



SHCHERBAKOV'S FORGOTTEN WORKHORSE

THE SHCHERBAKOV SHCHE-2 IN MILITARY & CIVIL SERVICE

In the wake of Germany's invasion of the Soviet Union in June 1942, the Russians identified a need for a dependable, rugged utility aircraft to carry vital supplies between factory and ever-shifting front line. Enter Aleksei Shcherbakov's little-known but much-used Shche-2 twin-engined transport. **NIKOLAY YAKUBOVICH** describes the type's genesis and subsequent service

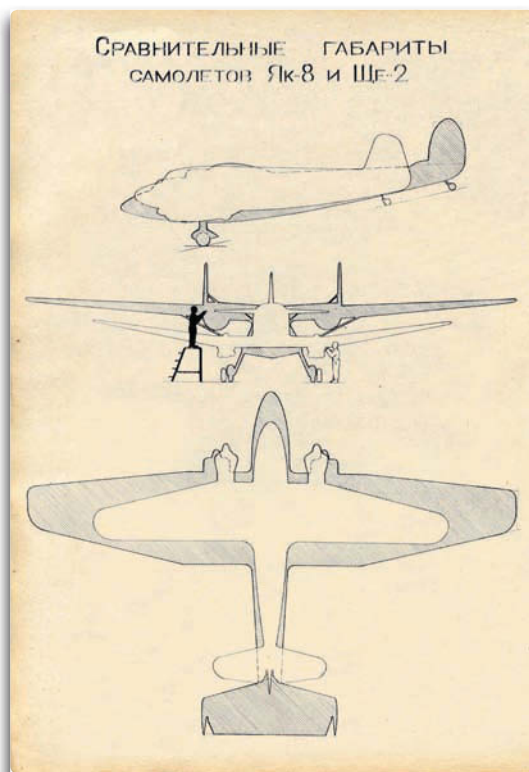
AT THE BEGINNING of the Great Patriotic War (as the Soviet Union's involvement in the Second World War is referred to in Russia) an acute need arose to deploy small cargo shipments by air to areas close to the front line. As a result, work began at the design bureaus of Aleksandr Yakovlev and Aleksei Shcherbakov on a pair of medium light twin-engined aircraft, designated Yak-6 and TS-1 respectively. The former passed state testing in the autumn of 1942 and entered series production. Operational experience, however, revealed that the Yak-6's two Shvetsov M-11F engines were woefully inadequate and that the fuselage capacity was insufficient to carry vitally important replacement aircraft powerplants and tank engines. As a result the military began to look into Shcherbakov's TS-1 proposal, which had a wider fuselage and a large cargo door.

DOING IT THE EASY WAY

Shcherbakov's design team fully understood the complexities of putting a brand new aircraft into production during wartime, and decided to use a simple design incorporating readily available sub-assemblies and parts previously developed for other series-production aircraft. Thus the engine-bearing section was borrowed from the Polikarpov Po-2 biplane trainer, powered by a 115 h.p. Shvetsov M-11D five-cylinder air-cooled radial engine. For the new design, two M-11s were installed on a high-mounted trapezoidal wing, which was braced with steel-tube struts.

The TS-1's fixed mainwheels incorporated the oleos of the Lavochkin La-5 fighter, while the tailwheel was from the Ilyushin Il-2 Shturmovik. The power from the two M-11s was insufficient to achieve high speeds, so the design team refined the external contours of the wide-cross-section fuselage as much as possible, giving it an aerodynamically clean shape. The cockpit was enclosed in a canopy, and the mainwheels were initially provided with streamlined fairings.

The aircraft was manufactured mainly from wood and fabric, with 23m³ of aviation-grade pine, 1,570m² of plywood and 350kg of steel alloy being used per aircraft, each of which took 1,000 man-hours to manufacture. The large dimensions of the cargo hold enabled the design to be used to transport large items up to 1.43m (4ft 8in) wide and 1.64m (5ft 5in) tall, including — importantly — standard barrels of fuel. The transport of cargo items up to 6.5m (21ft 4in) in length was permitted. The port side of the fuselage incorporated a cargo door, into which was integrated a passenger door.



