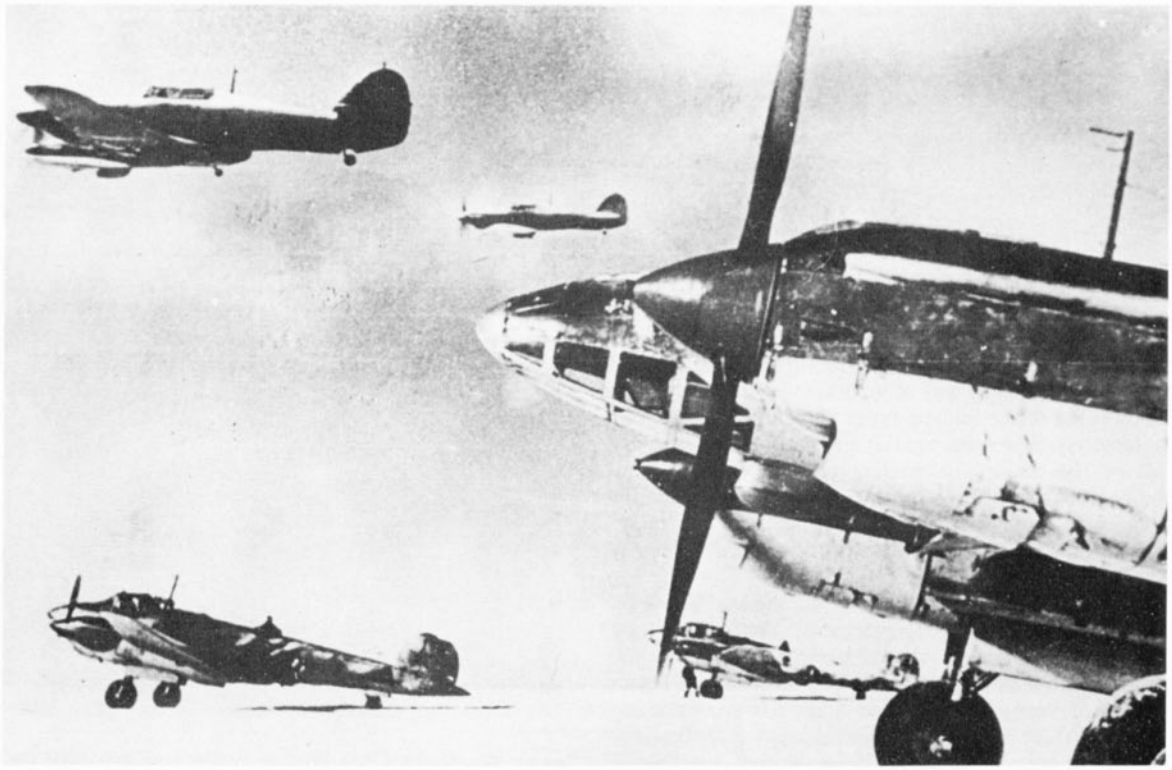
PROFILE 216

PETLYAKOV PE-2



A "still" from a Soviet documentary made in northern Russia in late 1941 when the Royal Air Force No. 151 Wing (Hawker Hurricanes) was based in the U.S.S.R. Acting as bomber escorts, the Hurricanes had to fly full throttle to keep up with Pe-2s.
(Photo: Soviet Official.) **Unless otherwise stated, all photographs are from this source**

Petlyakov Pe-2 and Variants

by Malcolm Passingham and Waclaw Klepacki

VLADIMIR Mikhailovich Petlyakov was a pupil of the illustrious N. E. Zhukovskii and was an associate of A. N. Tupolev from 1920 onwards. As such, he was involved in the design of the ANT-1 right through to the Pe-8 four-motor bomber which was originally designated ANT-42 (Soviet Air Force TB-7).

V. M. Petlyakov met his death in an air crash in late 1942, a year after being awarded Stalin's Premium in recognition of the designer's most famous achievement, the dive-bomber Pe-2. It is perhaps ironic that this aircraft—now regarded as one of the most important combat aircraft of the Second World War—was the instrument of Petlyakov's demise. A modest man, V. M. Petlyakov was scheduled to attend a meeting and, rather than arrange the personal transport his important status could command, he "hitched a ride" in a Pe-2. In flight, weather conditions deteriorated. He was deeply mourned but his name lived on in more than 11,000 Pe-2s built. From first to last they served in the giant Eastern Front conflict of 1941-45.

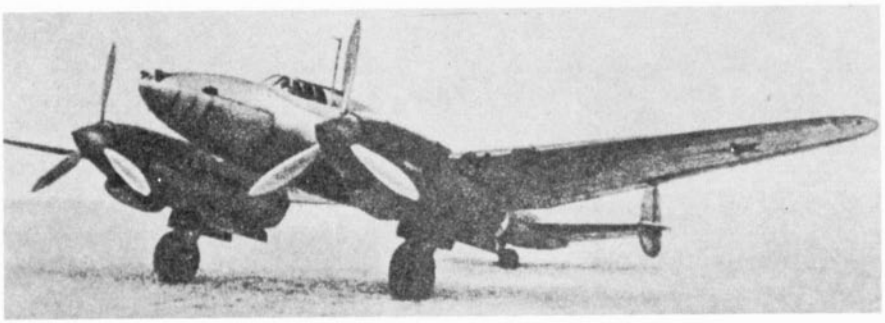
DEVELOPMENT: VI-100 TO PB-100

Towards the close of the 1930s, the design bureau then headed by V. M. Petlyakov was given the responsibility of evolving an advanced, high-altitude bomber interceptor. The requirement was to result in a compact, all-metal, two-motor monoplane with a pressurized cabin for the crew of two. Allocated the type number of 100, the prototype fitted into the classification of "Vysotnyi Istrebitel" or High-altitude Fighter—the VI-100.

VI-100. Within the demands of a very tight schedule, the VI-100 prototype was completed in early 1939. But, before the test-flying programme could be initiated, a change in official policy brought about the cancellation of the high-altitude fighter requirement. In its place, the Petlyakov bureau was called upon to produce a high-altitude bomber. To this end, the VI-100's engineering served as a logical starting point.

In respect of the original VI-100—and to achieve best-possible high-altitude results from both aircraft and aircrew—the airframe was designed around turbo-supercharged engines and a pressurized compartment for the crew. Fitted with TK-3 turbo-superchargers, the two M-105R liquid-cooled 12-cylinder Vee inlines (based on the French Hispano-Suiza 12Y formula but further developed by and credited to the aero-engine bureau of V. Ya. Klimov) each supplied 1,100 h.p. for take-off.

Perhaps the most unusual feature of the VI-100 was the high-altitude pressurized cabin system devised by Doctor of Technical Sciences M. N. Petrov. Both the pilot and the defensive gunner had separate cockpits joined by a long but hermetically-sealed canopy which



Left: *Known as "Sotka" ("The One Hundred"), the original prototype VI-100.*

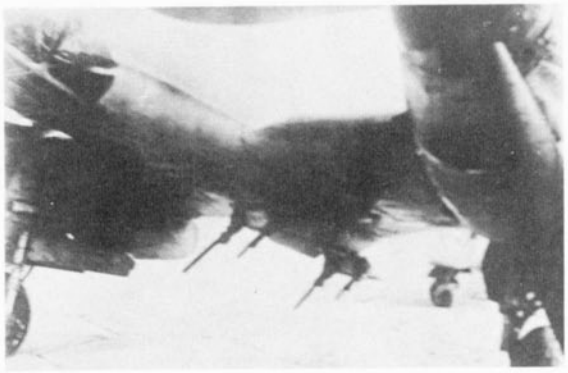
Below: *A prototype PB-100 modified for "Strafing" attack with four angled guns; 2×20-mm and 2×12.7-mm.*
(Photos: Soviet Official via Jean Alexander and Vaclav Nemecek)

provided excellent all-round visibility. So entry (and exit) was effected by way of separate ventral hatches, the seats being of the fold-up type. The gunner—operating a remotely-controlled machine-gun—was situated just aft of the mainplane trailing-edge. The problem of bailing-out in an emergency was solved by incorporating a quick-release device for the hatches.

The VI-100 had a forward-firing offensive armament of four cannon and machine-guns.

High-altitude Bomber. In redesigning the VI-100 for the high-altitude bomber requirement, the turbo-supercharged M-105R were retained and most of the airframe details. Bomb stowage had to be provided and the Petrov system of pressurized cabin was adapted to accommodate a crew of three housed in the forward part of the fuselage. The extra crew member would be the navigator/bomb-aimer. Whereas in the VI-100 fighter the defensive gunner was in charge of one remotely-controlled gun, in the bomber arrangement he had both dorsal and ventral remotely-controlled machine-guns to operate.

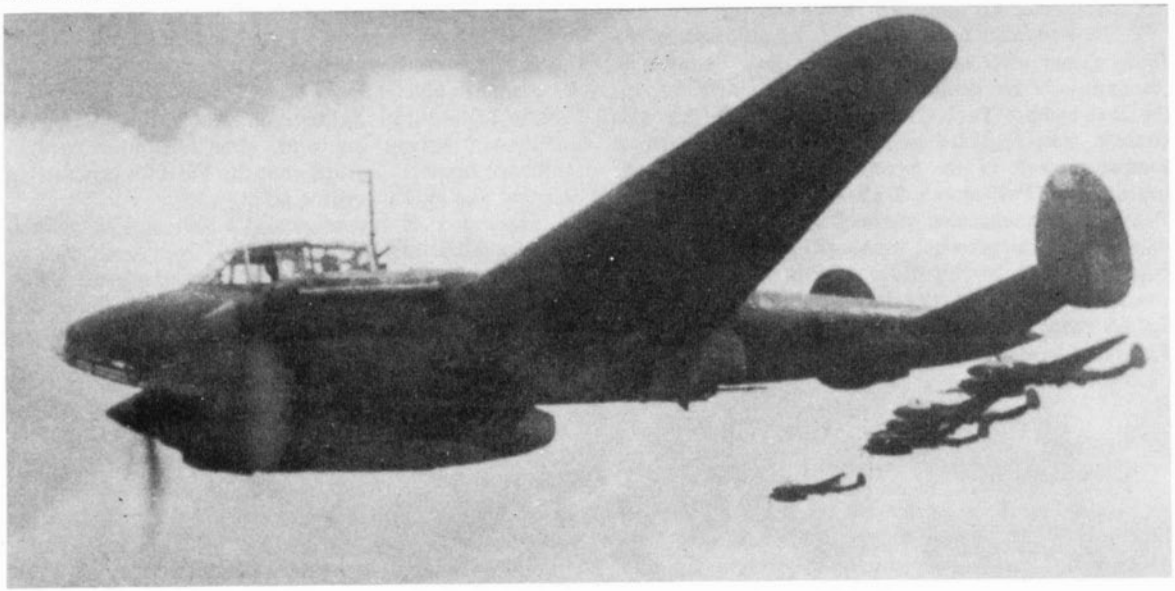
Before the prototype could be completed, yet another change in policy (in 1939) was introduced. Logically, doubt may have been cast on the relative efficiency of high-level "pin-point" bombing. At this period, the only nation which had pursued an active advancement of high-altitude bomb-sights was the U.S.A. with the much-vaunted and highly-secret Norden device. On the other hand, the Civil War in Spain had provided the Soviet authorities with first-hand experience of what could be achieved with dive-bombers.



PB-100. In scrapping the high-altitude bomber requirement, the Petlyakov design bureau was directed to prepare a dive-bomber variant of the VI-100—essentially a "front-line" bomber to be used in close-support of the ground forces. Incidentally, the instruction was given on the recommendation of the Air Force Technical Testing Centre, the NII-VVS—Nauchno Ispytatelnyi Institut (of the Voyenno Vozdushnye Sily or Military Air Forces).

