodate an extremely heavy defensive armament. In addition to twin 7,7 mm. guns in the nose, the bomber was provided with similar twin guns in a retractable ventral gondola, extending under the weight of the gunner, and with hydraulically-operated, fully-rotating, semi-retractable dorsal turret designed to take the 37 mm. Hispano-Oërlikon cannon or combinations of various other smaller calibre weapons including a 20-mm. cannon and two machine-guns or a battery of up to six machine-

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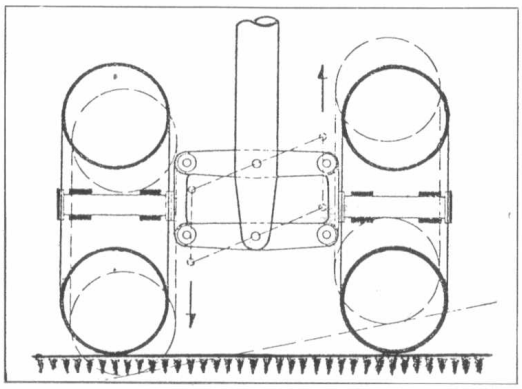

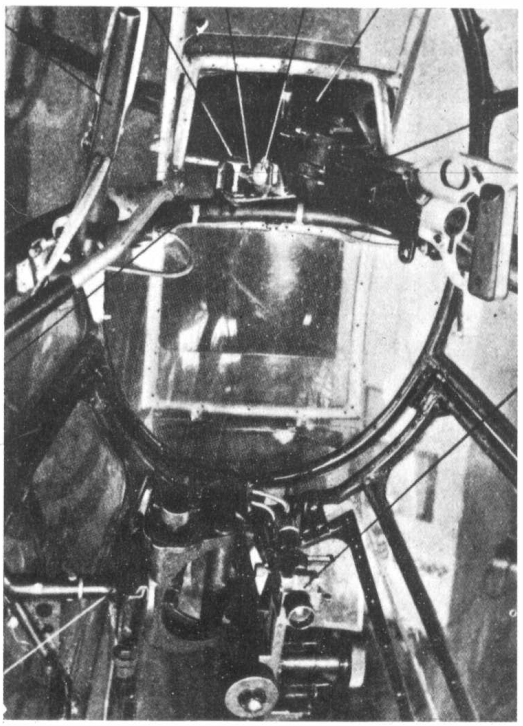

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1 *A close-up view of the revolutionary Kubicki main undercarriage leg of the P.37 bomber.*
(Photo: A. Morgała)

2 *Extreme nose of the Łoś bomber with a flexible gun (top) and bomb-aiming gear (bottom of the picture).*

3 *The starboard half of the Łoś bomb-bay, showing disposition of bombs in the fuselage and inboard of the engine nacelles.*

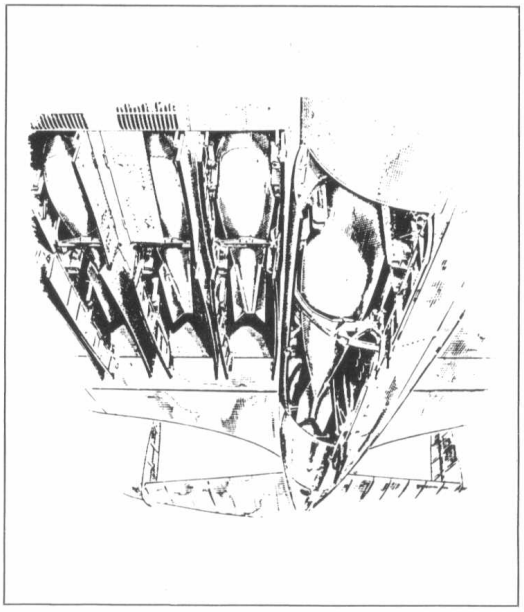
4 *The Polish KM Wz 37 machine-gun mounted in the dorsal position on the Łoś.*

5 *Flight controls of the Łoś bomber, off-set to port. Note the cut-out under the instrument panel (to starboard) to facilitate the passage to the nose compartment.*

6 *This drawing, by Wacław Klepacki, shows to advantage the remarkable bomb-carrying capability of P.37 Łoś bomber. The drawing represents the disposition of the normal maximum bomb-load of 2,580 kg (5,688 lb), consisting of ten 110 kg (242 lb) bombs in the upper tier, and eight 110 kg (242 lb) bombs and two 300 kg (661 lb) bombs in the lower tier.*

7 *The Łoś dorsal defence position, provided with a Vickers F gun which was fitted to early production P.37s.*

8 *Part of the Łoś fuselage interior with the ventral gun mounting. Note the open sliding cover.*



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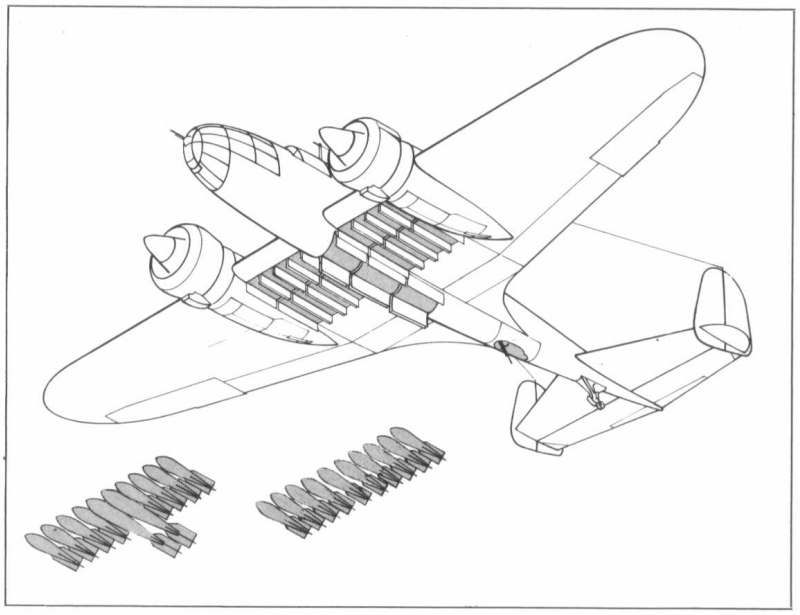

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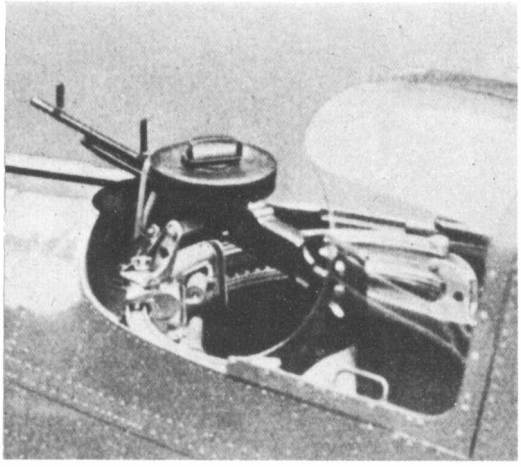

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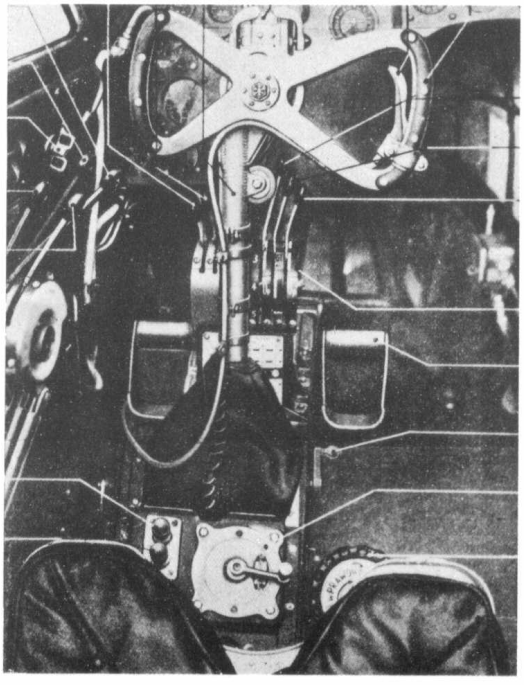

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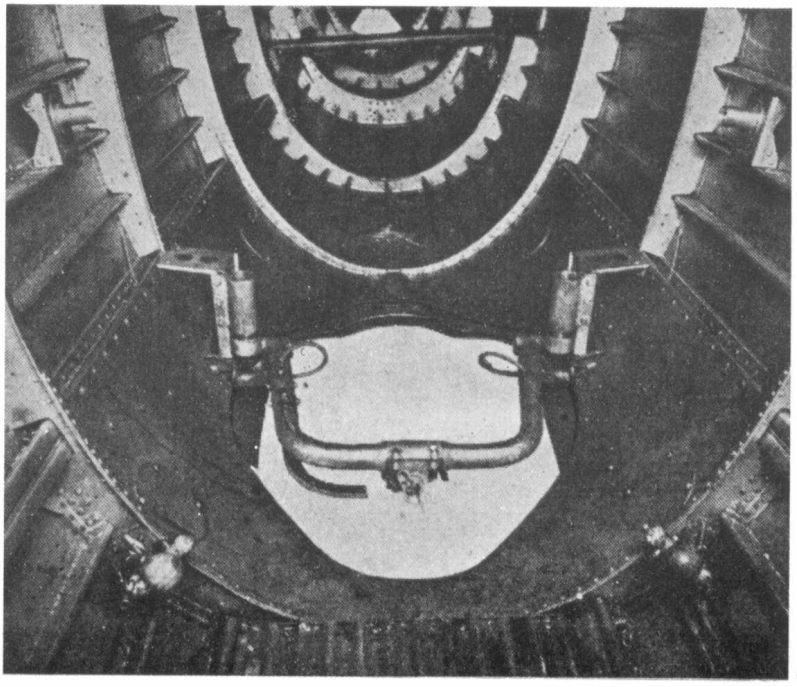