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ABOVE A contemporary Soviet document comparing the dimensions of the Shche-2 (shaded) and the Yak-8, a slightly larger development of the Yak-6, which was the main rival to Shcherbakov's original TS-1 design (TS for *Transportnyi Samolyet* – Transport Aircraft). Some 1,000 Yak-6s were built but only one Yak-8 prototype.

The TS-1 was capable of carrying 14 passengers on folding seats or nine casualties on standard army stretchers, as well as dropping paratroopers and cargo items. Moreover, the aircraft could easily be converted from a troop-carrying transport into a casualty evacuation (casevac) aircraft and back again. The wing incorporated slotted flaps able to deflect to 36°, which reduced the landing speed and the length of the landing roll by up to 160m (520ft).

FIRST FLIGHT

The prototype TS-1 was completed in January 1943 and in early February test pilot Vladimir Fyodorov undertook the aircraft's first flight. On August 1 the same year the TS-1 began its state testing programme at the Soviet Air Force Scientific Research Institute in both troop-carrying and casevac variants, under the super-

OPPOSITE PAGE, TOP *Front-line transport ancient and modern — a Red Army soldier poses with his bicycle beside Shche-2 serial 131947, fitted with Shvetsov M-11D engines and fixed-pitch two-bladed wooden propellers. Ukrainian-born Shcherbakov was initially a specialist in high-altitude aircraft and pressure-cabin technology.*

The prototype TS-1 in its original configuration with undercarriage fairings. These were later removed for operational use at semi-prepared airstrips and fields. Shcherbakov received funding in September 1942 and reportedly completed the design within six weeks. Construction of the prototype had begun by the end of the year.

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vision of test pilot Aleksandr Dolgov. On August 27 the aircraft returned to *Gosudarstvennoye Aviotsonnoye Zavod* (Aviation Manufacturing Plant — GAZ) No 482 at Khodynka, near Moscow, to address various issues that had come to light during testing. The following year, production of the aircraft was launched at GAZ No 47 in Chkalov (now Orenburg), the type being given the designation Shche-2. By the end of 1944 some 222 had been delivered to the *Voyenno-Vozdushnye Sily* (V-VS — Soviet Military Air Forces).

In May 1944 state testing of the first production Shche-2, serial 03147, was completed at the V-VS Scientific Research Institute and confirmed the data acquired previously. The floor of the cargo compartment had been strengthened and the mass balancing of the ailerons was also improved, as were the mainwheels' shock-absorbers. Other modifications included an oil-dilution system, a re-profiling of the fins and an increased wingspan.

The Shche-2 underwent continual refinement and in October 1944 a trainer variant, serial 08247, underwent testing at the Scientific Research Institute, having been developed by

Shcherbakov in accordance with requirements set out by V-VS Long-Range Aviation Command. The type was well suited to training pilots and radio-operators, but testing was stopped after ten days as the relevant equipment had not been properly installed. While 08247 underwent further modifications and “snagging”, Shche-2 serial 11547 arrived at the Scientific Research Institute to fulfil a similar role. It had been converted from a production aircraft at GAZ No 47 with the assistance of the 2nd Aviation Technical College in Chkalov. This aircraft was intended to train students in aerial navigation and communications, and trials proved that the aircraft could be used to train students in visual orientation, complex radio-navigation, radio-communications and aerial photography.

Further testing with 08247 revealed that not only was it possible to train navigators, but the crew as a whole. It was for this reason that an RPK-2S fixed-loop radio compass was added to the aircraft's equipment, as was an RSB-3bis radio suite with a US-1 receiver. Bombing training was achieved by day with the incorporation of an

Shcherbakov Shche-2 serial 03147 was the first production aircraft, and was operated as part of the People's Commissariat of Aviation Industry at Chkalov. It passed its State trials at the V-VS Scientific Research Institute in the spring of 1944 and is seen here in a standard three-tone scheme with red stars on fuselage and fins. Artwork by ANDREY YURGENSON © 2018



In 1945 the basic Shche-2 design was modified with uprated engines and various other refinements to become the Shche-2TM, the ultimate version of which was defined in serial 422047, as seen here. Note the reduced fin area, shortened wing struts and revised undercarriage with shorter legs.