The revised specification also brought about a change

Ventral gun position shows in this Winter 1941–2 photograph of early production Pe-2s. Photographer S. Kafafyan accompanied Pe-2s on their Front-line bombing missions.
(Photo: via John Stroud)



With snow falling, Winter 1941–2, a Pe-2 is readied for a bombing sortie.

Below:
Another close-up of the same Pe-2 appears on page 113.
(Photos: via John Stroud)

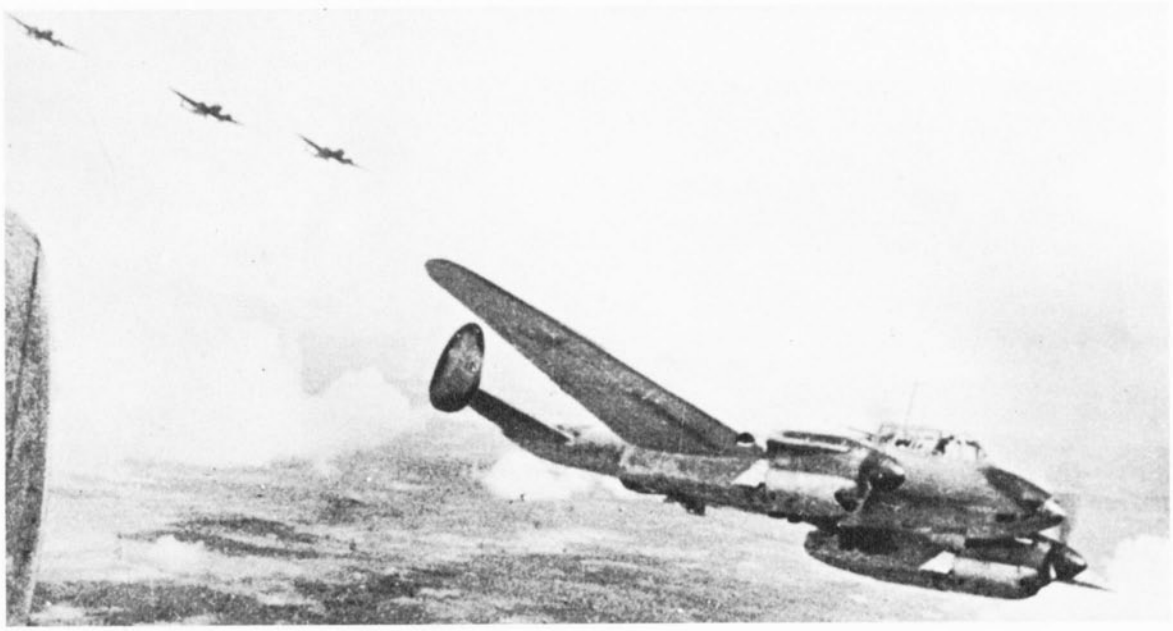
in designation to PB-100, the classification now being "Pikiruyushchii Bombardirovshchik"—Dive Bomber.

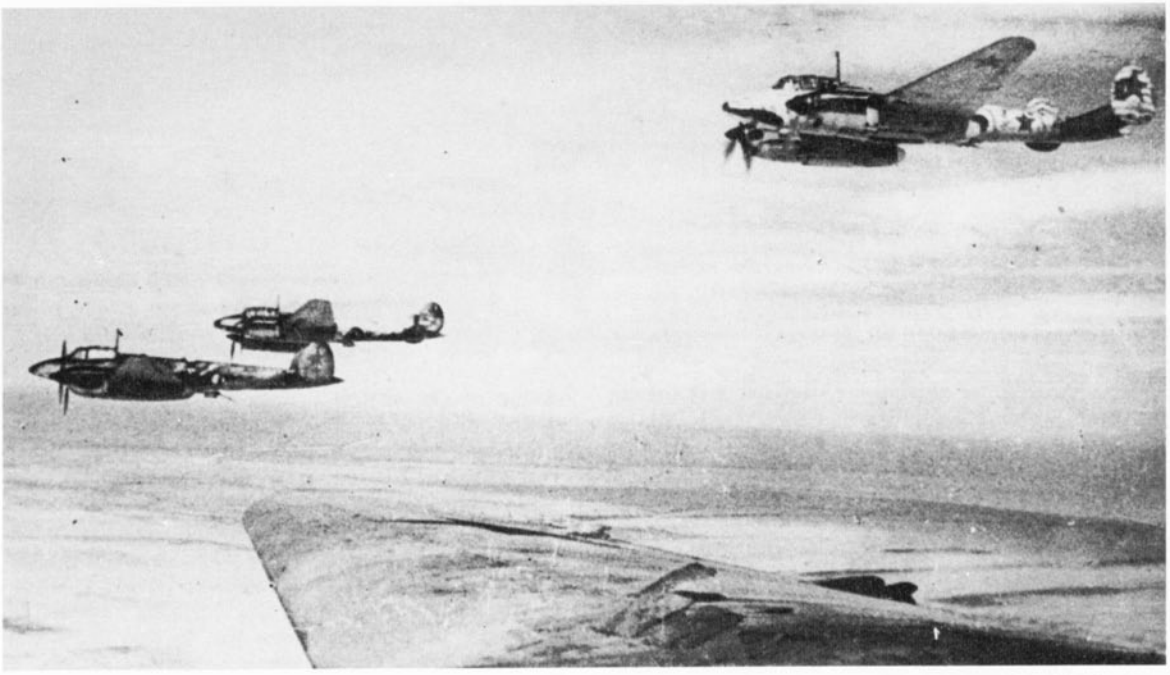
Since high-altitude performance characteristics were no longer of paramount importance, the design bureau dispensed with both the turbo-superchargers and the pressurization system. The new requirement also permitted some simplification of crew accommodation and armament layout. The navigator was to operate the flexible dorsal machine-gun while the gunner-radio operator—located in the rear amidships—would be in charge of the ventral defensive machine-gun. Large slatted dive-brakes were installed outboard of the underslung engine nacelles.

Test-flying the PB-100. With the prototype ready, the NII-VVS test pilot, P. M. Stefanovskii, prepared for the first flight on December 22, 1939. Prior to this, as he has since related, Stefanovskii had some doubt about the relatively small size of the twin fins and rudders. Nevertheless, he went ahead with the test-flying schedule. In the event, the chief test pilot was to have his doubt confirmed—in suitably dramatic fashion!

As was customary, the main undercarriage was locked in the "down" position for the first flight which began more or less as planned. But on the turn into the very first circuit, things began to happen in rapid succession. First, the starboard M-105R quit and Stefanovskii was left with asymmetric power. Next, the turning moment to the right increased and at the same time the test pilot felt the controls "go very loose". In this rapidly deteriorating position, Stefanovskii realised that the flight path would take him to the roof of a hangar. He was losing height and even if he cleared the hangar, just beyond were various servicing and test area"obstacles"—not least of which were big wooden static test stands for undercarriage retraction trials on full-size aircraft. Narrowly

Pe-2s (M-105R engines) heading for enemy concentrations. The Pe-2 in the foreground reveals both the underwing dive-brakes and the externally-mounted bombs inboard of the nacelles.
(Photo: via John Stroud)





With ventral guns "at readiness", Pe-2s outward bound and photographed from another "Peshka" ("Pawn"). The winter camouflage of early 1942 is noteworthy.
(Photo: via John Stroud)

missing the hangar, Stefanovskii saw the test stands immediately ahead. Then the PB-100 hit the ground hard and "bounced" back again sufficiently to clear the obstacles. Which says much for Stefanovskii's skill and the ruggedness of the main gear. Strangely enough, the production Pe-2 retained a reputation for being a "bouncer" and sensitive on landing although this characteristic in its extreme form saved both Stefanovskii and the PB-100 prototype on the first test flight.

On the subject of increasing the tail area, Stefanovskii had the satisfaction of noting that there was no subsequent argument. The fin and rudder areas were enlarged by almost one-third.

Evaluation of the PB-100. When the test programme had been completed, Stefanovskii and his colleagues made their report on the PB-100.

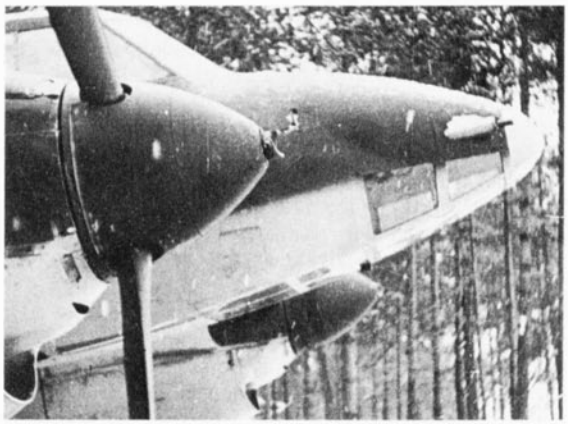
The general view was that the PB-100 was "a fine aircraft" and behaved well in its dive-bombing attitudes. The PB-100 possessed "steady behaviour" in a dive so that the (initial) bombload of 600 kg (1,323 lb) could be placed accurately on target. With dive-brakes extended, the diving speed did not exceed 600 km/h (373 mph). Dive recovery was effected by way of an automatic electro-mechanically-operated device.

The PB-100 was also extremely rugged aircraft with a high stress (safety) coefficient of eleven. For example, initial diving experiments took the PB-100 to speeds of up to 725 km/h (450 mph). And, on one occasion, an NII-VVS test pilot took the PB-100 into a very steep dive and the dive-brakes failed to extend. Despite exceeding

A rare photograph of the reconnaissance version, the Pe-2R, which carries two external fuel tanks inboard of the engine nacelles.
(Photo: via Air-Britain archives)

Excellent close-up showing disposition of pilot on port side and navigator/dorsal gunner on starboard rear. Pilot's heavily armoured seat also shown on page 127.

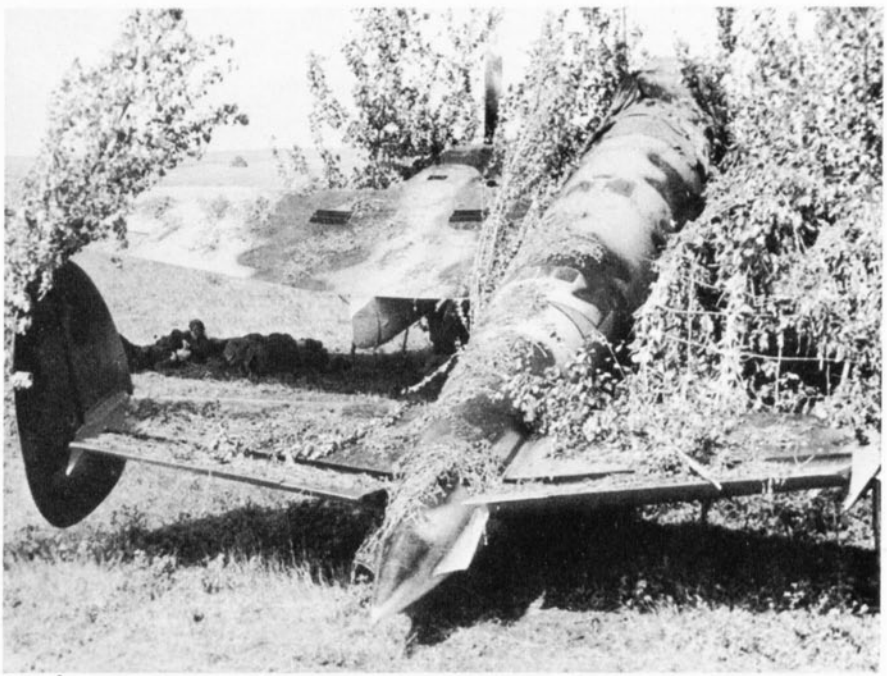
Below: *For extreme winter engine starting, nothing improved on the British Hucks system. The spinner Hucks-type starter "dog" is apparent; also starboard nose gun, the 12.7-mm Beresin UBS m.g.*
(Photos: via John Stroud)



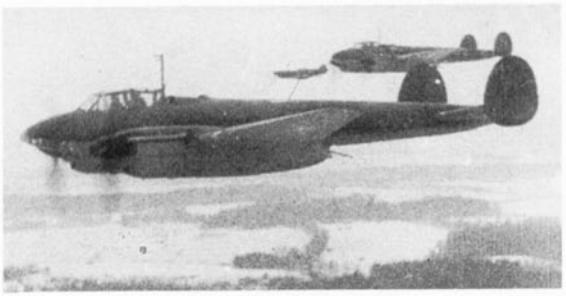
the stress coefficient limit—and reaching an unprecedented diving speed of around 800 km/h (500 mph)—the PB-100 survived the experience without mishap!