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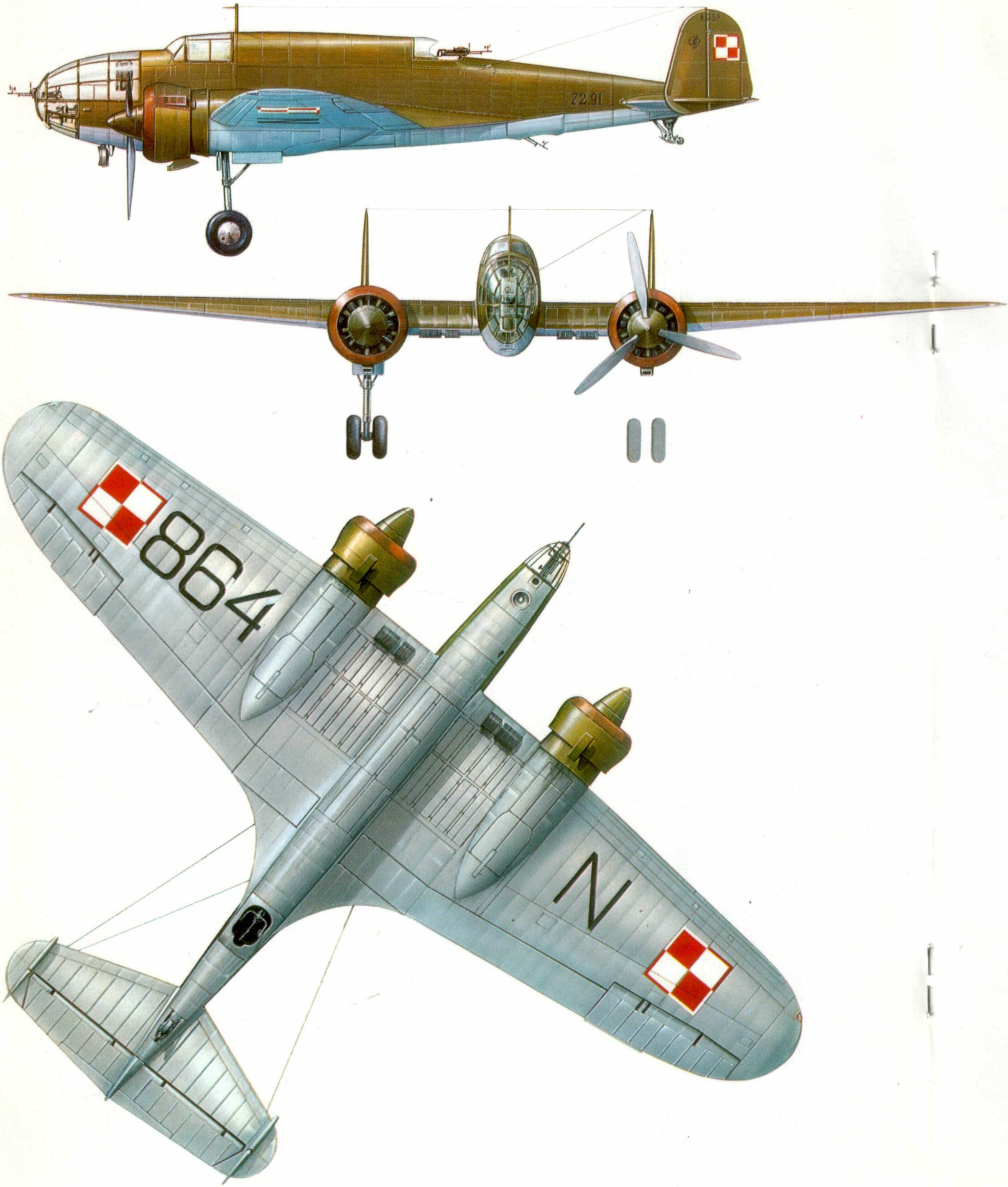
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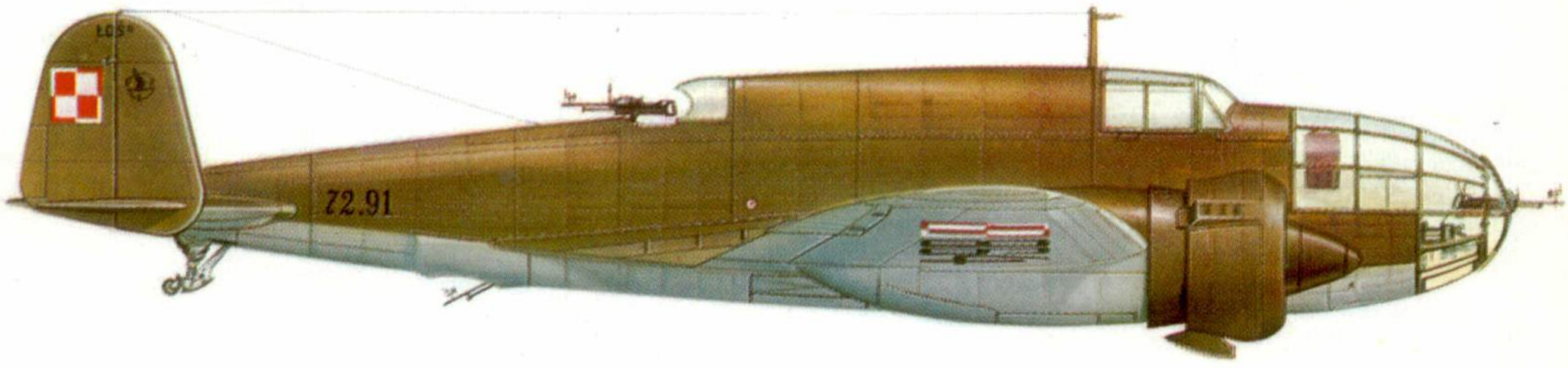
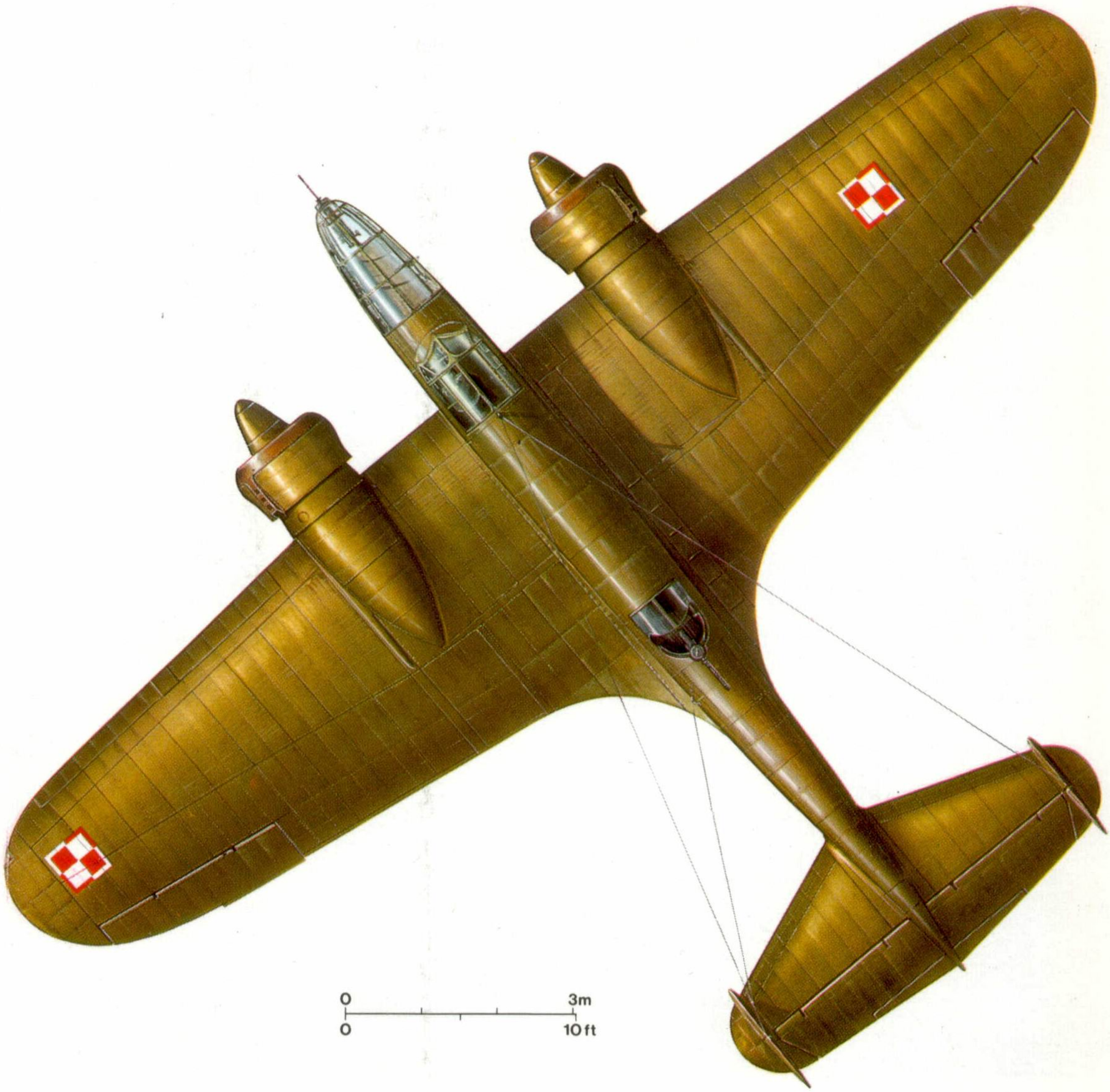


P.37B Łoś B (P.Z.L. Pegasus XX), Serial 72.91, X/I Bomber Dyon, Ulęż, August 31, 1939.