OPB-1 bombsight, and by night with the help of an NKPБ-7 night bombsight. An astrodome was fitted above the forward section of the fuselage to train navigators in astro-navigation.

The subsequent official test report stated that "08247, as submitted for trials, is more versatile in terms of the nature of the roles it is able to fulfil than 11547. [In the former's configuration] it [will be] indispensable for front-line units looking to train crews to fly bomber aircraft". The Shche-2 was accordingly put into series production as a trainer and fitted with RPK-10 and RPK-2 fixed-loop radio compasses as well as an RSB-3bis radio set. The aircraft could accommodate up to eight students and an instructor.

FURTHER IMPROVEMENTS

In June 1945 a further modified example, serial 071547, was submitted for trials fitted with uprated 145 h.p. M-11FM engines in low-drag NACA cowlings, a pneumatic starting system and new VISH-327D-451 variable-pitch propellers of 2.4m (7ft 10½in)-diameter, in place of the original wooden fixed-pitch propellers. The balancing of the ailerons was also improved, the mechanical drive for the flaps was replaced with a pneumatic system and a larger tailwheel was fitted. The fuselage was strengthened and a short-wave RSI-4M radio set and RPKO-10 compass with a distance-tracking device were fitted.

As a result the aircraft became 200kg (440lb) heavier but its flight characteristics substantially improved, with an increase in maximum speed from 157km/h (98 m.p.h.) to 169km/h (105 m.p.h.); this could have been higher but the low quality of the airframe's external finish, an unavoidable consequence of wartime production under severely restricted conditions, took its toll. The modified variant, designated Shche-2TM, was recommended for series production, but minus

the engine cowlings and with all the defects that had come to light having been eradicated.

Built at GAZ No 47 in 1945, Shche-2TM serial 422047 was the prototype of the final variant of the aircraft. Along with uprated M-11FM engines installed in revised nacelles, other modifications included a reduction of the wing area from 63.9m² (688ft²) to 54.9m² (591ft²), removal of the flaps and a reduction in length of the wing struts from 3.21m (10ft 6in) to 1.97m (6ft 5in). The struts were also hollowed to store compressed air. The area of the tailplane was reduced from 10.14m² (109ft²) to 8.12m² (87.4ft²) and that of the fin reduced from 5.48m² (59ft²) to 4.86m² (52.3ft²). Fuel capacity was reduced owing to the removal of the forward fuel tanks. The mainwheel legs were shortened, and the diameter of the mainwheels reduced. The front glass panels in the pilot's cockpit, which had previously protruded forwards, were replaced with panes of flat glass, and the cargo floor covering was lightened. All of this also had a positive effect on the aircraft's centre of gravity.

The aircraft arrived at the Scientific Research Institute in Moscow not having completed its static testing programme, which meant it could not undergo full-scale state testing, and so could not be recommended for series production. Nevertheless, a significant improvement in flight characteristics, when compared to a production example, was confirmed. The type completed trials with three fixed-pitch and one variable-pitch propeller, but the best results were achieved with two VISH-327-D210 variable-pitch propellers.

The Shche-2TM never entered series production owing to the large-scale curtailment of aircraft production that followed the end of the war, the same reason that work on a diesel-engined Shche-2, the factory testing of which had begun in July 1945, was left unfinished. By 1947 a total of 567 Shche-2s had been manufactured.



LEFT A rare photograph of a production Shche-2 (with M-11D engines and fixed-pitch two-bladed wooden propellers) at the V-VS Scientific Research Institute airfield, with a group of pilots and engineers. Second from right is test pilot and Hero of the Soviet Union Pyotr Belyasnik.

BELOW As well as being extensively used by the V-VS, the Shche-2 also saw service with the Soviet-controlled Yugoslav and Polish air arms in the immediate post-war period. Bearing unit marking "3", Shche-2 serial 18947 is seen here in the colours it wore while operating with the Polish Air Force's 13th Transport Regiment in 1947.