Stefanovskii has said that by the standards of the time (1939–40) the landing speed range was perhaps "rather high"—160–177 km/h (100–110 mph). Also, that in inexperienced or insensitive hands, the PB-100 was prone to stall and whip into a spin without warning. Similarly, heavy landings could result in "bouncing" as previously related.

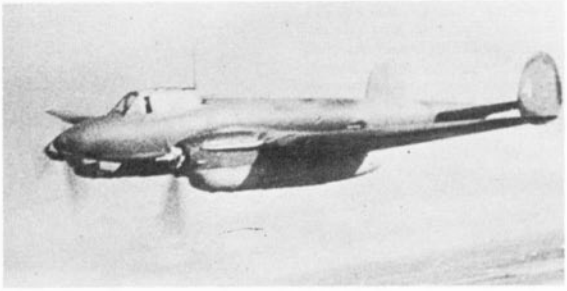
On the credit side, however, the PB-100 had an overriding advantage for a dive-bomber, namely, a fine turn of speed which rivalled that offered by new fighter prototypes then under test. And, with a maximum speed of 540 km/h (335 mph) at 5.000 m (16,400 ft), the PB-100 outflew many fighters then in combat service.



Excellent photograph indicating a type of ground camouflage employed by the Soviet Air Force "in-the-field". The long tail cone identifies this as an early production Pe-2. Flat top to M-105R cowling and its two radiator outlets are evident.
(Photo: via Imperial War Museum, ref. RUS673)



Pe-2s of the same sequence appearing on pages 111 and 113. In the background, two fighter escort LaGG-3s flying in parallel suggest a falsely elongated engine shape. (Photo: via John Stroud)



Another example of an early Pe-2. This one has the port spinner removed yet appears to still be retaining the other one. Pilot has his side window slightly open. (Photo: Soviet Official film "still")

More PB-100 testing. In common with all other Soviet Air Force aircraft, the PB-100 had to be able to operate effectively in the worst sub-zero temperatures and to be able to take-off and land on ice and snow. Accordingly, skis replaced the wheels and Stefanovskii took the first ski-equipped PB-100 into the air. He operated the retract mechanism which functioned without incident. The NII-VVS test pilot later related how he had then reversed the procedure prior to landing. But although the "down" control indicated this state, neither he nor his navigator could see the skis protruding. Stefanovskii then told the navigator to operate the emergency hand-cranking servo gear. After the prescribed number of turns, the main skis were still not in evidence. The mystery was soon solved. There, through the top of the wings were the undercarriage pistons torn off their hinges. After a "soft" snow landing—with damage little worse than bent propeller blades—Stefanovskii recalls that one of the ground engineers had the temerity to complain about the state of the propellers. Which was too much for the NII-VVS test pilot who exploded with some remarks in the direction of some undercarriage specialist designers. He summed up his feelings: 'If you left it to them, they probably want to fit wooden sleighs!'

Two of Stefanovskii's colleagues were less fortunate. On their first-test of the second PB-100, A. M. Khripkov (pilot) and P. I. Perevalov (navigator) were accompanied by their chief. The flight was successful. Not so for test flight number two. At some point during the take-off run, fire broke out and the crew compartment rapidly filled with blinding black smoke. By some mischance, the second prototype PB-100 mowed down several people before striking a trench and turning over on its back. Both crew members sustained various injuries resulting in hospitalization and, because bystanders had been killed, both the pilot and navigator were subjected to arrest. Several months later Khripkov and Perevalov were cleared of charges and they continued in the Air Force until their retirement.

"Front-line" strafer PB-100. Although the PB-100 was primarily tested for its dive-bombing effectiveness, modifications were carried out to convert a prototype into a "front-line" strafer for use against infantry. For this purpose it was equipped with a battery of four guns (two 20-mm ShVAK cannon and two 12·7-mm UBK heavy-calibre machine-guns). Mounted amidships and diagonally to the fuselage centre-line, the battery provided a fixed, forward-firing discharge. This PB-100 variant was not accepted for production.

THE PE-2 IN PRODUCTION

When the PB-100 was put into large-scale production

Typical of "in-the-field" operations. In the foreground, an array of 250 kg and the smaller 100 kg bombs. Although an obviously "posed" photograph, the view shows the rear dorsal gun and just reveals the porthole gun position, extreme right. (Photo: via John Stroud)

The Pe-2 was designed to work from unprepared surfaces as this view indicates of the dry summer conditions which prevailed.
(Photo: via John Stroud)

in 1940, the dive-bomber was redesignated the Pe-2. This was in accordance with the newly introduced Soviet Air Force procedure of designating production aircraft with the first syllable of the surname of the bureau chief. In day-to-day communications, it became more usual to allude to Pe-2s simply as "Petlyakovs" or, with some familiarity, as the "Peshki"—the busy "pawns" of the chessboard, a favourite pastime in the Soviet Union. Whether as a single "Peshka" or in strength as "Peshki", the Pe-2 was to be much in demand during the Russo-German conflict of 1941–45 which the Soviet Union names as the Great Patriotic War.

Some idea of the eventual build-up of the Pe-2 production can be gained from the following statistics. In 1940 the first two production Pe-2 were completed. In the first half of 1941 another 462 rolled off the assembly lines and, despite the German invasion in June of that year—and the need to relocate strategic industries to safe areas behind the Urals—the second half of 1941 netted another 1,405 Pe-2s. Eventually, Pe-2 units were to comprise around 75% of all two-motor bombers operating on all Soviet fronts and the grand total is quoted as 11,426.

Another "flaps down for take-off" view. (Photo: via John Stroud)

Pe-2 number "12" lurches dustily towards its position for take-off during the summer of 1942. The significance of the light-coloured band on the wing is not known.
(Photo: via Imperial War Museum, ref. RUS4441)

Pe-2 description. Details of standard production Pe-2s appear under the heading of "Specification" at the end of this *Profile* and such refinements as may be attributed to the Pe-2 are included as part of the main story.

Although the Pe-2 was constantly under scrutiny in the design bureau—Air Force units would naturally supply commentary on any type in which they had to fly and fight!—the demands of refinement were not allowed to interfere with one urgent priority, that of ever-increasing output from the factories.

So the original M-105R-powered Pe-2 remained in production until the new VK-105RF-powered version started coming off the assembly lines in February 1943. By this time the Pe-2 had various small aerodynamic trimmings—elimination of all unnecessary sources of turbulence—which led to the worthwhile benefit of an additional 41 km/h (25·6 mph). This was accomplished by tightening up the undercarriage doors, changing the engine cowling shape (oil cooler intake) and reducing the gap between fixed and movable surfaces. Most noticeable, however, are the revised cockpit line when the dorsal turret was installed and the reduction of nose glazing to underside panels only.

Post-war Pe-2s. In the immediate post-war years the Soviet Air Force retained numbers of Pe-2s in service mainly for training purposes. But then, also, several other air forces were equipped with Pe-2s—Poland,

Yugoslavia, Czechoslovakia (redesignated there as B 32) and China.

OTHER VARIANTS OF THE PE-2

In 1941, and again in 1944, re-examination of the original interceptor concept resulted in the Pe-3 and the Pe-2 I fighter variants. Other changes of status included the photographic-reconnaissance Pe-2 R and the advanced trainer Pe-2 UT. Finally, among the noteworthy experimental applications of the Pe-2 were those connected with rocket booster engine trials and some pioneer seat-ejection flight tests.

Pe-3. Essentially, the Pe-3—which appeared during the first half of 1941—was a multi-purpose fighter variant of the yearly production, M-105R-powered Pe-2 dive-bomber.

Despite appearing later than the production Pe-2, the fighter Pe-3 retained several constructional characteristics of the original VI-100. It also retained the latter's fixed, forward-firing offensive armament of two 20-mm ShVAK cannon and two 12·7-mm UBK machine-guns. The defensive armament comprised a single 12·7-mm Beresin UBT machine-gun, flexibly-mounted, for each of the dorsal and ventral positions. Additionally, the Pe-3 was capable of carrying both bombs and underwing rocket projectiles. The Pe-2's underwing dive-brakes were discarded and, to improve combat manoeuvrability, wing leading-edge slots were incorporated.

In overall performance, the Pe-3 mirrored the Pe-2 but with slight advantages being gained because of certain airframe weight reductions and "cleaning-up" by way of aerodynamic refinements. Production was limited to a small series but Pe-3s were in action with both Soviet naval and air force units.

Pe-2 R. For photographic-reconnaissance duties, the Pe-2 R ("Razvedchik"—reconnaissance) was equipped with three cameras coupled to an AK-1 automatic bearing device which, operated by the captain-navigator, kept the Pe-2 R on a steady course (plus or minus one or two degrees) when engaged in oblique/vertical photography. Incidentally, the same AK-1 could be used for accurate control during approach to target when the Pe-2 was used in a bombing role.

The Pe-2 R was intended for both day and night missions and was fitted with two extra fuel tanks (totalling 290 litres or 64 gallons) to provide an extended range of 1.700 km (1,056 miles).

Pe-2 UT. The suffix stands for "Uchebno Trenirovochnyi" or Advanced Trainer and, as an advanced operational trainer, the Pe-2 UT was fitted with dual controls and an entirely separate cockpit and canopy for the instructor well to the rear of the front cockpit.

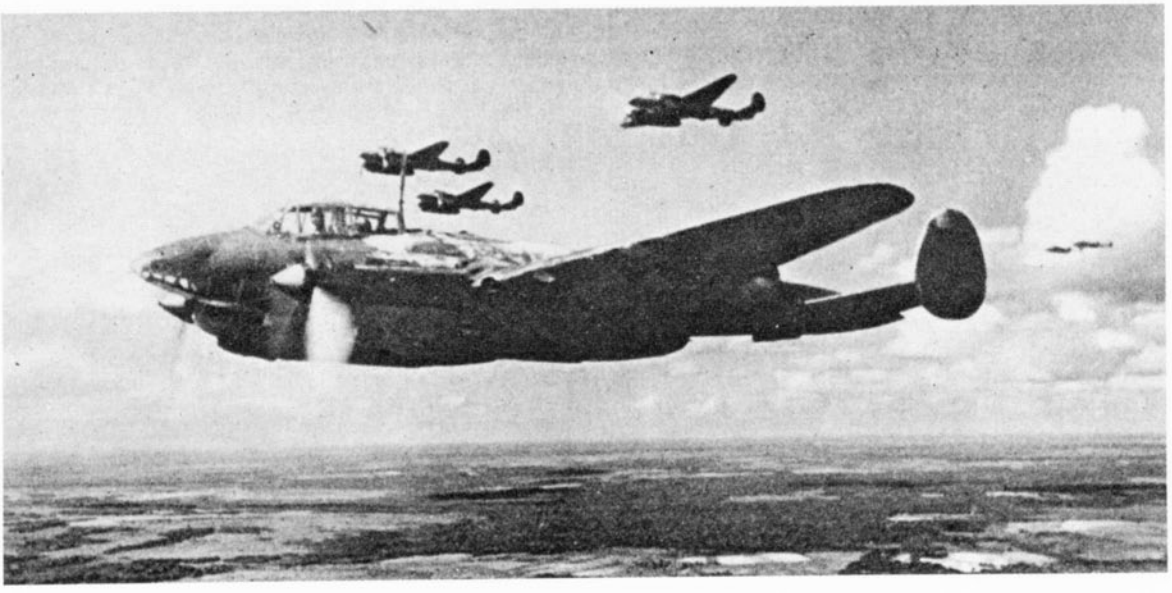
Pe-2 I. In November 1943, the 1,620 h.p. VK-107A (a more powerful development of the Klimov design bureau's M-105/VK-105 Vee inline) passed its official type tests and was put into production. Among the fighters selected for this new powerplant was the prototype of a fast interceptor, the Pe-2 I ("Istrebitel" or Fighter). The prototype Pe-2 I was completed in 1944 and the considerable redesign is credited to V. M. Myasishchev who succeeded A. I. Putilov who took over the Pe-2 design bureau following Petlyakov's death in an air crash in late 1942. This is the same Myasishchev who came into prominence from 1953 onwards in respect of the Mya-4 (NATO code-named as "Bison"), the Soviet Air Force's standard 4-jet intercontinental heavy bomber.