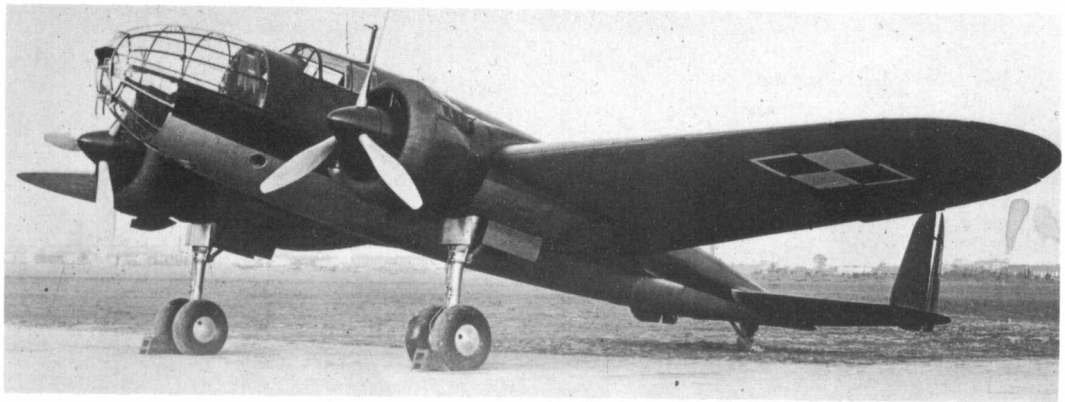


guns. The armament for the turret, the subject of intensive studies, had not yet been finalized when the war broke out. The undercarriage of the Miś was largely new. Each unit incorporated a P.Z.L. oleo-leg with a forward-folding extension, and twin wheels retracted upwards into the engine nacelles. The estimated normal loaded weight of the P.49 was 11.500 kg. (25,350 lb.) and the bomb-load was the same as that of the Łoś. The estimated maximum speed for the Hercules-powered P.49 was 520 km/h. (323.1 m.p.h.), and the maximum normal range 3.000 km. (1,864 miles).

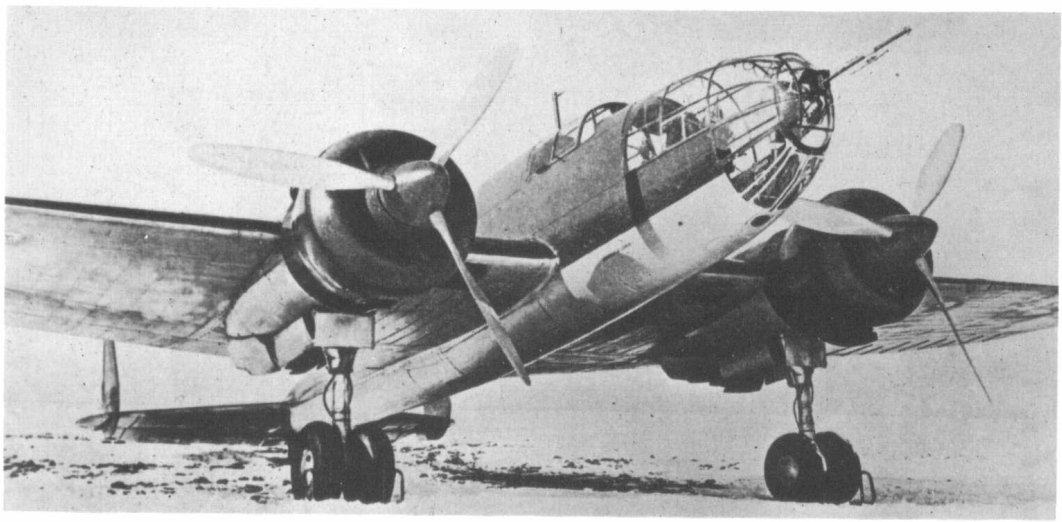
The P.49/I was expected to begin trials early in 1940, and it was originally hoped that the Miś would succeed Łoś in production by the end of that year. However, in view of the later policy changes, the quantity manufacture of the new bomber seemed rather uncertain.

In the summer of 1936, when the *Lotnictwo Wojskowe* expansion plan was taking shape, a force of 30 bomber squadrons, with six aircraft each (180 bombers in all), was requested by the Aviation Command[1]) as the minimum requirement, the Command's earlier recommendations, asking for up to 63 bomber squadrons (378 aircraft), being turned down as unrealistic on economic grounds.

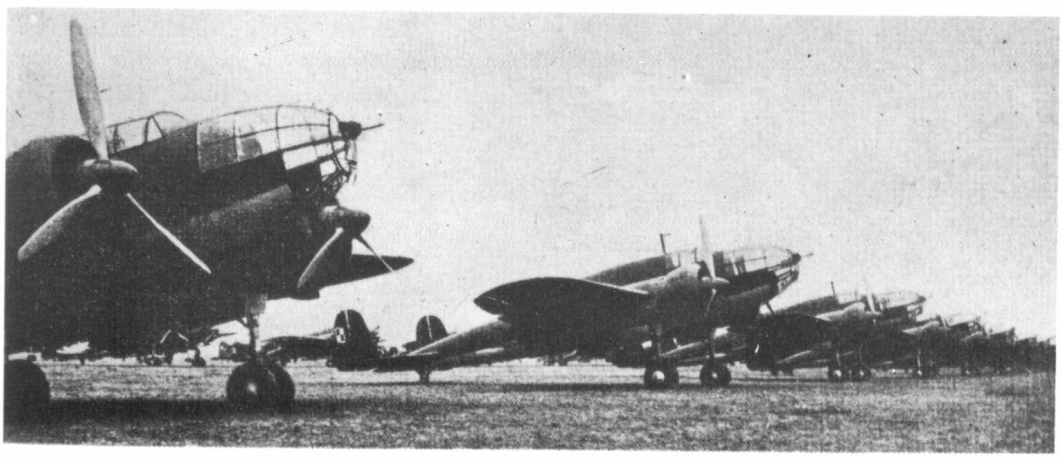
P.37B Łoś B bombers nearing completion at the P.Z.L.-W.P.1 Warsaw plant.



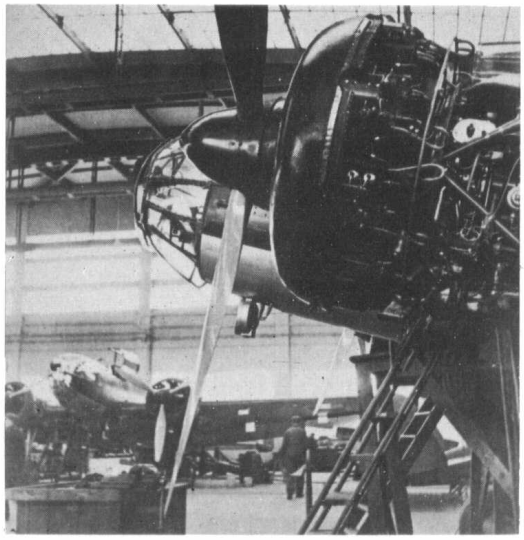
A factory-new standard production P.37Abis Łoś Abis lacking the defensive armament.

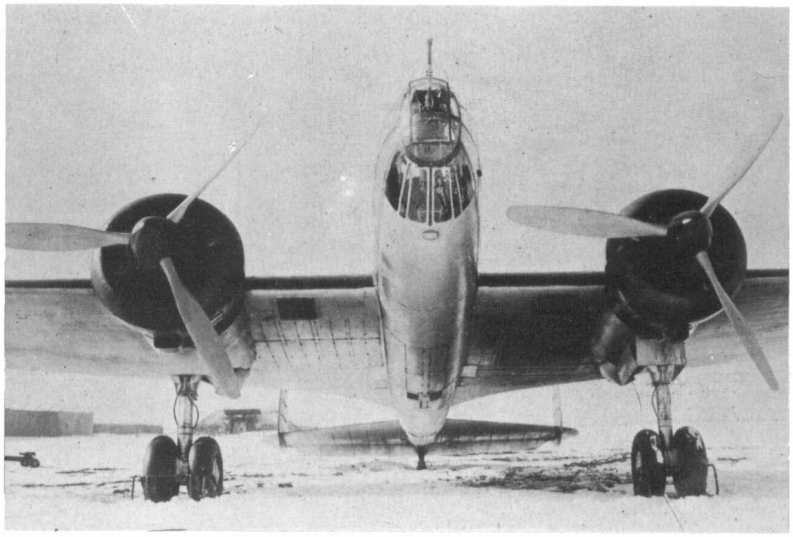


A beautiful photographic study of the first production P.37Abis Łoś Abis during the initial flight trials at the beginning of 1938.



Some of the 54 Łoś bombers massed at Okęcie airfield for the visit of Count Ciano at the end of February 1939.





The plan, initially to be implemented in four years, from April 1937 to April 1941, was to extend over five years, to April 1942, and envisaged the following time table for the build-up of the bomber force:

April 1937—the *status quo:* three bomber squadrons (Nos. 211, 212 and 213), with six Fokker F.VIIb/3ms each;

April 1938—formation of two squadrons (Nos. 214 and 215) with six L.W.S. 4 Żubrs each;

April 1939—re-equipment of the three Fokker squadrons with the P.37 Łoś; formation of three new Łoś squadrons;

April 1940—build-up of the Łoś force to 13 squadrons;

April 1942—re-equipment of the two Żubr squadrons witn the P.37 Łoś; 30 fully operational Łoś squadrons.

However, the army authorities cut down even on this minimum proposal, and the plan, as finally approved at the XVIIth Session of the K.S.U.S. (Committee for Armament and Equipment Affairs) on October 13, 1936, called for the formation of only 21 bomber squadrons with seven aircraft each (147 bombers in all). Later, in 1937, it was decided to increase the size of a bomber squadron to nine aircraft and to reduce the number of squadrons to be established to 16. These twin-engined bomber units were to be supplemented by light bomber squadrons, created by the division of the existing, obsolete army co-operation force into new, separate light bomber and reconnaissance units, which were to be equipped initially with the P.23 Karaś (Crucian-Carp) and later with the P.46 Sum (Sheatfish) single-engined monoplanes.

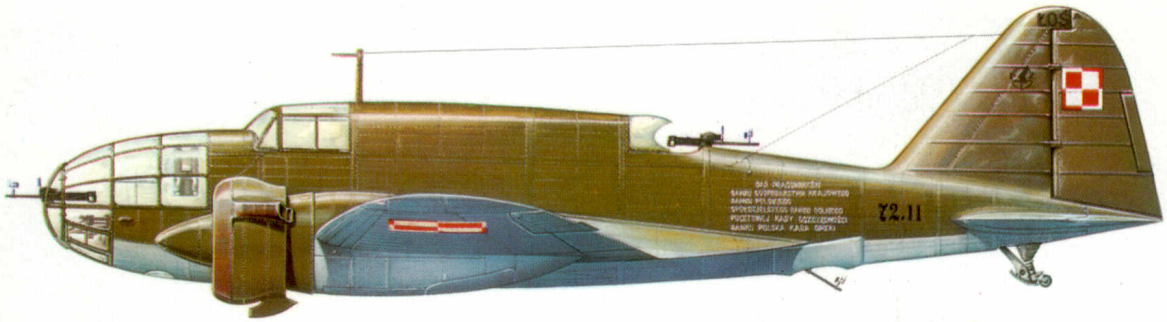
Apart from these changes, the realization of the plan was delayed by an utter failure of the L.W.S.4 Żubr which, because of serious structural faults, became available in quantity only in the middle of 1938 and proved completely unsuitable for operational use. On top of that, in the spring of 1939 the whole bomber programme was stopped in its tracks by the sudden reversal of the equipment policy.