During the Great Patriotic War V-VS Shche-2s were used to transport all manner of materiel, including aircraft engines, propellers, fuel and spare parts, to front-line airfields. Some of the first examples were sent to the 600th Air Transport Regiment, which became part of the 4th Special Air Division. On joining the regiment these examples began to replace the unit's war-weary Yak-6s. The commander of the 600th Regiment, which comprised 41 aircraft across four squadrons by the end of 1944, was Major Vladimir Petrov.

The first serious combat test for the type took place during June–July 1944, when ten crews from the 600th Air Transport Regiment flew their Shche-2s during the Bobruysk Offensive, led by the 1st Belorussian Front (equivalent to an Army Group). The crews fulfilled orders they had been issued by the Commander of the 6th Air Army, to transport air crews and technical personnel during the repositioning of their units, as well as supplying them with equipment, ammunition and fuel and lubrication materials.

The Shche-2 was also used on several occasions to transport high-ranking officials, as well as deliver ammunition, medical supplies and provisions to cadres of partisans behind enemy

lines. The type also operated successfully as a medical evacuation aircraft to transport wounded personnel back behind Soviet lines.

In addition to its primary transport role, the Shche-2 was used to train parachutists and deliver paratroopers behind enemy lines, and undertook courier duties and delivery sorties carrying urgent operational information from the front line to Supreme Command Headquarters. Aside from its somewhat unsatisfactory power-to-weight ratio, the Shche-2 proved to be a very low-maintenance and reliable machine. Most of its shortcomings were the result of manufacturing issues, caused by a generally low level of qualification among junior workers.

The 600th Air Transport Regiment operated the Shche-2 until May 1945, when the unit re-equipped with the Lisunov Li-2, essentially a licence-built version of the ubiquitous Douglas DC-3. Amazingly, only two Shche-2s were lost in accidents, both owing to engine failure.

OUT OF UNIFORM AND ABROAD

A civil variant of the Shche-2, fitted with Shvetsov M-11D engines, was put forward and underwent comprehensive testing at the Civilian

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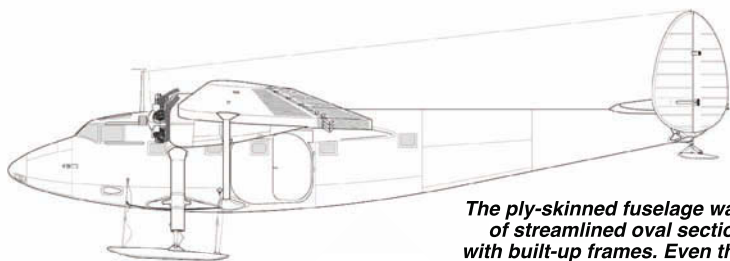