In fighter configuration, the more powerful VK-107As promoted greater performance and, in particular, the

Key to colour illustration

An early production Pe-2 (with M-105Rs) in markings of the 1941–2 period. The red stars with black outline were still painted on the mainplane upper surfaces at this time. Front view (outer wing panels omitted because of page width limitations) shows maximum early-period load of four 250 kg bombs. Extensive nose glazing was later progressively reduced.

Pe-2s returning from a Front-line bombing mission. The tailwheel doors are slightly open. Later production Pe-2s were cured of this source of drag. (Photo: Soviet Official)



M. Trim

An excellent photograph of an intermediate production Pe-2 with more rounded propeller spinners and the original FT dorsal turret. This is the subject of a colour side view on page 124. (Photo: Airphotos, Jamestown, N.Y., U.S.A., ref. 1955)

fighter Pe-2 I is said to have reached its best speed of 657 km/h (408 mph) at 5.700 m (18,700 ft). Offensive armament was also advanced from the earlier Pe-3's two nose-mounted 20-mm cannon to two 23-mm VYa cannon. The rear dorsal defensive armament was retained as a single flexible 12·7-mm UBT machine-gun.

The Pe-2 I was built only in experimental numbers; but, a limited production "front-line" bomber variant served with a few selected units following the defeat of Germany in 1945. With an enlarged internal capacity, the variant could carry up to 2.000 kg (4,410 lb) of bombs with an additional 1.000 kg (2,205 lb) on external wing racks.

Booster rocket-engine trials. Despite the pressures forced on the Soviet aviation industry by the German invasion of 1941, experimental work on jet propulsion units continued. In 1942, for example, the RD-1 liquid-fuel rocket engine made its first appearance. The RD-1 was capable of providing a static thrust of 300 kg (660 lb) and consumed 90,7 kg (200 lb) of fuel per minute—this being a mixture from separate tanks of nitric acid and kerosine. S. P. Korolev, who had carried out a great deal of the research, presented the authorities with a joint report (which also carried the name of the bureau's chief, V. P. Glushko) outlining a proposal to boost the performance of standard production Pe-2 using the new propulsion unit.

S. P. Korolev—who, since the war, has become a noted figure in Soviet space rocket development—suggested that with a Pe-2 carrying some 900 kg (2,000 lb) of rocket fuel, at around 7.000 m (22,900 ft) an extra 108 km/h (67·5 mph) could be added to the maximum speed in an acceleration time of 80–100 seconds. If the unit was to be used for take-off and initial climb, the benefits would be a take-off run shortened by 67 m (220 ft) and climb rate improved by as much as 30 per cent.

The proposal was accepted and a Pe-2 (aircraft no. 15/185) was selected for the experimental installation. The combustion chamber and jet efflux nozzle were housed in the rear of the fuselage and the two tanks of nitric acid and kerosine were installed forward of the rocket unit. The RD-1 operated independently with the exception of the fuel pumps which were activated by the piston engines.

Another intermediate production Pe-2 illustrating the FT dorsal turret with rear-positioned aerial mast still retained. Once airborne, those heavy flying suits would be welcomed.
(Photo: Soviet Official)

The definitive Pe-2 with VK-105RFs cleaned-up engine cowlings and aerial mast removed to the forward position. The oil cooler intakes are revised, too. (Photo: via Imperial War Museum, ref. RUS4750)

For the first in-flight trial of the booster rocket, the modified Pe-2 was airborne on October 1, 1943. A two-minute firing was successfully completed before shut-down on entering cloud. A satisfactory initial speed increment of 91,7 km/h (57 mph) was recorded.

The concluding report for the test programme—bearing the name of V. M. Myasishchev—was submitted in May 1945 and recommended that further booster rocket tests be carried out jointly with the Air Force through its representative. Meanwhile, the programme had logged no fewer than 110 flights with Pe-2 No. 15/185. During the course of the trials, 67 flights were devoted to aspects concerning a reliable ignition system. V. P. Glushko is credited with the perfection of a suitable chemical ignition system—called the KhZ—which led to a further redesignation of the rocket unit which became the RD-1KhZ.

Rocket-booster interceptor proposal. In February 1944, S. P. Korolev submitted a proposal for rocket-boosting Pe-2s to around 14.935 m (49,000 ft) where, it was hoped, they could intercept high-flying German reconnaissance aircraft. As in the original VI-100 prototype, a pressurized cabin would be necessary but, with turbo-supercharged M-105s and one RD-1 rocket unit installed in each engine nacelle, it was envisaged that from normal cruising altitude to interception height, the maximum speed would reach 772 km/h (480 mph). A gun pack of two 20-mm cannon under the centre-section would be operated by the pilot—no other crew member being carried.

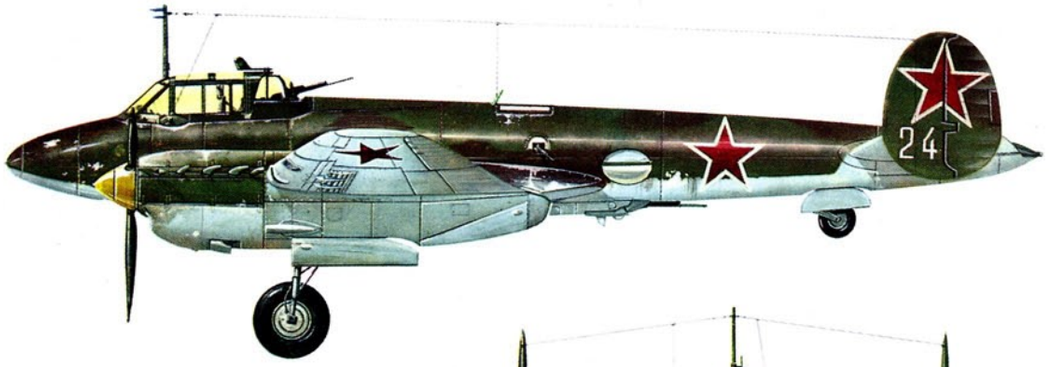
This high-altitude fighter development of the standard Pe-2—the weight increase overall would have been in the order of only 816 kg (1,800 lb)—was not proceeded with nor was a proposal for similar adaptation of the VK-107A-powered fighter Pe-2 I.

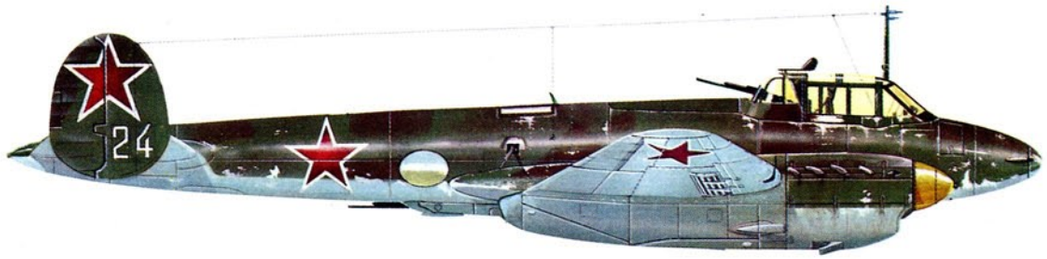
Pe-2 seat-ejection tests. Apart from photographic evidence which became available in the late 1940s, the authors have been unable to trace sources which would provide a more detailed account of Soviet ejection-seat development involving the Pe-2 as a flying test vehicle.

TACTICAL USE OF THE PE-2

By the time Germany attacked the Soviet Union on June 22, 1941, over 450 Pe-2s had left the assembly lines

Another subject for a colour side view on page 124, this is a late production, VK-105RF-powered Pe-2 in Autumn 1944 at Tri Duby airfield during the Slovakian national uprising. (Photo: via Zdenek Titz)





A typical first-line Soviet Bomber Air Regiment "Peshka" (familiarly, the chess pawn) in early 1945 colouring; the "Front-line" dive-bomber Pe-2 with two VK-105RF inlines.

M. Trim

The definitive Pe-2. Period, Autumn 1944. Above the wing root can be seen the open hatch—complete with windshield—and the head of the radio operator/ventral gunner. The porthole gun just below this hatch appears to have been censored. (Photo: via Air-Britain archives)

—at June 30 the figure has already been quoted as 464. Soviet Air Force regiments were thus in the very early stages of converting from the familiar two-motor "horizontal" bombers (exemplified by A. N. Tupolev's SB-series) to the new "dive-bomber". The Pe-2 represented advanced technology and was to demand greater disciplines on the part of aircrews accustomed to the comparative "docility" of the slower Tupolev "fast bombers", the "Skorostnoi Bombardirovshchik" or, simply, "SBs".

Despite the evidence which the Soviets had culled from their own experience of dive-bombing in the Spanish Civil War and the subsequent use of the tactical dive-bomber in the German invasion of Poland in 1939, the specialist role of the Pe-2 was not exploited to the full in the first year of the Russo-German conflict. In fairness, the same observation could be applied to other air forces before and since where entirely new types have been introduced. Refinements in training and combat techniques are rarely evolved overnight.

The fact that the Pe-2 also had the capability of exploitation as a "horizontal" bomber found favour with some bomber air regiments. But there were shining examples of the Pe-2 being employed with great success in its specific dive-bombing role. In this respect, the example of Colonel (later Twice Hero of the Soviet Union Major-General) I. S. Polbin appear with frequent mention in this narrative. Also, the name of A. G. Fedorov who, in August 1942 when he commanded the Pe-2-equipped 9th Bomber Air Regiment, was instructed by the Deputy Chief of the Air Force High Command, General N. I. Krolenko, to prepare a paper on the combat use of the dive-bomber. This was then circulated to all bomber air regiments equipped with Pe-2s. The general remarked that the Soviet aircraft industry was producing a first-class weapon in the Pe-2 and it was the duty of all aircrews to use it with the greatest possible skill.

1941 : Defence of Moscow and counter-offensive

One of the first available references to Pe-2s in combat is in connection with the Soviet counter-attack in the region of Smolensk, July 23–25, 1941. Alongside SB-2s and Il'yushin I1-2s (the famed example of "Shturmovik" or Attacker), Colonel Polbin's Pe-2s of the 150th Bomber Air Regiment played a prominent part. For the three days of the action, the Pe-2s averaged three-four sorties daily against tank and troop concentrations.

In the course of time, the Pe-2 was called upon to engage in combat activities outside the dive-bombing role. An early example refers to the defence of Moscow in July-August 1941. At that time, A. G. Fedorov was attached to a Pe-2 Special Duties Group in the Moscow region. This unit served as a training group and Fedorov was its Bombing Training Inspector. The German Luftwaffe was making night raids on the capital and Fedorov's Pe-2s engaged the enemy. But in a most unusual manner. First they were airborne on the night of July 11–12 to observe the realism of ground-fired decoy targets. Next, and providing considerable realism, on the night of July 22–23, they acted as decoy "pathfinders". In this, they led the Heinkels (two-motor He 111s) to selected dummy targets where they let go live bombs! The deception was regarded as successful enough for the ruse to be repeated again on several occasions.