The Łoś was developed in an atmosphere of internal conflicts and tensions. Various officials, advocating the wider use of domestic raw materials, such as wood and fabric, in the construction of aircraft, were deeply annoyed when Dąbrowski's duralumin wonder was approved by the Department of Aeronautics, and every difficulty and mishap in the P.37 development was used by them to undermine confidence in the bomber. In 1936, General Józef Zając, an infantry officer, was pro-

A close up of P.37Abis. Observe the bomb-bay doors in the fuselage underbelly and inboard of the engine nacelles.
(Photo: W. B. Klepacki)

A P.37 Loś in company of P.11a and P.11c fighters from Nos. 111 and 112 Squadrons at the base of the 1st Air Regiment at Okęcie early in 1939.

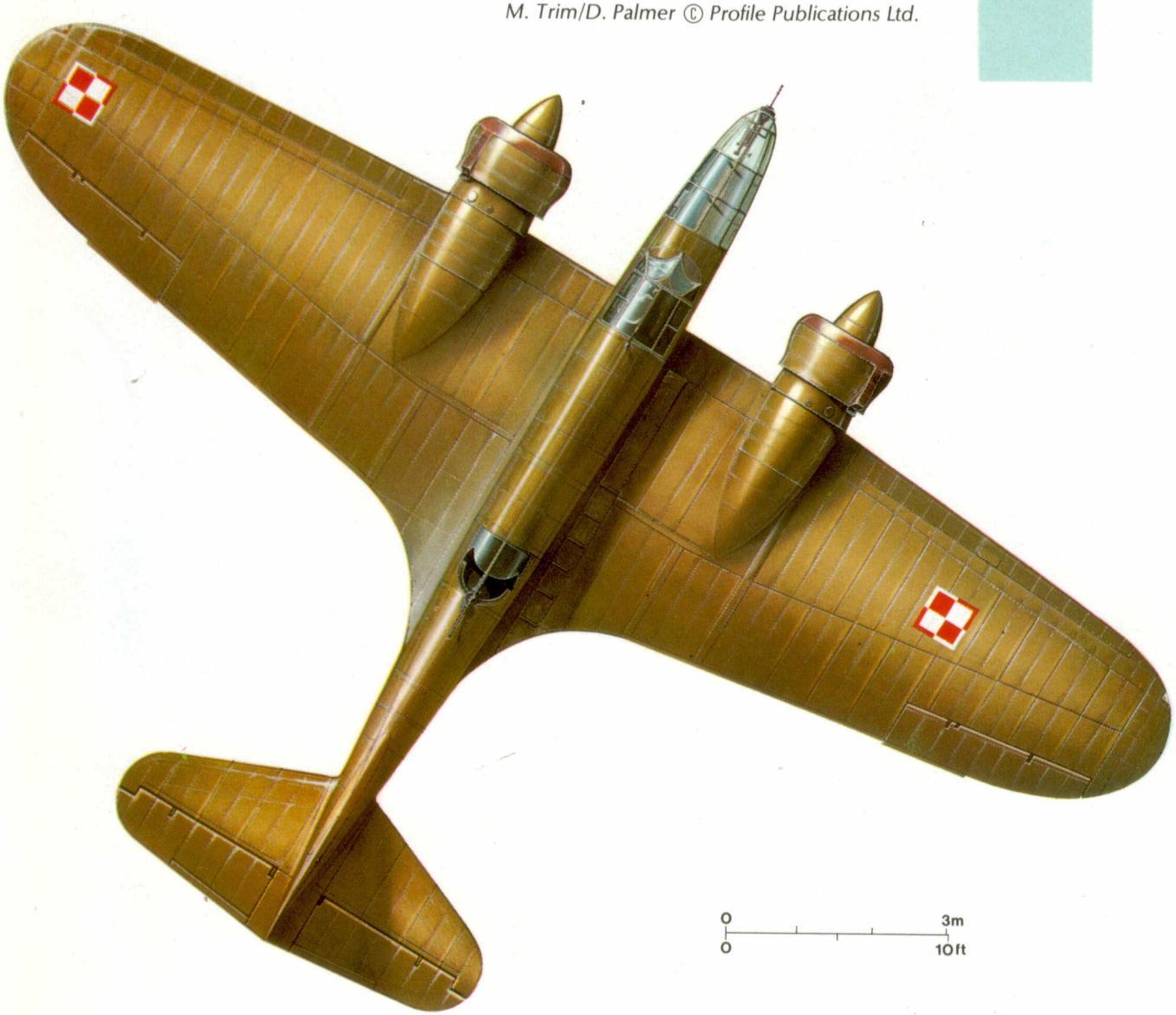
[1]In 1936 the Department of Aeronautics of the Ministry of Military Affairs was renamed the Aviation Command.



P.37A Łoś A (P.Z.L. Pegasus XIIB), serial 72.11, 1st Air Regiment, Warsaw-Okęcie, December, 1938.

Inscription reads:-

DAR PRACOWNIKÓW	(Gift from employees of the
BANKU GOSPODARSTWA KRAJOWEGO	BANK of NATIONAL ECONOMY
BANKU POLSKIEGO	POLISH BANK
SPÓŁDZIELCZEGO BANKU ROLNEGO	CO-OPERATIVE AGRICULTURAL BANK
POCZTOWEJ KASY OSZCZĘDNOŚCI	POST-OFFICE SAVING BANK
BANKU POLSKA KASA OPIEKI	BANK of the POLISH ASSISTANCE TREASURY)



moted to the new post of Inspector of Anti-Aircraft Defence of the State. He was a complete newcomer to aviation, yet, because of anomalies in the organization of the *Lotnictwo Wojskowe* he began to exercise a profound influence upon aviation affairs. He understood the need for fighters and army co-operation aircraft, but bombers represented to him an extravagant class of warplanes which Poland did not require and could afford even less. Inspired by the critics of the Łoś, he voiced the view that the P.37 was not a very satisfactory bomber because it was not provided with dual controls and, when carrying the full bomb-load, it had a limited range. Both allegations were astonishing, but were used effectively to convince many high-ranking army officers who were completely ignorant of aviation matters.

In fact all P.37s were fitted with a detachable control column and rudder bar in the bombardier's cockpit in the extreme nose, while most other medium bombers of World War Two operated without duplicated controls, and full dual controls could be easily added to Łoś if required—as in the case of Łoś A/Abis. As to the second point, it is obvious that range can be increased only at the cost of reduced bomb-load. In the overload condition the P.37 would lift a bomb-load of up to 3.020 kg. (6,657 lb.), which could be exchanged for a maximum range of 4.500 km. (2,796 miles). Surprisingly small in size, the aircraft possessed phenomenal load-lifting capabilities and could carry a bigger load than its own empty weight, an achievement unparalleled by any other contemporary bomber, which, combined with excellent overall performance, put it on top of its class.

When, at the end of March 1939, General Ludomił Rayski resigned as the Commander-in-Chief *Lotnictwo Wojskowe*, the post which he held for 13 years, General Zając at once took steps to cut back the Łoś programme. P.Z.L. was asked to stop production of the bomber immediately at 104 aircraft but, as this request was totally impracticable, Zając eventually agreed that a 20 further examples then approaching completion could be finished.

The Łoś was very fast and possessed good manoeuvrability; these attributes were shown to advantage during fighter-like aerobatics at various public displays. In view of the official decision against the build-up of the bomber force and the complete lack of modern fighters, Dipl. Ing. Franciszek Suchos suggested in the spring of 1939 a comparatively simple conversion of the P.37 into a heavy two-seat fighter with eight fixed guns in a solid nose, but the idea failed to evoke any reaction.

The P.37 Łoś in service

First unarmed P.37As were delivered to the Production Aircraft Squadron of the Experimental Dyon[1]) of the 1st Air Regiment at Warsaw-Okęcie base in the winter of 1937-38. These were followed by the P.37Abis bombers, and, in the spring of 1938, a Łoś conversion training unit was formed at the 1st Air Regiment from personnel selected from Nos. 211, 212 and 213 Squadrons. As the Fokkers were gradually withdrawn from the first-line strength, the Łoś conversion unit became No. 213 Squadron. The P.37Bs began to reach the *Lotnictwo Wojskowe* in the autumn of 1938 and, in March 1939, two former Fokker squadrons, Nos. 211 and 212, completed re-equipment with Łoś B and were formed into X/1 Bomber Dyon with the statutory strength of 18 aircraft; nine bombers being in each squadron. A second Łoś Bomber Dyon, the XV/1, comprising two new squadrons, Nos. 216 and 217, with nine aircraft each, became operational in May 1939, bringing the combat strength of the Łoś force to 36 examples. A chronicle of No. 217 Squadron, covering the period from April 17 to October 12, 1939, survived the war, and this document recorded serials of all P.37Bs used by the squadron, which were as follows: (72.) 100, 102, 106, 114, 115, 118, 119, 120, 135, 174, 182 and 210.

Meanwhile No. 213 Squadron, equipped with the early Łoś A/Abis bombers which received full dual controls, was progressively expanded and eventually became the Łoś maintenance centre and the receiving and fitting-out base for all new P.37s arriving from P.Z.L. unarmed. In the summer of 1939 the squadron, moved to the new base at Malaszewicze, possessed about 40 Łoś bombers, including several of the B variant which constituted equipment reserve for the combat units.

Towards the middle of 1939, the four Łoś operational squadrons, supplemented by five P.23 Karaś squadrons, were organized into a Bomber Brigade, an independent tactical formation under the orders of the C.-in-C. Polish Armed Forces. On August 24, the Łoś units were mobilized and five days later were ordered to move from their peacetime Okęcie base to combat airfields in the region of Dęblin. The X/1 Dyon, commanded by 2nd Colonel Józef Werakso, with No. 211 Squadron under Captain Franciszek Omylak and No. 212 Squadron under Captain Stanisław Wołkowiński, was established at Ulęz. The XV/1 Dyon, commanded by Captain Stanisław Cwynar, with No. 216 Squadron under Captain Władysław Dukszto and No. 217 Squadron under Captain Eugeniusz Prusiecki, was established at Podlodów.

