

# Tupolev Tu-22 Blinder

SUPERSONIC BOMBER - ATTACK - MARITIME  
PATROL & ELECTRONIC  
COUNTERMEASURES  
AIRCRAFT



SERGEY BURDIN & ALAN E DAWES

# **TUPOLEV TU-22**

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## RUSSIA'S PIONEERING SUPERSONIC BOMBER

Sergey Burdin and Alan Dawes



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I also wish to express my gratitude to 'veterans' of 290 ODRAP at Zyabrovka for their archive material and personal recollections, which have enlivened the pages of this book. Particular thanks in this regard are extended to Squadron Commanders, Lt-Col Aleksandr Yerusenko and Lt-Col Mikhail Chernyshev, along with Senior Crew Chief, Major Mikhail Ivashutin. Separately, I also wish to offer special thanks to former Tu-22 airborne operator, Major Ivan Khvorost for his active help over the many years of my research of the aircraft. I have used several photographs in the book provided by my aviation history colleagues, Alfred Matusyevitch, a former Inspector in the Air Army HQ in L'vov in the Ukraine, and Valery Romanenko, a journalist with the Ukrainian magazine *Voysko Ukrainy*. Thanks to their generosity I have been able to include photographs of the Tu-22 in service with 341 TBAP and 199 ODRAP, which were based on Ukrainian territory. Another of my colleagues, aviation historian and photographer Sergey Tsvetkov, provided photographs from his archive, including those depicting the Tu-22R in Soviet Naval Air Force service, for which I am very grateful. To conclude, I wish to acknowledge the great contribution made by all those who created, tested and operated the Tu-22, without whose involvement there would not have been a story to tell about this fascinating aircraft. Finally, translator and co-author Alan Dawes would also like to take this opportunity to thank his friend Stu Clay and his colleagues at BAE Systems at Warton in Lancashire for clarification of certain technical and electronics queries arising during translation.

# Translator's Comment

For the benefit of readers who know Russian, the more important abbreviations in the text have been expanded and transliterated to give a better understanding of certain items of equipment, or their function. The transliteration 'system' used has been chosen to enable the reader to read and pronounce the word as accurately as possible, without any pretension to it being a Russian language guide. Wherever possible, given the difficulties of providing a literal equivalent of some Russian (Cyrillic) letters in English, the original 'shape' of the Russian word has been retained, including the use of the apostrophe mark (') to represent the Russian 'soft sign' placed after certain letters. (The effect of this is to soften the sound of the preceding letter, but proper discussion of this feature of Russian is beyond the scope of this book.) I hope that inclusion of these transliterated items within the text will be more useful to the reader than a glossary at the end of the book. Alan Dawes



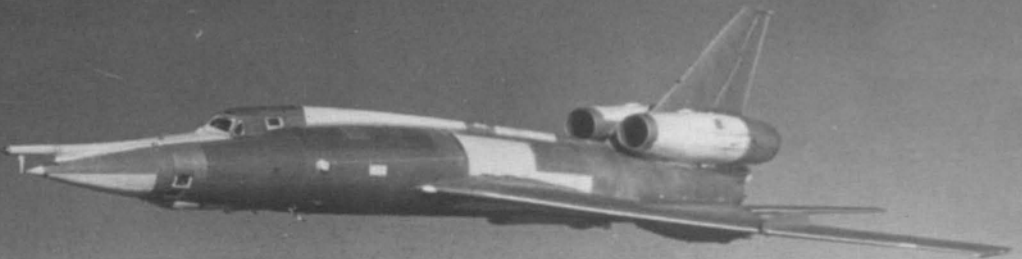
Map showing locations of Soviet Long-range Air Force Tu-22 bases and their associated weapons ranges. *Sergey Burdin*

# *Introduction*

The subject of this book was once one of the most feared and respected, albeit imperfectly understood, Soviet Air Force adversary facing NATO in the darkest period of the Cold War. In fact, there has perhaps never been a military aircraft in recent history which has given rise to so many 'legends' and so much speculative analysis as Tupolev's formidable Tu-22 *Blinder*. In no small way this was due to the heavy cloak of secrecy which enshrouded everything about Soviet society and its military institutions, making the Tu-22 no less mysterious to the inquisitive outsider than the Egyptian pyramids were to early explorers! This was not helped by the practice at the time for Western defence analysts to attribute greater capability and performance to Russian weapons in a perverse attempt to exaggerate the threat 'from the East' and so encourage 'retaliatory' defence spending. Now, using material accumulated after more than ten years of research, Sergey Burdin provides us with the opportunity to take a more reasoned look at this fascinating aircraft and reassess its true position in the history of military aviation. Much of the material is based on Soviet Ministry of Defence archive material, which was declassified in 1993–4 by the General Staff of the Russian Federation Air Force, augmented by Sergey Burdin's own archive data.