At the same time, more positive action was desired and to this end, some Pe-2s were fitted with two underwing searchlights. Cooperating with other groups flying single-seat fighters, Fedorov's searchlight Pe-2s achieved some measure of success. This night interception was carried out without the advantage of airborne radar aid; but, with the disadvantage that the Pe-2s were roaming around inside the Moscow Anti-Aircraft Defence Zone. On the night of August 10–11, 1941, the Pe-2s claimed four enemy bombers.

Fedorov has since related that, with three other Pe-2s, he was cruising at 5.000 m (16,400 ft) over Moscow. Ground explosions revealed the silhouettes of Heinkels (He 111s) and Dorniers (Do 215s). Fedorov positioned the Pe-2 towards the leading Do 215 and his navigator, Lieutenant Korol, operated the searchlights. Despite vigorous evasive manoeuvres, the Do 215 was held in the pincer of light and was engaged by one of the single-seat fighters. The German bomber fell away on one wing and finally exploded. From start to finish the engagement lasted a brief four minutes.

In the first major Soviet counter-offensive of the Great Patriotic War, December 1941, Pe-2s were well to the fore. In front of Moscow the Soviet 10th Army advanced and, despite bad weather conditions, Soviet aircraft flew some 800 sorties in the first three days. Pe-2s of the 28th Bomber Air Division alone contributed some 90–100 sorties daily. The tactical support afforded by Pe-2s is instanced by the work of another unit, Colonel V. E. Nestertsev's 23rd Bomber Air Division. On December 9, the 23rd's Pe-2s annihilated an enemy troop convoy retreating along the Klin-Teryaeva Sloboda road. The first wave of nine dive-bombers straddled the head of the convoy with bombs and machine-gun fire. Ten vehicles were set on fire and the convoy was blocked. Two further waves of Pe-2s swept in and completed the total destruction.

When the enemy struck in June 1941, only a few dozen Pe-2s were fully operational. With its fighter-type turn of speed, the Pe-2 presented the then standard Messerschmitt Bf 109 E ("Emil") with insufficient disparity to permit easy interception. Later, in 1942, when the Bf 109 F appeared on the Russian Front, Pe-2 formations were forced to leave their best operational cruising height of between 3–4.000 m (9,800–13,100 ft) and fly at between 5–7.000 m (16,400–22,900 ft).

Fighter pilots of the British Royal Air Force were also early witnesses to the Pe-2's speediness. On September 24, 1941, Hawker Hurricane Mk. IIBs of No. 151 Wing operating from Vianga (in the far north, near Murmansk), acted as fighter cover for a Pe-2 bombing mission. The Hurricane pilots found that they had to fly at full throttle in order to stay with the dive-bombers.

1942: The year of Stalingrad

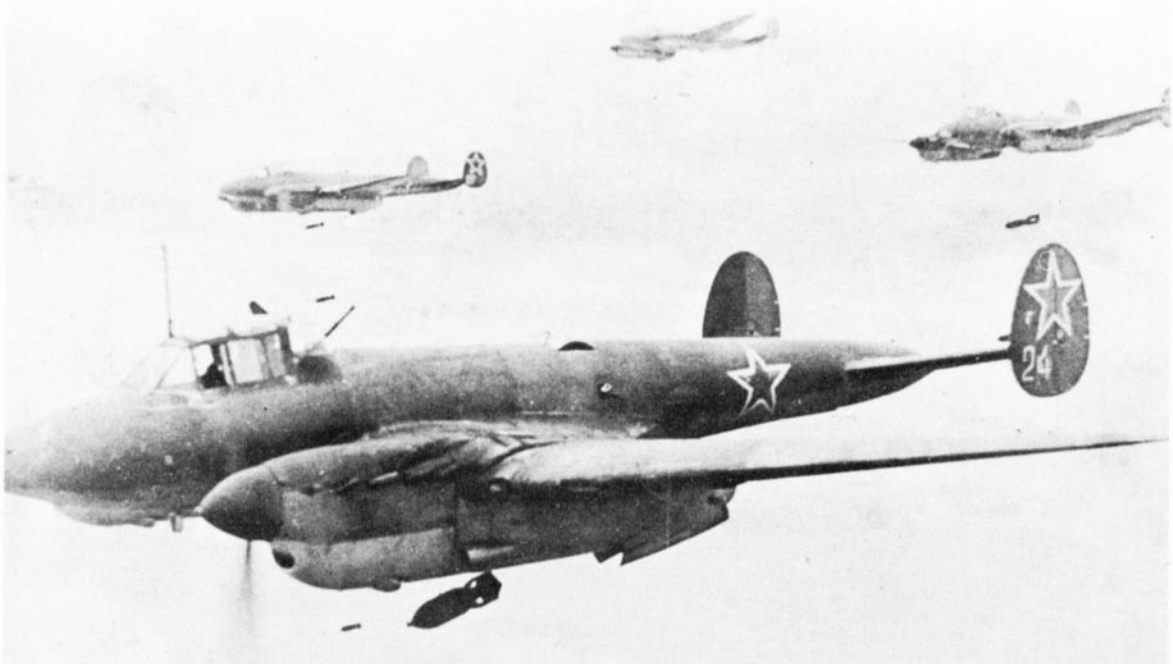
After the initial Moscow offensive of 1941, the next campaign of overriding significance, from the Soviet viewpoint was the ferocious Battle of Stalingrad (the great city on the Volga which was formerly Tsaritsyn and is now Volgograd). By early 1943, the siege gave way to a counter-offensive which marked a turning-point in the outcome of both the Great Patriotic War and the 1939–45 War.

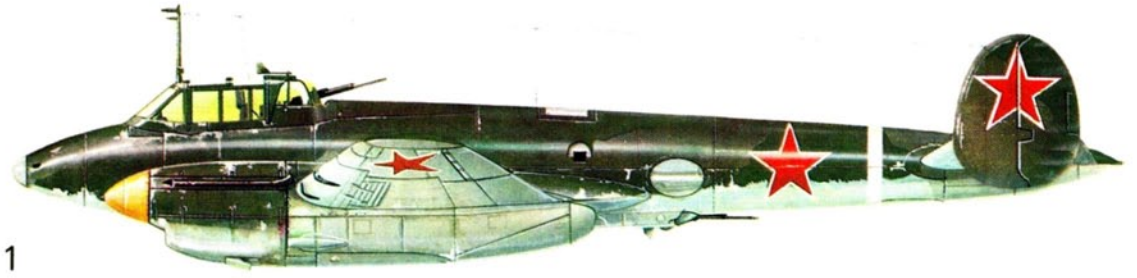
Previous to Stalingrad, the summer of 1942 was a time when Soviet armies were hard pressed. Not least, the Soviet 62nd Army which had been encircled in the area of Verkhne-Businovki in July 1942. The Soviet 8th Air Army rallied to the call and its units rained down hundreds of tons of bombs in a round-the-clock process of attrition. The air bombardment started on July 26 and involved not only hundreds of Pe-2s but also other aircraft including those from elements of the ADD—the Soviet Long Range Bombing Force.

On July 28, 1942, the National Commissar for Defence issued the famous order, "Not another step back!" The Air Force played its part. One unit alone accounted for the complete destruction of 40 tanks and 50 transport vehicles in four days—this was Colonel Polbin's 150th Bomber Air Regiment.

The 8th Air Army was also involved in the Stalingrad campaign. In December 1942, the German army of von Paulus came under Soviet pressure and von Manstein's

The same Pe-2s of the facing page. The ventral gunner's head is no longer evident but the unusual engine nacelle rear bomb compartment's doors are clearly visible. (Photo: via Air-Britain archives)





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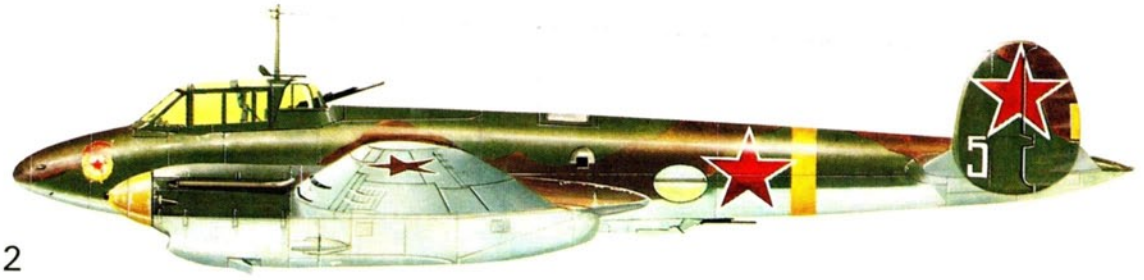

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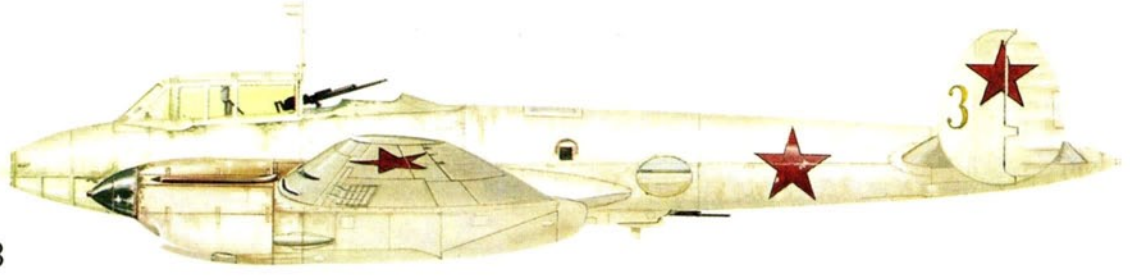

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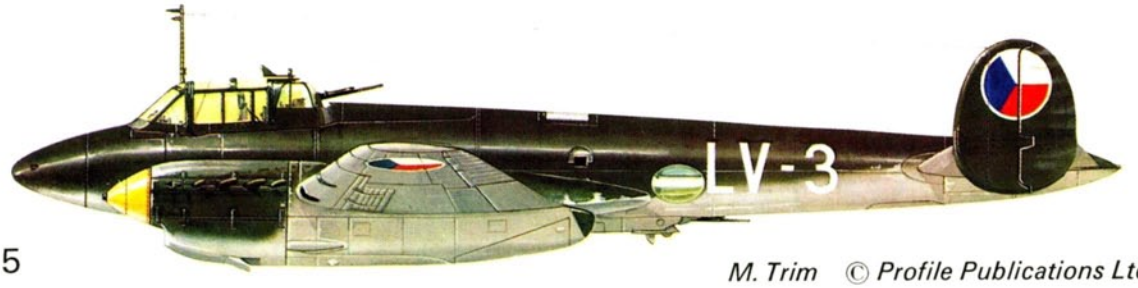

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Key to colour illustrations

1. Late production Pe-2 seen at Tri Duby, Czechoslovakia in Autumn, 1944. Has cleaned-up cowling to VK-105RFs and forward-positioned aerial mast.
2. Intermediate-type Pe-2 with longer tail cone and two-fin aerodynamic balances on FT turret. Compare oil cooler intake of M-105R with VK-105RF in the first side view. On the nose, the Guards badge.
3. Winter camouflage scheme of early Pe-2, Winter 1941–2. Maximum nose glazing is apparent.
4. Definitive production Pe-2 with VK-105RF; Polish Air Force. Late 1940s.
5. Similar late-series Pe-2 of the Czechoslovakian Air Force.

relief force was only about 50 km (30 miles) away. The Military Council of Stalingrad called on the 8th Air Army to spare no effort in destroying the enemy in close support of the Soviet ground forces. On December 18, enemy tanks and mechanised divisions began to break through the outer perimeter of the encircling Soviet troops and von Paulus was poised to break out and link up with the relief force. Every available Soviet aircraft went into action. One incident alone gives an indication of the type of aerial assault which was involved in this campaign. Seventy-four Pe-2s of the 2nd Bomber Air Corps (commanded by General I. L. Turkel), together with 10 "Shturmoviks" of Colonel G. I. Komarov's 28th Ground Attack Air Division, set upon a large concentration of German armour and troop carriers near the town of Karpovka. A total of 112 Soviet aircraft was involved—including the fighter cover of 28 Yak-1s from Colonel A. V. Utin's 220th Fighter Air Division. Catastrophic losses were inflicted, a process which was to be repeated again and again and resulting in the German's enforced retreat and the eventual surrender of von Paulus's shattered besieging force.