Through indecision on the part of the Polish High Command as to how to use the bombers and the necessity of changing the allotted airfields, the aircraft were not used in force until the fourth day of war. The first operational sortie to be carried out by Łoś was a reconnaissance mission flown by a single aircraft from the X/1 Dyon at noon on September 2, and a similar flight was made on September 3. On the same day, the P.37s were made ready for a retaliatory raid on Königsberg in East Prussia, but the C.-in-C. Polish Armed Forces refused permission for the action. The impatient crews, strained by inactivity almost to

[1]The Experimental Dyon worked in liaison with the I.T.L. and conducted service suitability and acceptance trials with military models. It consisted of the Prototype Aircraft Squadron and Production Aircraft Squadron.

Key to colour views

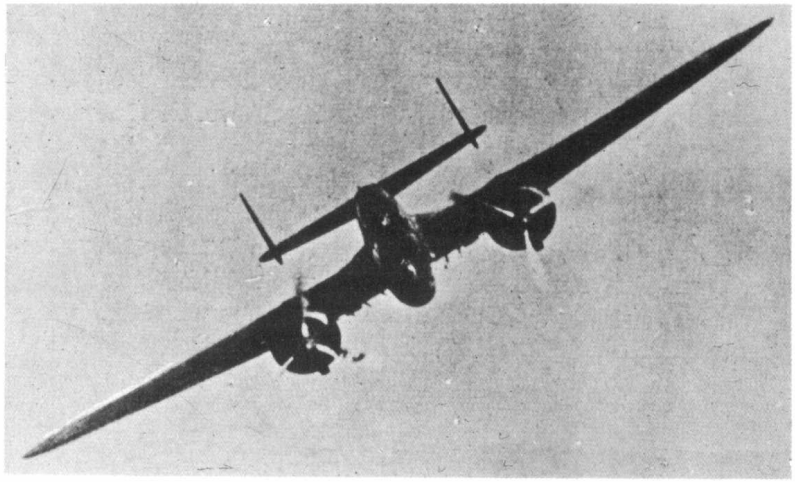
P.37B Łoś B (P.Z.L. Pegasus XX), Serial 72.91, X/1 Bomber Dyon, Ulez, August 31, 1939.

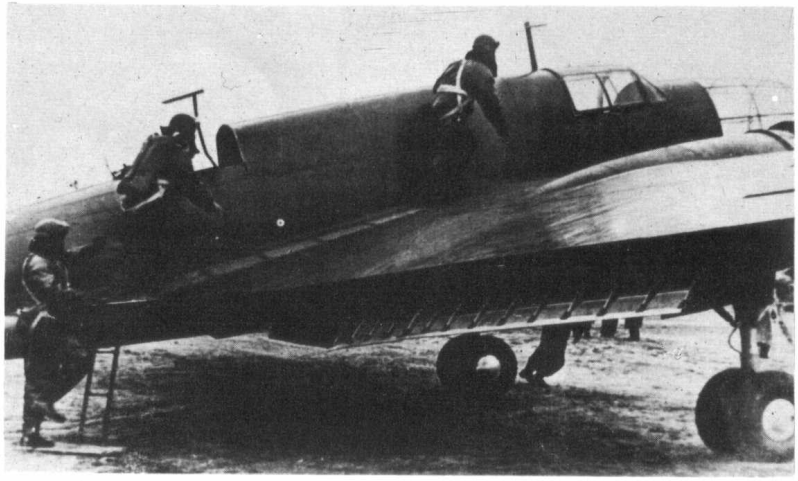
P.37A Łoś A (P.Z.L. Pegasus XIIB), Serial 72.11, 1st Air Regiment Warsaw-Okecie, December, 1938.

the limits of human endurance, at last went into action on September 4. All 17 serviceable bombers from the X/1 Dyon and 11 from the XV/1 Dyon, each carrying 1,200 kg. (2,645 lb.) of bombs, struck in waves at the German armour, with smaller groups repeating the attacks again in the afternoon. Despite heavy anti-aircraft defences, the enemy, and in particular its XVIth Armour Corps, suffered crippling damage. Two Messerschmitt Bf 109 fighters were shot down by Łoś gunners, but eight Polish bombers and five crews were lost in the day's actions.

During the following days the Łoś bombers continued the concentrated bombardment of the German armour, mainly in the region of Radomsko-Piotrków on the central front and in the Pułtusk area in the north. The enemy armour thus engaged was brought to a halt but, through heavy losses and supply shortages, the Łoś bombers were unable to maintain the pressure, so that the effects of their courageous strikes were tragically short-lived. On September 9, Łoś units were instructed to collect 20 replacement aircraft from No. 213 Squadron at Małaszewicze, but eventually only nine were received (three by the X/1 Dyon and six by the XV/1 Dyon), and only three of these could be used operationally, as the others lacked full armament and some essential flying instruments. Combat sorties were flown until September 16, but because of the small number of bombers involved they were of little consequence. On the next day the Russians struck at Poland's back, and the Bomber Brigade was ordered to withdraw to Rumania.

During the September Campaign, in addition to some 30 reconnaissance missions, over 100





1
This head-on view of Łoś reveals the slimness of the bomber's fuselage.

2
Łoś crew members on the way to their cockpits. (Photo: W. B. Klepacki)

3
A line-up of Łoś Abis bombers with flying and ground crews in front of the aircraft. The second bomber bears the serial 72.17.

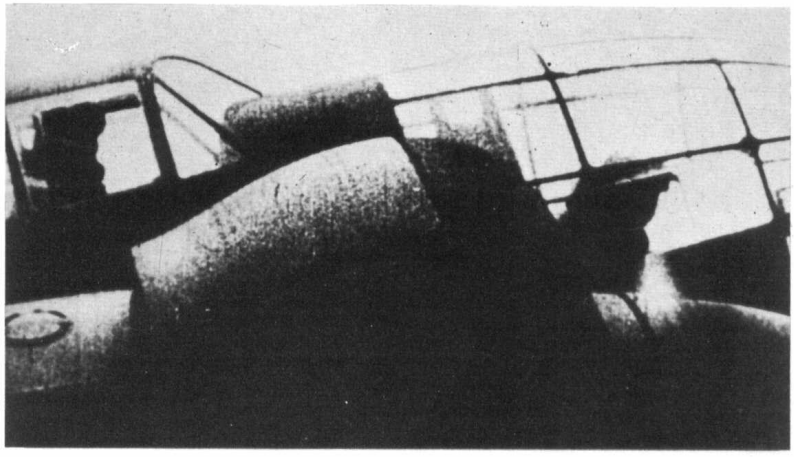
A pilot mounts the Łoś' cockpit.
(Photo: W. B. Klepacki)

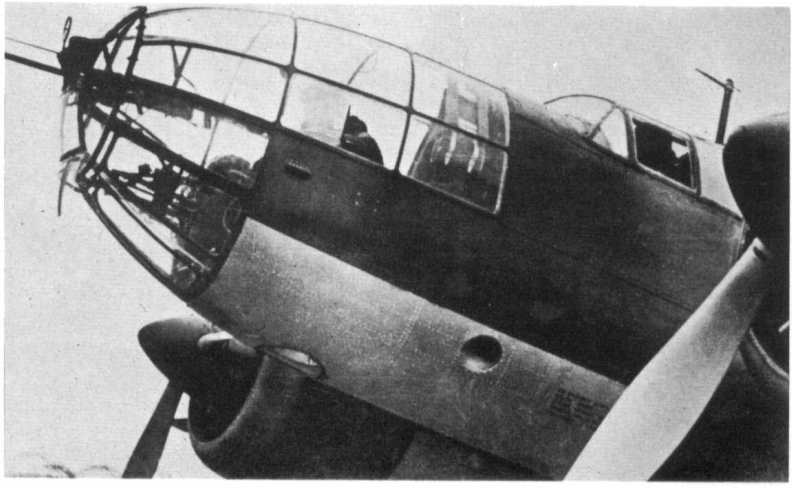
▼ 1
A close up of the Łoś' engine cowling and the pilot's and navigator's/bombardier's cockpit on a 'still' from a newsreel.
(Photo: A. Morgała)

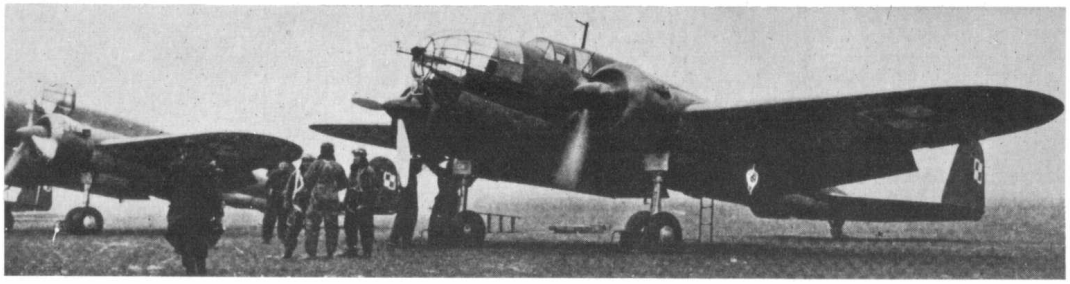
▼ 2
The nose of a Łoś bomber with a machine-gun on a flexible P.Z.L. mounting.

bomber sorties were flown by the P.37s, which dropped a total of about 150.000 kg. (330,700 lb.) of bombs and were credited with shooting down six Bf 109s. Of the outgoing strength of 36 bombers and nine replacement aircraft, 26 P.37s were lost as follows: 12 shot down by enemy defences; four lost in landings because of battle damage; two destroyed on the ground by the *Luftwaffe's* action; seven lost or abandoned through accidents or mechanical failures; one shot down by Polish anti-aircraft fire. Nineteen bombers, seven of the X/1 Dyon and 12 of the XV/1 Dyon, reached Rumania, and these, together with more than 20 P.37s of No. 213 Squadron were later impressed into service with the Rumanian Air Force. Three Łoś bombers (one of them being serial 72.125), presumably from No. 213 Squadron or factory examples, landed by mistake in Russia. A special team from the Soviet Scientific Research Institute for Aviation examined two of the aircraft at the landing site and the Russian test pilots Stefanovski and Nyuchtikov flew them to the Institute's base. The bombers, demonstrated before Soviet government officials and later used in a number of research programmes, were highly praised by the Russians. In October 1939, one of the P.37s captured by the Germans was overhauled by the W.P.1 plant (renamed by the Germans Brandenburgische Werke) and delivered to one of the *Luftwaffe's* test centres for trials.