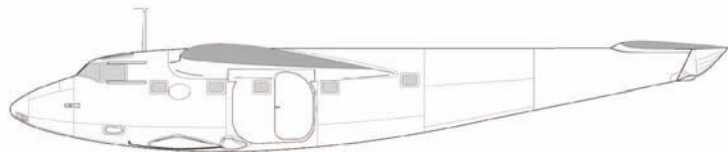
SHCHERBAKOV SHCHE-2

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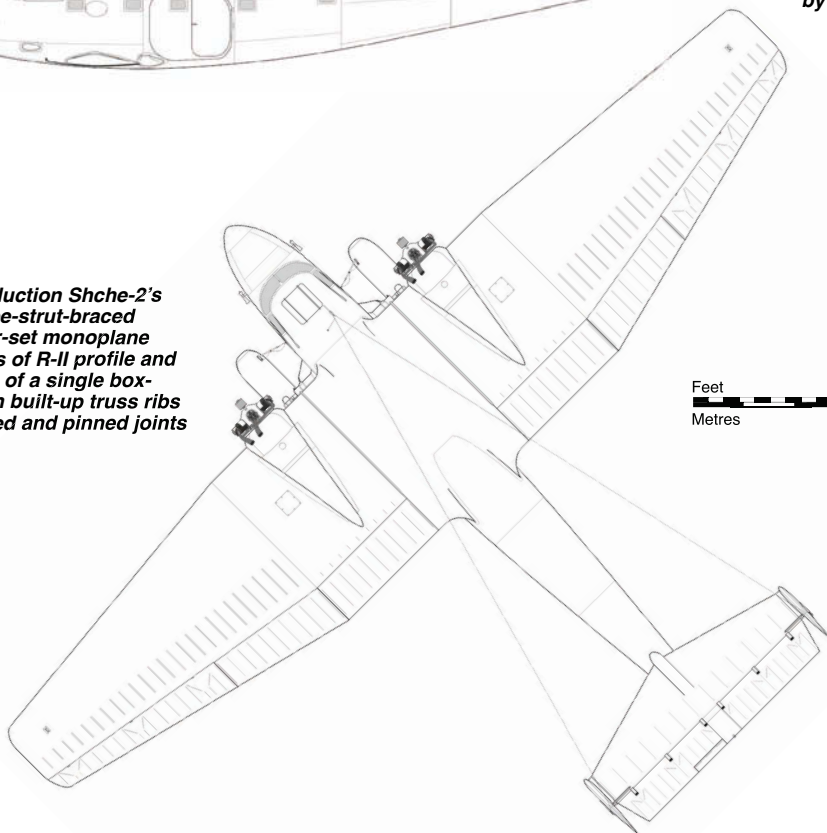
After the war the Shche-2 was deployed in a number of roles in civilian service, including being fitted with skis and used in support of winter fishing expeditions in the Archangelsk region of northern Russia, as depicted in this three-view. The view below shows the wing and tailplane aerofoil sections



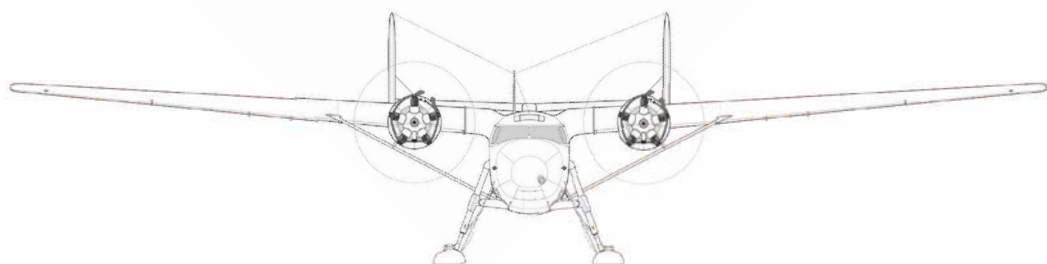
The ply-skinned fuselage was of streamlined oval section with built-up frames. Even the stringers were built-up: they were light 10mm x 30mm box sections comprising 4mm x 8mm timber booms connected by 1mm ply webs



The production Shche-2's steel-tube-strut-braced shoulder-set monoplane wing was of R-II profile and made up of a single box-spar with built-up truss ribs with glued and pinned joints



Feet 10ft
Metres 3m





ABOVE Shcherbakov Shche-2 "White 2" has its engines run up in preparation for a training sortie while serving with the Polish Air Force's Military Pilots' School at Dęblin in eastern Poland circa 1946. Reportedly, while in V-VS service, one Shche-2 was fitted with General Motors diesel engines from an American armoured vehicle and flown.