Colonel I. S. Polbin may be regarded as the greatest exponent of the Pe-2 as a dive-bomber. Early in 1942, his own bomber air division had mastered various advanced techniques of dive-bombing including Polbin's best-known "Vertushka" or "Merry-go-round". This carousel method of attacking targets within a closely defined area involved a follow-my-leader 70° diving

Early production Pe-2s, Winter 1941–2. Middle Pe-2s lack spinners. The dark shape behind the pilot in foreground Pe-2 is his extensive head and back armour protection.

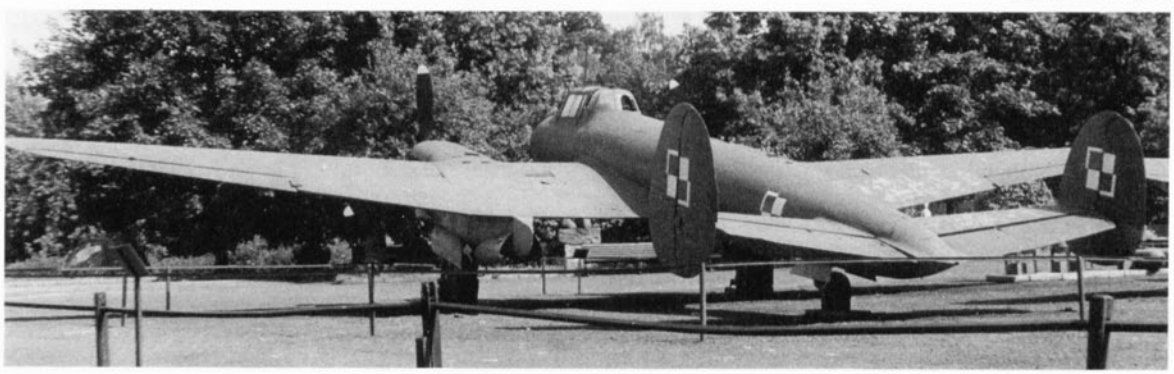
(Photo: Soviet Official via John Stroud)

attack, spaced out at 500–600 m (1,500–2,000 ft) intervals, which would start from the time a complete circle had been formed from the target-approach formation, the traditional vee-of-vees if none Pe-2s were involved. This "Vertushka" ensured that the target was kept under continuous attack. By the time the first Pe-2 was pulling out of its dive, the second was already well down on the dive path to release its bombs and the third Pe-2 was just beginning its dive.

Colonel Polbin also devised methods of securing the best possible use of a fighter cover during dive-bombing. The fighters were divided into sections with a high cover and two or three fighters charged with close cover to provide flanking defence—even to the extent of actually diving down alongside during the actual dive-bombing sequence.

In August 1942, as previously mentioned, Colonel

Contemporary comparison of the Pe-2 with the de Havilland Mosquito is less fanciful when the "Peshka" is viewed from this angle. This former Polish Air Force Pe-2 is now on display at the Armed Forces' Museum, Warsaw. (Photo: J. B. Cynk)



An "on display" Czechoslovakian Air Force late production Pe-2 at Prague Airport in the immediate post-war period. This particular Pe-2 is the subject of the colour side view on page 124. (Photo: via Vaclav Nemecek)

A. G. Fedorov started working on the paper which General Krolenko wanted to issue to all Pe-2 units. Fedorov began by drawing on the experience of noted exponents of Pe-2 dive-bombing techniques including those of Colonel Polbin. But before putting his seal to the document he asked for permission to put his findings into practical perspective—both on the bombing range and under actual combat conditions. This was approved.

What Fedorov and his unit had proved on the bombing range was then to put to the final test—a dive-bombing attack on German tanks and artillery in the Roslav area. While one flight of three Pe-2s made a 60° diving attack on the anti-aircraft guns, the rest of the Fedorov unit manoeuvred into a Polbin "Vertushka" merry-go-round. The carousel formation appears to have confused the defending guns—at least those which had not been silenced in the initial Pe-2 deployment—so that it was not until the "Vertushka" was repeated that the defending guns opened fire. All the bombs went down on target and the unit escaped without total loss although four Pe-2s were damaged to some degree.

Having arrived at the right formula for Pe-2 dive-bombing techniques, Colonel Fedorov was also concerned that Pe-2 pilots should have complete confidence in their ability to master the aircraft which had gained a certain reputation both for take-off and landing. Fedorov established that, with the right amount of power applied to the port engine any tendency on the part of the Pe-2 to swerve to the right could be counteracted. This led to a sharp fall in the incidence of aborted take-offs. Similarly, greater skill was required to effect smooth landings and this in turn would be the best answer to the Pe-2s tendency to bounce and bounce again if set down "according to the book". Finally, Fedorov is said to have demolished the prevalent idea that with one engine "dead", the Pe-2 was impossible to hold in the air or to land under asymmetric conditions. The Pe-2 was demanding of those who flew it, Fedorov has said, but, as he proved to the young dive-bomber pilots, not impossible. In 1944, Fedorov was once again devoting his attentions to getting the best out of Pe-2 crews.

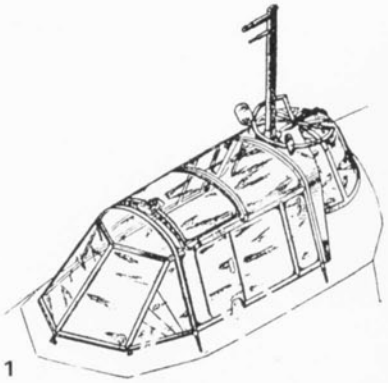
In 1942, the Messerschmitt Bf 109 F appeared in Soviet skies and began to give Pe-2 crews concern where in the previous year the Bf 109 E had not because of the relative parity in speeds at height. Front line Pe-2 units soon demanded better defensive capability and the State Defence Committee put the problem to the Petlyakov design bureau. But almost immediately, Petlyakov was killed in the air crash of late 1942 and the bureau's leadership passed to A. I. Putilov. The bureau's answer was to replace the earlier 7·62-mm ShKAS machine-guns with single dorsal and ventral heavier-calibre 12·7-mm Beresin UBT machine-guns. And, altering the shape of the upper defensive position, the bureau installed a dorsal turret known as the FT ("Frontovoye Trebovaniye"—the "Front-line Demand"). Some extra crew armour plating was added at this time as well.

Of some of the "front-line" units it is said that they had anticipated later developments by using the existing small portholes on each side of the fuselage amidships as firing points for flexibly-mounted 7·62-mm ShKAS machine-guns.

1943: The Kursk Salient tank battles

At 05:30 on July 5, 1943, German-held airfields in the Kursk area were bombed and strafed by 417 aircraft of the Soviet 2nd and 17th Air Armies—including Pe-2s and Il-2s. Although some 60 *Luftwaffe* fighters and bombers were destroyed, Soviet Air Force losses to German anti-aircraft fire were high enough to bring about a change in tactics. In future, and where possible, conventional smaller formations would be superseded by the mass attack of larger groups.

The Kursk counter-attack by the Soviet Armies was to



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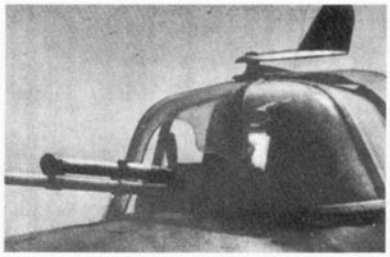

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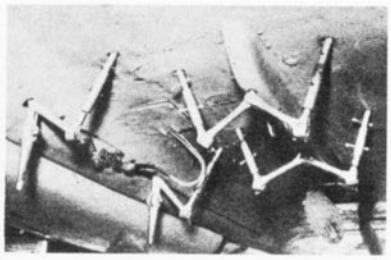

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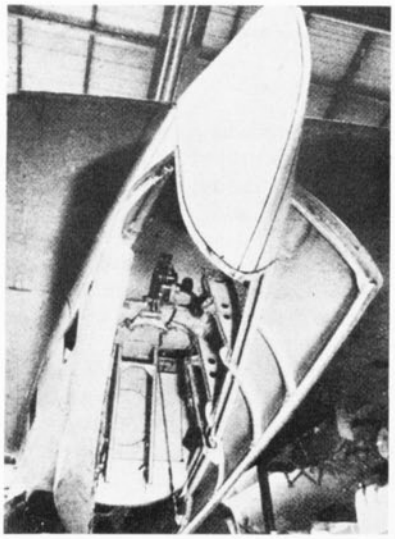

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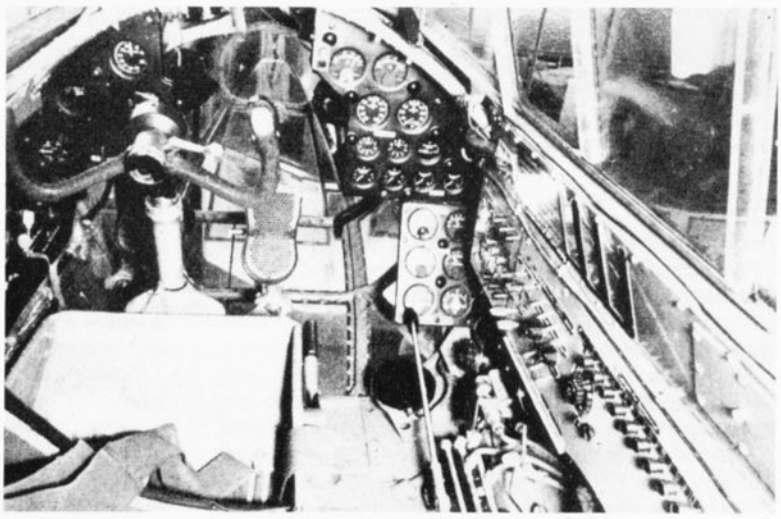

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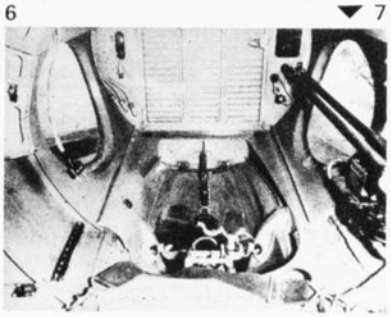

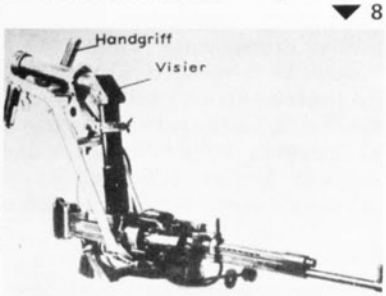

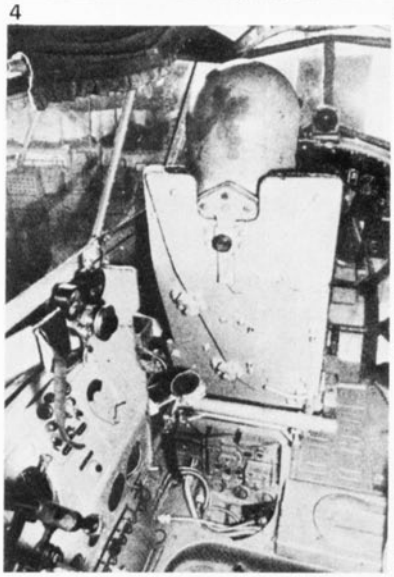

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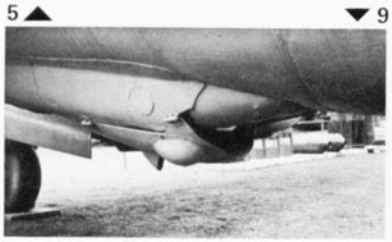