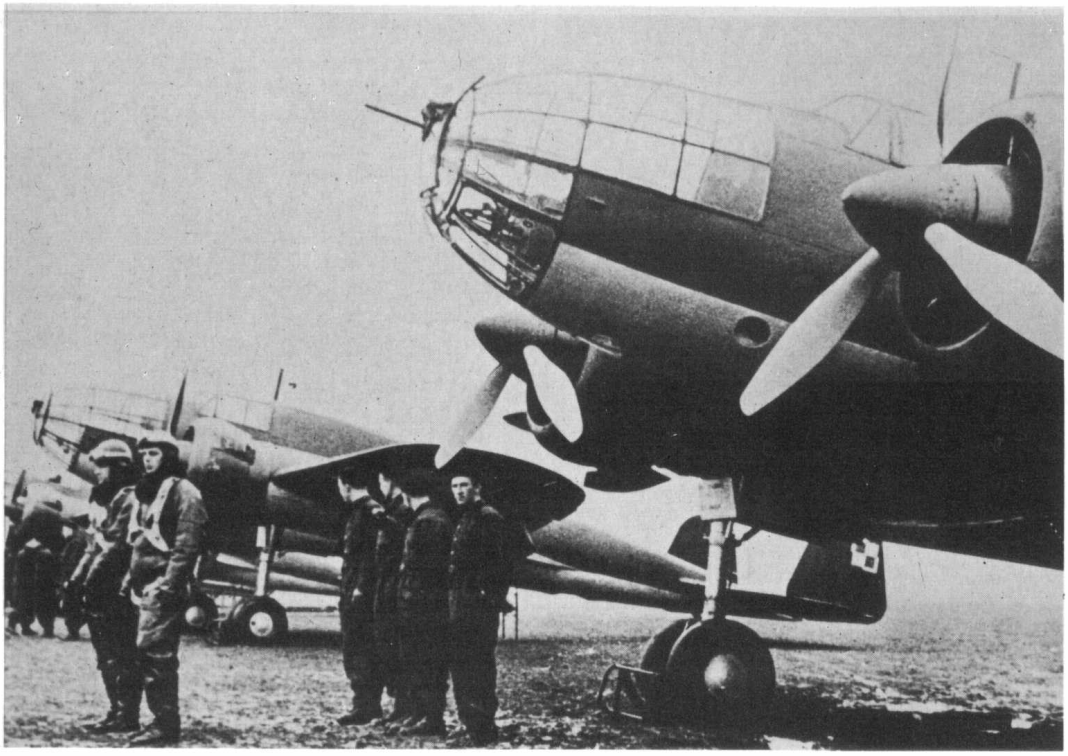
The ex-Polish P.37s in Rumania, refitted and modified by the addition of a small window on either side of the fuselage above the ventral gun position[1], were formed into three bomber



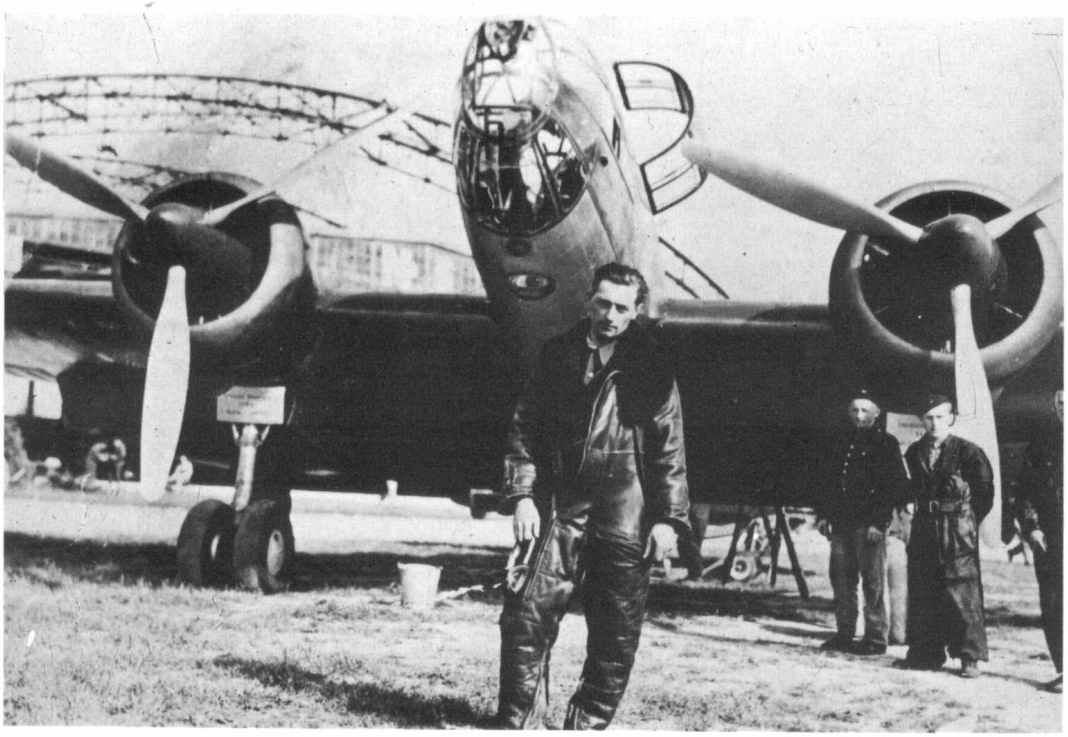




Łoś bombers with engines being warmed-up.



The X/I Bomber Dyon on parade with the Łoś serial 72.43 in full view.
(Photo: A. Glass)

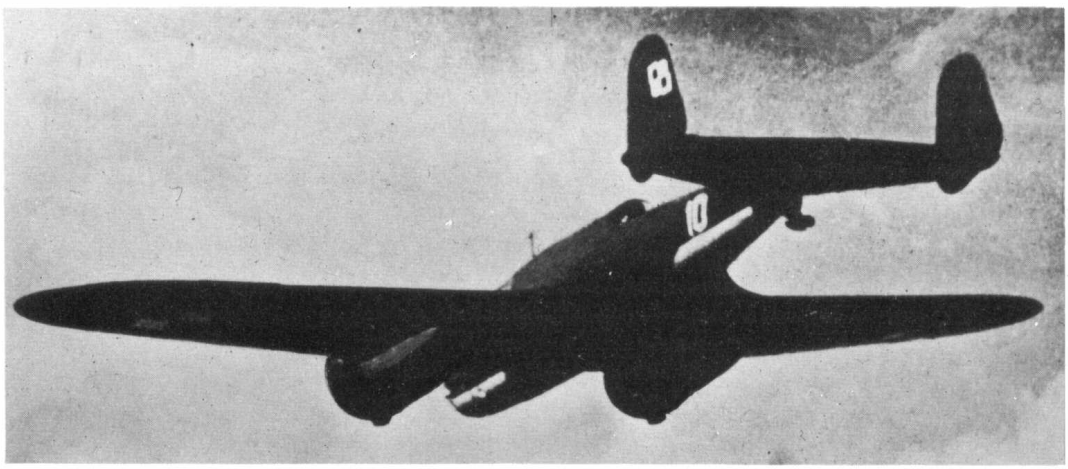


A Łoś bomber in front of No. 6 hangar of the 1st Air Regiment at Okęcie base. Call-number 803–N is partly visible on the outer wing undersurfaces.
(Photo: T. Żychiewicz)

squadrons, which constituted a quarter of the Rumanian bomber force deployed, under the command of the German Air Fleet, *Luftflotte* 4, against Russia, and played an important part in the capture of Bessarabia and the Rumanian thrust into Ukraine in the summer and autumn of 1941. Some of the P.37s survived the war and the Rumanian Government offered to return them to Poland, but the Polish authorities showed complete indifference and the P.37s stayed in Rumania. At least one Loś was still flying in the colours of the Rumanian Air Force in the mid-1950s, serving as a target-tug.

[1] Refer to page 139. This modification was first introduced experimentally on some Lotnictwo Wojskowe P.37B bombers in the summer of 1939.

Łoś bomber at Okęcie airfield.



A previously unpublished flying study of an operational Łoś B bomber of the 1st Air Regiment. Note the white number 10 on the fuselage. (Photo: T. Żychiewicz)

The P.37 Łoś: Technical description

The P.37 Łoś was a cantilever monoplane bomber of all-metal construction, manned by a crew of four. The wing, set halfway between the true low- and mid-wing positions, was built in three parts: A centre-section—carrying the engines and main undercarriage units and built integral with the fuselage—and two tapering outer sections. The structure, evolved on the Misztal principle, was built up round a load-carrying central box consisting of light front and rear spar, joined at the flanges in the fore-and-aft plane by a stress-bearing sandwich skin comprising an internal layer of corrugated heavy-gauge light alloy sheet and smooth outer duralumin sheet. The undersurface of the centre section was covered by hinged panels which formed the bottom of the bomb-bay. The outer sections, featuring detachable wingtips, D-section leading-edges and hinged trailing-edges bolted to the central box, were fitted with Handley Page auto slots, which could be locked by the pilot, and with split trailing-edge flaps inboard of the ailerons. The differential ailerons were balanced statically and aerodynamically. The total wing area was 53,5 square metres (575.9 square feet).

The fuselage was an oval-section, semi-monocoque structure built up of frames and light longerons and covered with a smooth duralumin skin reinforced internally by Z stringers. The pilot was seated in an enclosed, heated and well-ventilated cockpit, with the radio operator, who also manned the ventral gun, behind. The navigator/bomb-aimer, who commanded the bomber, was accommodated in the glazed nose, and was provided with detachable dual controls. The open dorsal gunner's position was partly screened by a transparent canopy.

The twin fin and rudder tail assembly—or the single fin and rudder in the case of Łoś A—was a cantilever all-metal structure covered with smooth duralumin. Rudders and elevators were balanced statically and aerodynamically, and were fitted with Flettner tabs which could be operated in flight.