SHCHERBAKOV SHCHE-2 DATA COMPILED BY NIKOLAY YAKUBOVICH

	Shche-2 serial 03147 as at 17.05.1944	Shche-2 serial 071547 as at 14.07.1945	Shche-2TM serial 122047
Powerplant	2 x 115 h.p. Shvetsov M-11D	2 x 145 h.p. Shvetsov M-11FM	2 x 145 h.p. Shvetsov M-11FM
Dimensions			
Span	20.48m (67ft 2in)	20.48m (67ft 2in)	18.13m (59ft 6in)
Length	14.27m (46ft 10in)	14.27m (46ft 10in)	14.27m (46ft 10in)
Height, tail down	3.82m (12ft 6in)	3.82m (12ft 6in)	3.82m (12ft 6in)
Wing area	63.88m ² (687.6ft ²)	63.88m ² (687.6ft ²)	54.9m ² (591ft ²)
Crew	1-2	1-2	2
Weights			
Empty	2,340kg (5,159lb)	2,422kg (5,384lb)	2,000kg (4,409lb)
normal take-off	3,400kg (7,496lb)	3,500kg (7,716lb)	3,100kg (6,834lb)
overload take-off	3,600kg (7,937lb)	3,700kg (8,157lb)	3,400 (7,496lb)
Fuel			
normal	370kg (816lb)	—	355kg (783lb)
maximum	—	630kg (1,389lb)	—
Normal commercial load	500kg (1,100lb)	520kg (1,146lb)	—
Payload			
normal	1,130kg (2,491lb)	—	1,100kg (2,425lb)
maximum	1,330kg (2,932lb)	—	1,400kg (3,066lb)
Performance			
Speed			
max, sea level	160km/h (99 m.p.h.)	169km/h (105 m.p.h.)	171km/h (106 m.p.h.)
cruising	134km/h (83 m.p.h.)	—	—
Take-off distance*	300m (980ft)	315m (1,030ft)	265m (870ft)
Landing distance	110m (360ft)	—	165m (540ft) [†]
Rate of climb	1.85m/sec (364ft/min)	—	1.65m/sec (324ft/min)
Time to climb			
to 500m (1,600ft)	5min	7min	5min 30sec
Service ceiling	2,400m (7,900ft)	2,000m (6,600ft)	—
Range			
normal	850km (530 miles)	708km (440 miles)	805km (500 miles)
ferry flight	2,160km (1,340 miles)	—	—

* From a rolled snow-covered runway

[†] On runway with artificial surface



A pair of Shche-2s await their next sortie while operating on fishing expeditions from bases in the Archangelsk region after the war. The type was neither fast nor luxurious, but proved to be dependable and capable in such demanding conditions.


BELOW *Shcherbakov Shche-2 registration CCCP-X867 belonged to the People's Commissariat of the Fishing Industry and is seen here in the colours it wore while operating with the Northern Directorate of the Civil Air Fleet in support of hunting and fishing expeditions from Ruchyi Air Base in the Archangelsk region, circa 1948.*

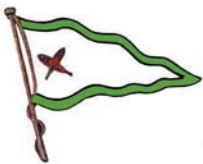
Air Fleet Scientific Research Institute, with the aim of establishing the aircraft's suitability for transporting up to nine passengers on folding seats, or cargo, over a distance of up to 900km (560 miles). The recommendations that were drawn up for Aeroflot's pilots by the Civilian Air Fleet Scientific Research Institute enabled short-route commercial operators to use the Shche-2 in the post-war years widely, up until the entry into service of the Antonov An-2 biplane, which first flew in late August 1947.

The Shche-2 was also used extensively for casevac and transport duties in remote regions, and undertook fisheries reconnaissance. A notable example of the latter was the Archangelsk Directorate of the Civilian Air Fleet's use of the type to deliver fishermen directly on to the ice during the winter fishing season.

A number of Shche-2s entered service with Yugoslavia's newly formed *Jugoslovensko Ratno Vazduhoplovstvo* (JRV — Yugoslav Air Force) in 1945, and played a key role in the formation of the

Lotnictwo Wojsko Polskiego (the Soviet-controlled People's Polish Air Force). In the spring of 1944 Polish paratroopers used Shche-2s for training purposes at one of the flying schools in Chkalov, and in 1945 Shche-2s began to enter service with the Polish Air Force. Polish pilots had first encountered the type in 1944 during their basic radio-navigation training at the 2nd Military Navigation School in Chkalov.

The Polish Air Force's 13th Separate Transport Air Regiment received its first Shche-2 in February 1945 and operated it up until the end of May 1945. In March the same year two Shche-2s entered service with the Polish 15th Separate Reserve Air Regiment, and another two joined the Military Pilot's School at Dęblin. These aircraft contained a gift to Poland from Soviet Command in the shape of training instruments and navigation, bombing and aerial gunnery equipment. In the second half of 1945 all the Polish Shche-2s were transferred to the Military Pilots' School. The last example was taken out of service in October 1947. 



CCCP-X687



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