PE-2 DESIGN IN CLOSE-UP: *(1) The FT turret with earlier semi-circular rail mounting two aerodynamic-balance fins and (2) the later single-fin version. (3) The inboard bomb racks and internal bomb-bay doors. (4) Rear nacelle bomb-bay. (5) Pilot's armour with adjustable headpiece; navigator's instrument panel to rear. (6) Pilot's "office". (7) Ventral gun position. Control link to tail assembly runs across the port rear window. (8) Ventral gun assembly with periscopic sight and extension "handlebar" to left. This should settle a lot of arguments! (9) & (10) Two aspects of the late production ventral turret assembly. The additional rear "eyelid" cover shows to advantage. (11) Navigator's starboard seat.* (Photos: WAF, RLM and Z. A. Datkiewicz)

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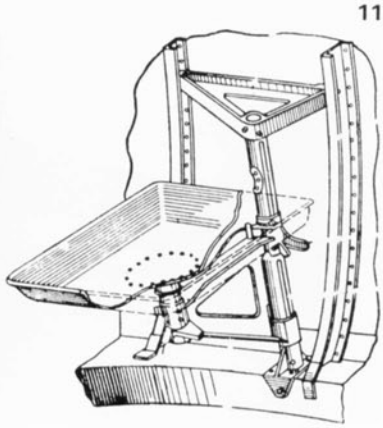


Interior 1: *Photographed from inside the Pe-2's nose, the pilot's semi-spectacle control column and head protection armour are noteworthy.* (Photo: via Jean Alexander)

Interior 2: *From a wartime issue of the Soviet newspaper "Izvestya", an equally rare illustration of the ventral gunner using the porthole 7.62-mm ShKAS m.g.* (Photo: Soviet Official)

result in the greatest tank battles of World War Two. The "Front-line Demand" for the Pe-2 in this critical phase—including the close cooperation with Soviet armoured ground forces—was to provide the model for future large-scale dive-bomber operations in the drive to Berlin.

In October 1943, on the grimly contested Belorussian Front, there was enacted an extraordinary duel between opposing dive-bombers. Polbin who then commanded the 1st Guards Bomber Air Corps, was returning from a mission with 17 Pe-2s and fighter cover. Ahead, 18 "Stukas" (Junkers Ju 87s) were preparing to dive on a Soviet troop concentration. The Soviet fighter escort was ordered to engage the enemy's own fighter cover while Polbin's Pe-2s swooped in to attack the Ju 87s. In turn, the Ju 87s hastily dropped their bombs and departed with the "Peshki" in hot pursuit. Over the enemy-held air base of Berezovka, Polbin's Pe-2s saw and intercepted other *Luftwaffe* bombers taking-off. Raked by machine-gun fire, several enemy aircraft were accounted for including two Ju 87s which collided immediately after take-off. In all, 13 enemy aircraft were destroyed for the loss of one Pe-2; the whole "incident" lasting only a matter of minutes. Polbin was credited with two "kills" in this engagement.

Towards the end of 1943, the much-improved Messerschmitt Bf 109 G-2 (the "Gustav") began to be used on a considerable scale on the Eastern Front. This underlined the need for even better performance from the Pe-2. Fortunately, the more powerful 1,610 h.p. VK-105RF version of the Pe-2 had started to come off the assembly lines in February 1943. The new Pe-2s, with shorter take-off run and better speed characteristics, helped in part to redress the balance.

1944: The Belorussian offensive

Under Marshal of the Soviet Union K. K. Rokossovskii, the main impetus in 1944 was on the Belorussian

Pe-2 bomber air regiments were keen to cut down the time taken to become airborne and get into combat formation; which is the reason for this relatively close grouping prior to take-off of three early production Pe-2s. (Photo: via John Stroud)

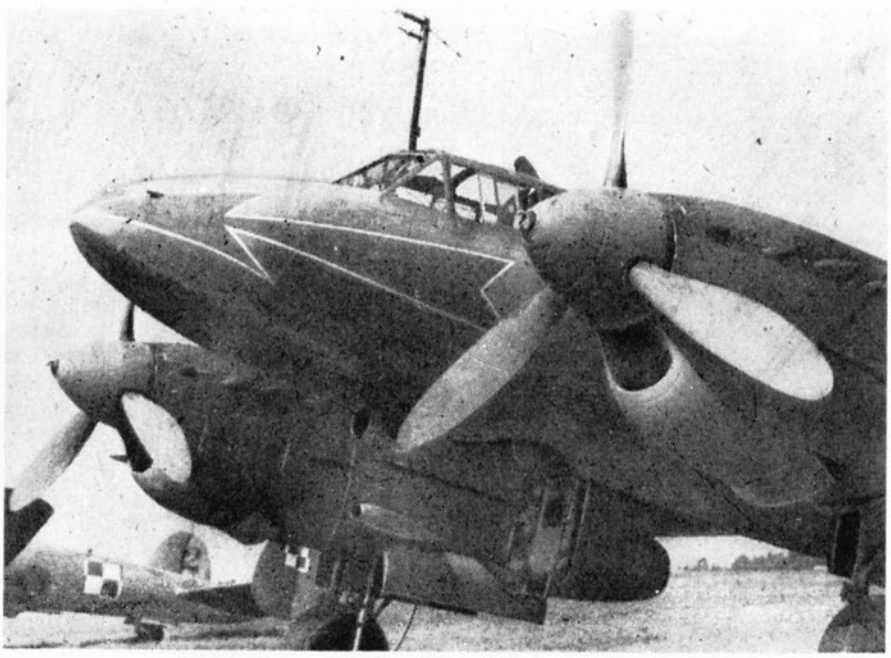
Intermediate production Pe-2s, with FT dorsal turret, on route towards the enemy. (Photo: Soviet Official)

Front which was then renamed the Soviet First Front. At the river Beresina, in June, the "Bobruisk Cauldron" developed and the jam of German troops and mechanised forces became a magnet for the Pe-2s. Bridges, generally accepted as one of the trickiest of all bombing missions, came in for much attention. These were to be dive-bombed by selected crews with outstanding combat records who became known as "snipers"—the word is spelled the same way in Russian. The only available railway bridge over the Beresina was repeatedly attacked, eventually from the low altitude of 900 m (3,000 ft). The eventual successful destruction of this bridge sealed the fate of the enemy trapped in the "Cauldron".

In all the operations on the First Front, the four Soviet Armies were supported by the Dnieper Flotilla, the Belorussian partisan forces and a total of 5,700 combat aircraft drawn from the Soviet 1st, 3rd, 4th, 6th and 16th Air Armies.

One of the actions on this Front calls attention to a unique facet of the Soviet Air Force—the front-line employment of women flyers. During the battle for Borisov in June 1944, Pe-2 squadrons of the 125th Guards Bomber Air Regiment (commanded by Colonel V. V. Markov) served with such distinction that the regiment was subsequently honoured by inclusion of the town's name in its official title. Squadrons of Pe-2s, led by Captains Nadezhda Fudutenko, Klavdia Fumicheva and Maria Dolina, resolutely dive-bombed enemy artillery, mortar batteries and troop concentrations.

Following the success of the First Front, on July 13–14, 1944, the Soviet 1st Ukrainian Front launched a crushing attack in the western Ukraine with some 3,000



The definitive Pe-2 in service with the Polish Air Force after the war. Ventral hatchway is open. Pe-2 in background has, unusually, its individual number on the rudders' inboard surfaces. (Photo: WAF)

Apart from the interest in the garb of this typical group of Pe-2 crews, this photograph shows clearly the porthole 7.62-mm ShKAS machine-gun position above the extensive wing root fillet. (Photo: Soviet Official)

combat aircraft of the Soviet 2nd Air Army in support. The immensity of the action can be judged by one glimpse of the aerial effort of July 15. A German counter-attack was met by a five-hour dive-bombing and ground-attack assault by some 2,000 aircraft including hundreds of Pe-2s and Il-2s. At one of the most decisive stages, no fewer than 1,000 Soviet aircraft were over the battlefield at one time! Marshal of the Soviet Union Zhukov, the Front's commander, reported: 'On July 15, the Soviet Air Force saved the 38th Army from a very critical situation.'

1945: From the Vistula to the Oder

At the start of the New Year, and in preparation for the final great winter offensive, the various Soviet Fronts from the Baltic to the Black Sea could command a strength of 16,500 first-line combat aircraft. For the main direction of attack, the central First Front was allocated almost 30% of this unprecedented striking force (4,770 aircraft) under the command of the 2nd and 16th Air Armies. Beyond the Vistula, the goal was, yet again, Berlin.

The main weight of the giant offensive began to roll forward between January 14–16 and Pe-2 units were in constant "Front-line Demand". One sidelight on this "Demand" was a call to the 779th Bomber Air Regiment (of the 241st B.A. Divn., 16th Air Army) to re-supply a Soviet spearhead tank formation which had run out of fuel deep inside enemy-held territory.

The main contribution of the Pe-2 units involved was in answer to the requests of Soviet ground forces to reduce strong points including fortresses, silence artillery and mortar batteries (the latter accounting for casualties and pinned-down forces with considerable effect), and to deal with tanks, bridges and pockets of resistance.

In response to calls for even more effective defensive armament, about this time the Pe-2 was also protected by a little-known weapon called the AG-2 air grenade. It has been said that the AG-2 accounted for some 17% of all aerial "kills" when used by Pe-2s. The AG-2 normally exploded some 70–80 m (230–260 ft) behind the "Peshka" and had an effective splinter radius of about 100–120 m (300–400 ft).

In the midst of all this intense activity, the redoubtable Ivan Semyonovich Polbin led his last fearless attack—on German fortifications. The man who had done so much to raise Soviet Pe-2 dive-bombing practice to a peak of perfection, who had risen to the rank of Major-General, and who had been accorded the highest honours (Twice Hero of the Soviet Union), was killed in action on February 11, 1945. It was his 40th birthday. Polbin was ceaseless in his resolution to get the most out of the "Peshka". The story is told of how one of the dive-bomber pilots had disobeyed the flight instructions for Pe-2s by testing its roll capability. Polbin believed in combat aerobatics. He questioned the pilot concerned and when he discovered that the manoeuvre had been carefully worked-out beforehand, he went on to try for himself. Eventually, Polbin engaged in a series of continuous rolls!

Pressure on the central front was maintained with the powerful air support available. The Germans were using the ice-bound Vistula to withdraw their forces and Pe-2s were called upon to ice-bomb the surface. This they accomplished for a distance of about 20 km (12 miles) near the town of Wyszogrod, thus preventing the enemy with additional hazards.

Most of the eastern bank of the Oder was in Soviet Army control by February and Pe-2s of the 24th Bomber Air Regiment were sent in to reduce the vital Küstrin (now Kostrzyn) Fortress on March 5–6, 1945.

Later in March came the mass crossing of the Oder and once more the 24th Bomber Air Regiment attacked the Küstrin Fortress. Already honoured (May 1943) as the 24th Red Banner "Orlov" B.A. Regt., the unit was awarded the Order of Suvrov (IIIrd Class) for its successful dive-bombing contribution.

Now, the breakthrough into Germany proper produced much stiffer air opposition with more *Luftwaffe* units available through redeployment from the Western Front. In the vicinity of Berlin alone there were 35 airfields from which fighters of the German 6th Air Fleet

Final development of Pe-2 production, the Pe-2 I ("Istrebitel": "Fighter") powered by VK-107 As in slimmer cowlings and with individual exhaust stubs.
(Photo: via Vaclav Nemeeek)

and the Berlin Air Defence could be raised to intercept the Pe-2s.

April–May 1945: Battle of Berlin

April 16, 1945 was the first day of the final drive for Berlin. A day heralded with due ceremony and speeches by Soviet commanders. These were not to be empty speeches for, on that day alone, the Soviet 16th Air Army made over 5,000 sorties with 2,500 combat aircraft. In 140 engagements, no fewer than 165 German aircraft were claimed; while the day's losses for the Soviet 16th Air Army totalled 75 aircraft destroyed.