The undercarriage consisted of two main oleo-pneumatic legs, each carrying the Kubicki-system twin wheels. The wheels were raised backwards into the engine nacelles, the apertures being fully closed by doors. The retraction was by an electrically-driven pump with an emergency hand pump. The wheels were fitted with pneumatic brakes. A sprung tail-skid, combined with a tailwheel, swivelled through 180 degrees.

The standard powerplant comprised either the 873 h.p. P.Z.L. Pegasus XIIB (Łoś A/Abis series), or 918 h.p. P.Z.L. Pegasus XX (Łoś B) air-cooled, supercharged, 9-cylinder radials, driving Hamilton/P.Z.L. (licence-built Hamilton Standard) variable-pitch, 3-blade metal propellers. Export models were to be powered by various marks of the Gnome-Rhone 14N air-cooled, 14-cylinder two-row radials, but any other radial of up to 1,200 h.p. could be installed. The fuel tanks, housed in the wing centre-section and in the fuselage, had a normal capacity of 1,500 litres (329 Imperial gallons). Additional tanks with a total capacity of 900 litres (198 Imp. gal.) could be carried in place of two 300 kg. (661 lb.) bombs. A further reduction in the bomb-load could increase the tankage correspondingly. Oil capacity was 220 litres (48 Imp. gal.).

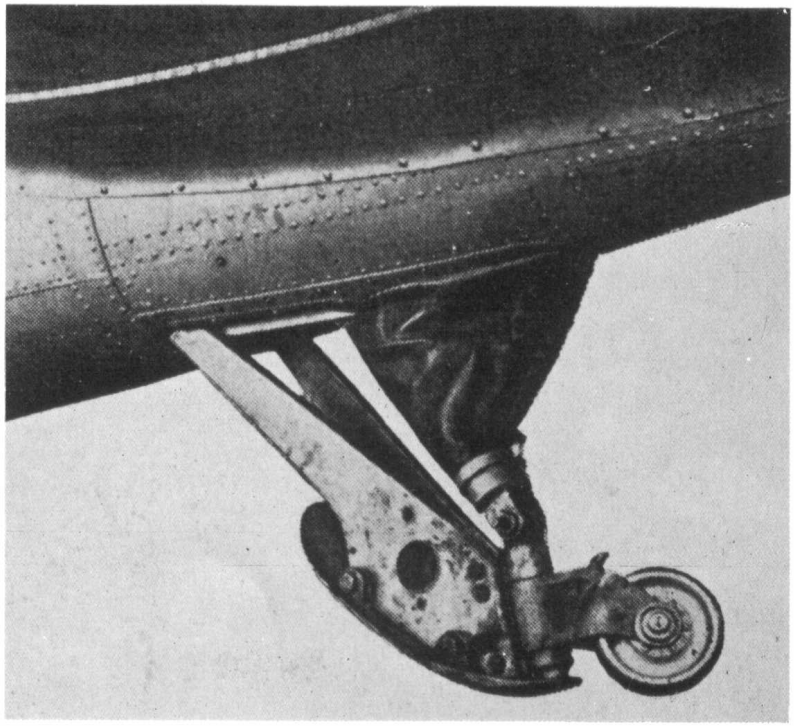
Defensive armament comprised three single 7,7 mm. machine-guns, either of the Vickers F or the Polish KM Wz 37 types, on flexible P.Z.L. mountings, in the nose, dorsal and ventral positions, the latter two guns being housed in the fuselage when not in use. A total of 1,700 rounds was carried for the three guns. All bombs were hung in a series of double tiers across the wing centre-section and fuselage stretching from one engine nacelle to the other. The standard combinations were: 20 x 50 kg. (110 lb.); 20 x 110 kg. (242 lb.); or a combination of 18 x 110 kg. (242 lb.) and 2 x 300 kg. (661 lb.) bombs. The maximum bomb-load to be carried internally was 2.580 kg. (5,688 lb.); but, in the overload condition, four extra 110 kg. (242 lb.) bombs could be hung up—increasing the maximum load to 3.020 kg. (6,657 lb.). Electrically- and hand-operated bomb releases were installed, permitting the discharge of bombs singly or in salvoes at intervals of 0·1 to 2 seconds, or the whole load simultaneously. Four flares were carried, two in each engine nacelle.

Full night-flying equipment—with engine-driven generators, navigation, instrument and landing lights, including a powerful retractable headlight was carried. R/T and direction-finding radio were installed. Cameras could be mounted in the fuselage. Other equipment also included full oxygen installation and automatic and manual fire extinguishers.

P.37 ŁOŚ SPECIFICATION [1]

	P.37Abis	P.37B	P.37C	P.37D
Span (metres)	17.90	17.93	17.93	17.93
(ft. in.)	58.9	58.10	58.10	58.10
Length (metres)	12.90	12.92	12.92	12.92
(ft. in.)	42.4	42.5	42.5	42.5
Height (metres)	5.08	5.08	5.08	5.08
(ft. in.)	16.8	16.8	16.8	16.8
Wing area (square m.)	53.50	53.51	53.51	53.51
(sq. ft.)	575.9	576.0	576.0	576.0
Empty weight (kg.)	4225	4280	4300	4300
(lb.)	9314	9436	9479	9479
Disposable load (kg.)	4275	4280	4280	4280
(lb.)	9425	9436	9436	9436
Loaded weight (kg.)	8500	8560[2]	8580[2]	8580[2]
(max. normal) (lb.)	18739	18872	18915	18915
Wing loading (kg./m.[2])	158.9	160.0	160.3	160.3
(max. normal) (lb./sq.ft.)	32.54	32.77	32.82	32.82
Power loading (kg./hp.)	4.87	4.66	4.42	4.08
(max. normal) (lb./hp.)	10.73	10.27	9.72	8.99
Max. speed (km./h.)	410	445	460	490
(m.p.h.)	254.7	276.5	285.8	304.4
at (m.)	2150	3400	4000	5100
(ft.)	7053	11154	13123	16732
Ceiling (with 2.200 kg. = 4,850 lb. (m.)	5000	6000	7000	9000
bomb load) (ft.)	16400	19680	22960	29520
Ceiling (mid-range (m.)	8500	9250	10500	10500
without bombs) (ft.)	27890	30350	34450	34450
Range (with 2.200 kg. = 4,850 lb. (km.)	1400	1500	1450	1600
bomb-load) (miles)	870	932	901	994
Range (with 1.760 kg. = 3,880 lb. (km.)	2400	2600	2600	2700
bomb-load) (miles)	1491	1615	1615	1677

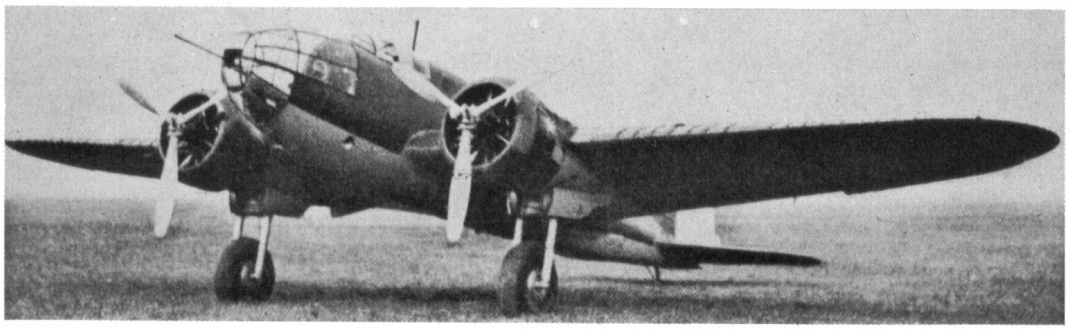
[1] Factory data; all performance figures guaranteed within 5 per cent.
[2] Maximum permissible loaded weight 8.900 kg. (19,621 lb.).



A close-up of the Łoś tailskid, combined with a tailwheel.

ACKNOWLEDGEMENTS

The author wishes to express his thanks to Wacław B. Klepacki for his collaboration in preparing meticulous engineering drawings for the colour artwork, and to A. Glass, A. Morgała and T. Żychiewicz, Polish aviation historians and archivists, for the help with the photographic material.



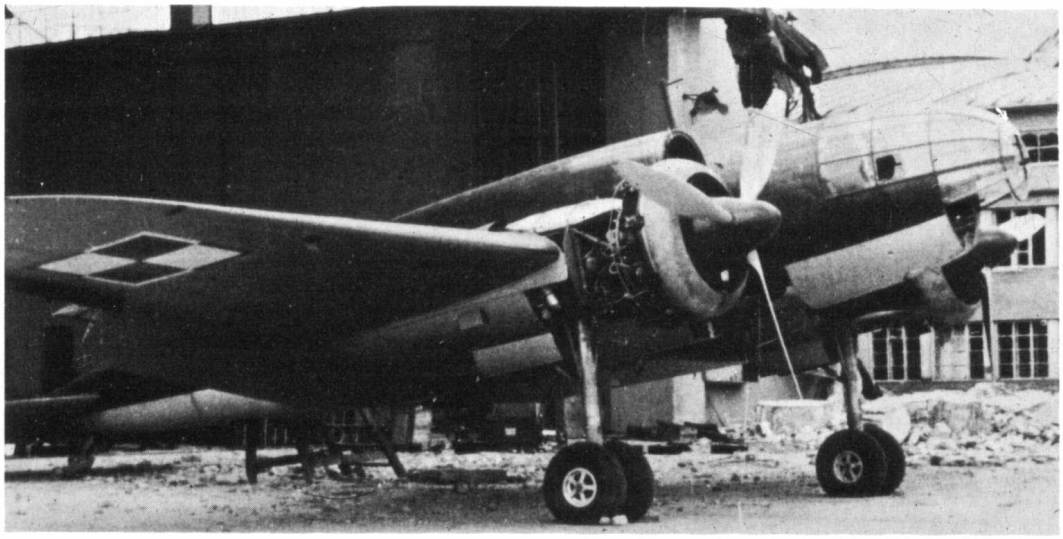
Another view of the P.37/I prototype.