The final house-by-house battle of Berlin was about to begin. In the skies were units of not only the Soviet 16th but also the 2nd and 4th Air Armies, with additional support from the 18th Strategic Air Army, formerly the Long Range Bombing Force.

No fewer than 7,500 Soviet first-line combat aircraft were poised for the relentless aerial bombardment. The 16th Air Army, for example, contributed some 40,000 sorties. It seemed that all the masters of the Pe-2 techniques of "sniper" dive-bombing were there—the pinpoint bombing experts who could "place their bombs inside chimney stacks".

Precision attacks had to be the order of the day and it is the proud boast of the Soviet Air Force that they never placed their bombs on the wrong target—their own ground forces. Equally, this called for the utmost precision in adhering to the specially devised Berlin air traffic control which had to deal with the complications of an often swiftly changing "Front-line Demand" for the Pe-2s. Units had to enter the control zone by way of two "gates". The eastern gate was by way of Grosser Müggelsee and the northern via Shönwalde Weissensee. Exits were made along the perimeter of the city. When making a sortie, the Pe-2 group leader first made radio contact with the prescribed control-point. Unless a clear run-in could be sanctioned, "control" would specify either a "waiting zone" or a reserve target. In this manner, the pressure was maintained without let-up. Typical of the hundreds of small incidents was the attack on a hastily prepared "airstrip" near the Tiergarten in the city centre. On April 27, 1945, Pe-2s dive-bombed this last air evacuation site which had been the remaining hope of those still in command of the slowly overwhelmed German defenders. The strip made useless. Behind the Pe-2s came the ground-attack Il'yushin Il-2s. The *coup-de-grace* was final.

Three months later, Pe-2 units were in action against the Japanese. But the atomic bomb had been dropped and the last chapter of the Second World War ended before Tokyo could experience the terrible fate of Berlin.

Of "Peshka" the pawn, the prophetically epigrammatic observation of P. Deryushkin (when still a Junior Lieutenant in the Soviet Air Force) comes to mind. Chess players especially will appreciate the gambit: 'We will yet make a Knight of our Peshka and, soon, it will mate any King!'

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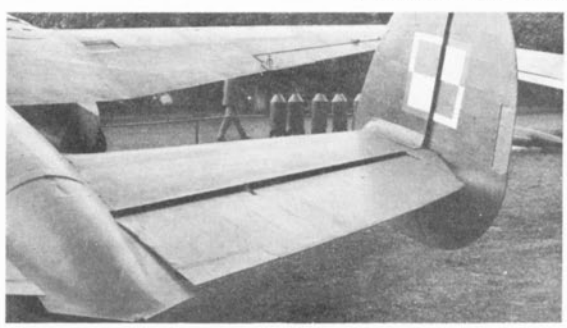
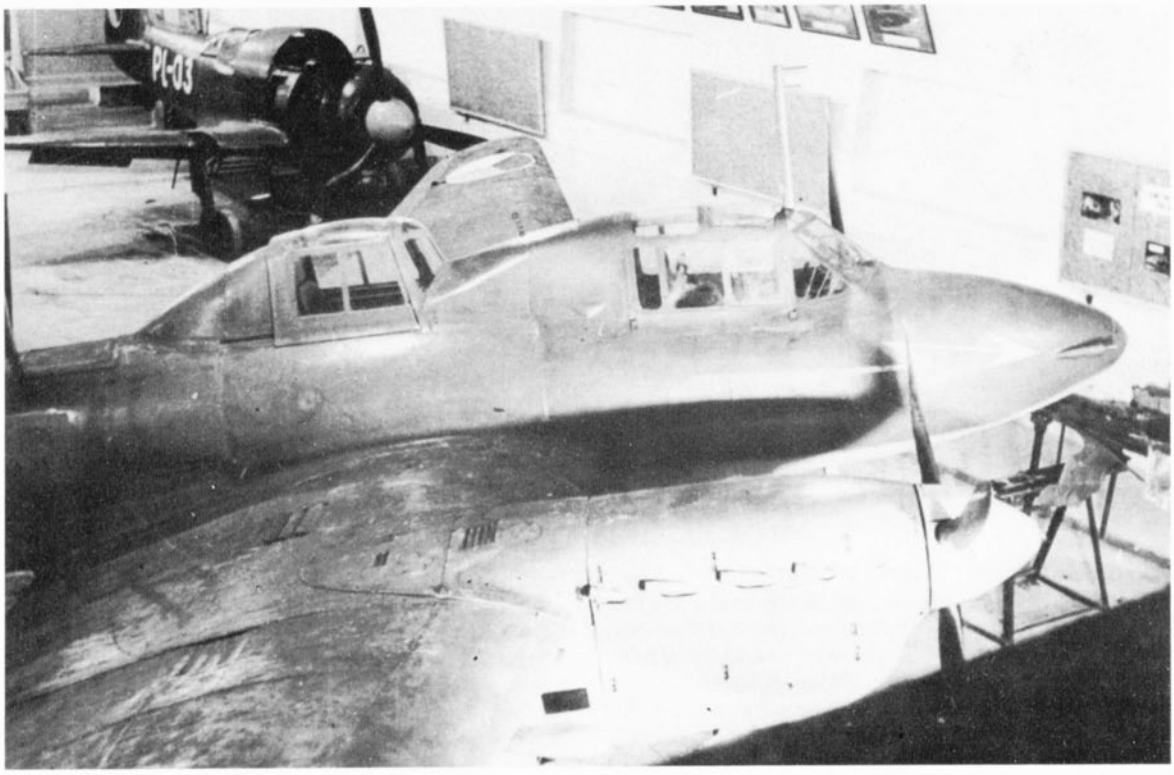
The Warsaw Armed Forces' Museum's Pe-2. The photograph clearly shows the shorter "beaver" tail to the fuselage of the definitive Pe-2.
(Photo: Z. A. Datkiewicz)





A Czechoslovakian Air Force Pe-2 UT conversion trainer which was on exhibition at Olomouc in 1957 but has since been dismantled. Pilot instructor sat in rear cockpit. In the background is a Lavochkin La-7 fighter also in C.S.S.R. military colours. (Photo: Zdenek Tifz)

SPECIFICATION FOR PE-2 WITH M-105R

Construction. All-metal, two-motor, cantilever low-wing monoplane with fully retractable main undercarriage and tailwheel. All control surfaces fabric-covered and trim-tabs electrically operated. Stressed-skin, two-spar mainplane incorporating electro-hydraulic split flaps and undercarriage units. Underwing slatted dive-brakes electrically-operated and functioning between 50–70° dive angles. Stress (safety) coefficient : 11. Fuselage bolted together in three sections; monocoque with closely spaced frames and stringers.

Accommodation. Pilot (port, front); navigator/dorsal defensive gunner (starboard, amidships); and radio operator/ventral defensive gunner (rear fuselage at wing root, separate dorsal hatch with transparency and retracting windshield). Navigator on fold-up seat facing forward but with radio-aids instrument panel sited on port side of fuselage behind the pilot's armoured seat.

Powerplant. (M-105R) Two 1,100 h.p. V. Ya. Klimov aero-engine design-bureau M-105Rs. Liquid-cooled, 12-cylinder 60° upright-Vee inlines with electrically-controlled two-speed (7·85:1 & 10:1) superchargers. Cubic capacity of 35,0 litres (2,136 cu. in.) Performance: Sea-level take-off, 1,100 h.p. at 2,600 r.p.m. with boost of 1·29 atm.; at 2.000 m (6,560 ft), 1,100 h.p. at 2,700 r.p.m. (low gear) with boost of 1·235 atm.; at 4.000 m (13,100 ft), 1,050 h.p. at 2,700 r.p.m. (high gear) with same boost. Cruising power at same altitudes but 2,600 r.p.m. and 1·24 atm. boost, 900 h.p. (low gear) and 945 h.p. (high gear). Fuel, 95 octane. Propellers: Two VISh-61 three-blade units, electrically-operated and controllable-pitch through 35°.

Fuel capacity. Normal fuel in eight wing tanks and one fuselage tank, 1.500 l (330 gals). Oil, 180 l (39·6 gals).

Bomb load. Normal, 600 kg (1,320 lb); maximum, 1.000 kg (2,205 lb). Main load carried on underwing racks close to fuselage, either (normal) 2 × 500 kg or 4 × 250 kg. Fuselage centre-section internal stowage for light-calibre bombs; also in rear of each engine nacelle.

Armament. (Offensive): Fixed, forward-firing light and heavy machine-guns sighted by the pilot. One 7.62-mm ShKAS (port) and one 12.7-mm Beresin UBS (starboard). This was standard nose section armament; earlier production Pe-2s originally had lighter offensive armament of two 7.62-mm guns. (Defensive): Flexible, rear-firing dorsal and ventral single 12.7-mm Beresin UBT machine-guns. Ventral UBT not retractable but on a suspended mounting (see photo p. 127) and aimed by way of a OP-2L periscopic gunsight. Dorsal gun later mounted in FT turret. On each side of the fuselage, approximately in line with the wing trailing-edge, a small porthole could be used to mount a flexible 7.62-mm ShKAS. Earlier production Pe-2s had the lighter defensive armament of two 7.62-mm guns. Ammunition carried varied according to gun position, 7.62-mm (500–750 rounds) and 12.7-mm (150–200 rounds). Tail defence AG-2 air grenades for Pe-2s are mentioned, specifically in early 1945 instances.

Special features. The Pe-2 was unusual for the period in the large number of electric motors (18 in all) installed; six for the radiators, five for the trim tabs, two each for the propellers and superchargers and one each for dive-brakes, flaps and undercarriage. The engine cooling radiators, one each side of the M-105Rs, were mounted between the wing spars, with small air intakes in the wing leading-edge and outlets (louvres) on the upper surface of the mainplane. The nine fuel tanks were protected and sealed by a vulcanised sponge rubber sheath. CO_2 cylinders supplied sufficient gas to fill the vacuum in the fuel tanks and to reduce fire risks. Aircrew armour plate was of 6 to 9-mm thickness; the pilot having a seat with both side and head-shaped protective sheeting. The Pe-2 had full facilities for night-flying. Also, a fully automatic dive recovery system.

	Pe-2 with M-105R	Pe-2 with VK-105RF	Pe-2 with VK-107A
Span ft in (m)	56 3½ (17,16)	56 3½ (17,16)	59 0½ (18,00)
Length ft in (m)	41 6½ (12,66)	40 10 (12,45)	42 4 (12,90)
Height ft in (m)	13 1½ (4,00)	13 1½ (4,00)	n.a.
Wing area sq. ft (sq. m)	436 (40,50)	436 (40,50)	451 (41,90)
Weight, empty lb (kg)	12,943 (5.870)	13,119 (5.950)	14,332 (6.500)
Weight, loaded lb (kg)	16,934 (7.680)	17,133 (7.770)	19,845 (9.000)
Weight, maximum lb (kg)	18,730 (8.496)	18,786 (8.520)	n.a.
Take-off power (engine type no.)	1,100 (M-105R)	1,210 (VK-105RF)	1,650 (VK-107A)
Speed, max. m.p.h./ft	335·5/16,000	361/16,400	408·2/—
(km/h @ m)	(540/5.000)	(581/5.000)	(657/—)
Dive-brake max. m.p.h. (km/h)	373 (600)	373 (600)	—
Speed, cruise m.p.h./ft	265·9/16,000	298·3/16,400	n.a.
(km/h @ m)	(428/5.000)	(480/5.000)	n.a.
Time to 5.000 m in mins.	7	n.a.	n.a.
Service ceiling ft (m)	28,900 (8.800)	29,500 (9.000)	34,400 (10.500)
Range, normal miles (km)	932 (1.500)	1,100 (1.770)	1,243 (2.00)

NOTE: n.a. =not available.