THE P.37 ŁOŚ ORDER BOOK

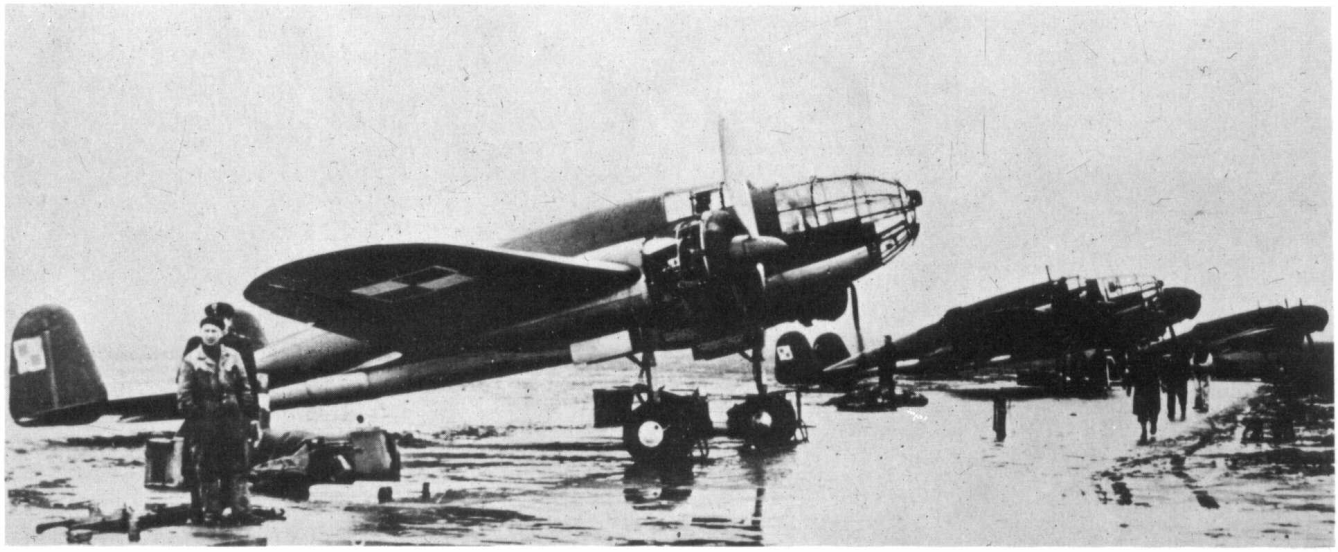
Customers	Number ordered	Number built	Designation	Serial Nos.	Remarks
Lotnictwo Wojskowe					
Prototype order	2	2	P.37/I (1)[1] P.37/II(1)[1]	72.1 72.2	Plus one static airframe
Pre-production series	10	10	P.37/III(1)[1] P.37A(9)	72.3–72.12	Originally 10 P.37As and no prototype
II series	20	20	P.37Abis	72.13–72.32[2]	Including SP-BNL
III series	50	50	P.37B	up to 72.210[3]	Reduced to 94. By September 1939 last 18 in final assembly stage.
IV series	50	44	P.37B		
V series (tentative)	50	None	P.37B		Order cancelled.
Export					
Bulgaria	15	None	P.37C	—	Delivery by June 1940.
Rumania	30	None	P.37D	—	Delivery in 1940.
Turkey	10	None	P.37D	—	Plus parts for 25 and a licence.
Yugoslavia	20	None	P.37C	—	Delivery by June 1940.
Greece (tentative)	12	None	P.37D	—	

[1] Two prototypes for the factory use on development work; the P.37/II accepted by the *Lotnictwo Wojskowe* in exchange for the P.37/III.
[2] Believed to be changed to non-consecutive serials in 1938.
[3] The highest known P.37B serial from existing records.

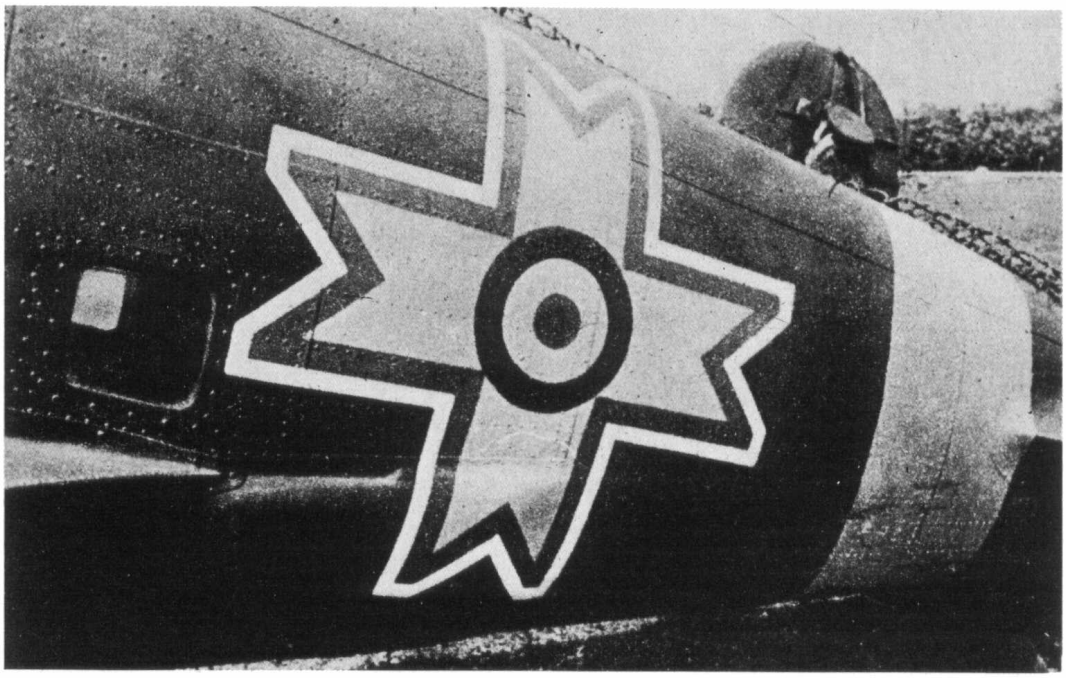
Series Editor
CHARLES W. CAIN



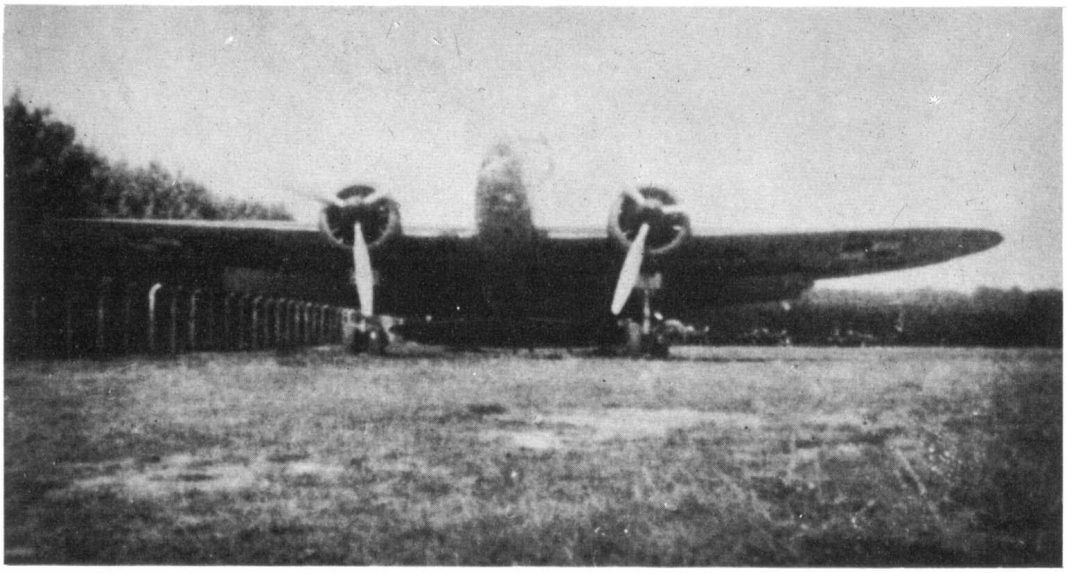
A recently completed P.37B, seemingly intact, in front of a damaged hangar at Okęcie airfield, September 1939.
(Photo: R. C. Seeley)



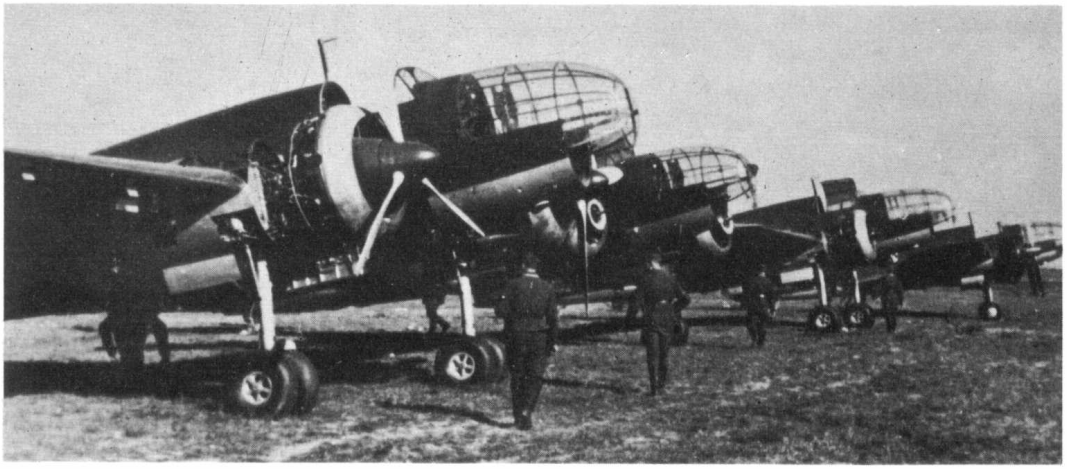
Łoś B bombers of the X/1 Dyon during servicing at Okęcie base in the spring of 1939.
(Photo: A. Glass)



A Rumanian P37B displays additional window on either side of the fuselage above the ventral gun position.



An extremely rare, hitherto unpublished, photograph depicting Łoś Bs of the X/I Dyon at Ulęż combat airfield on August 31, 1939. (Photo: M. Krzyżan)



Almost complete, but lacking equipment and armament, P.37B bombers captured by the Germans undamaged on the grounds of the P.Z.L.-W.P.1 plant at Okęcie in September 1939. (Photo: R. C. Seeley)

One of the ex-Polish P.37B bombers used by the Rumanian Air Force during offensive operations against Russia in 1941.