Using this material, we have attempted to examine the Tu-22 objectively, neither embellishing its merits, nor resorting to unjustified criticism of its failings. We hope that after reading the book the reader will be better able to judge the often tenuous comparisons between the Tu-22 and its US counterpart, the Convair B-58 Hustler, frequently found in books and magazine articles over the years. In spite of its shortcomings, the Tu-22 was clearly the more successful of these two pioneering supersonic bombers, outliving its American rival by more than two decades and only being retired from service in the mid-1990s. With a take-off weight similar to that of the Tu-16, its more conventional stablemate, the supersonic Tu-22 exhibited almost fighter-

A Tu-22PD in close formation with the leader, the distance between the two aircraft being no more than 20m (65ft). *S Burdin Archive*



like performance and allowed the Soviet Air Force's long-range aviation branch to develop a number of operational tactics which were, hitherto, the natural province of tactical aviation. Equally importantly, it also gave this vital component of Russia's deterrent force a significant head start in the operation of large supersonic bombers. Today, the benefits of that early experience are still being exploited by the crews flying the Tu-22's descendants – the Tu-22M3 *Backfire-C* and the Tu-160 *Blackjack* supersonic bombers.

In addition to a wealth of new factual information about the Tu-22, the value of the book as a work of reference is enhanced by the personal recollections of the pilots, navigators, airborne operators and engineers who devoted their lives to the aircraft. These provide the English-speaking reader with a unique opportunity to discover at first hand what it was like to fly one of Russia's most prestigious combat aircraft in the psychologically demanding conditions of the Cold War.

By definition, bombers are unglamorous aircraft, usually only possessing a singular destructive purpose, but the Tu-22 openly contradicts this definition by also being one of the most graceful-looking combat aircraft ever built. It is thought provoking to consider, moreover, that it was never called upon to be used 'in anger' by the Soviet Air Force, its purpose as an offensive weapon being fulfilled instead by its value as a deterrent force.

Of the 104 Tu-22s struck off charge and transferred to 6213 Aircraft Disposal Base at Engel's up to the end of 1994, only six remain: one aircraft is displayed in front of the garrison HQ at Engel's, a second was put on display in Saratov, at the request of the city's Governor, while the other four are displayed at the Museum of the Long-range Air Force at Engel's airfield. These are, of course, in addition to the aircraft already exhibited at Monino, just outside Moscow and at Ryazan'. We hope that our book will now give wider access to this historically important aircraft from the comfort of the armchair, and possibly inspire visits to see the few remaining examples in the museums mentioned above.

*Sergey Burdin*

*Minsk, Belarus', November 2004*

*Alan Dawes MRAeS*

*Cambridgeshire, England, November 2004*

# Tu-22 Variants

Tu-22A	Blinder-A	Soviet
Tu-22A Variant B	Blinder-A	Iraq/Libya
Tu-22K	Blinder-B	
Tu-22KD	Blinder-B	
Tu-22KDP	Blinder-B	
Tu-22KPD	Blinder-B (Variant)	
Tu-22P	Blinder-E	
Tu-22P1	Blinder-E1	
Tu-22P2	Blinder-E2	
Tu-22P4	Blinder-E	
Tu-22P6	Blinder-E	
Tu-22P7	Blinder-E	
Tu-22PD	Blinder-E	
Tu-22R	Blinder-C	
Tu-22RD	Blinder-C	
Tu-22RDK	Blinder-C (Variant)	
Tu-22RDM	Blinder-C2	
Tu-22RDM-2	Blinder-C2	
Tu-22RM*	Blinder-C (Variant*)	
Tu-22U	Blinder-D	

All the variants are described in detail in the text, but for convenience a brief explanation is also given here:

The suffix 'K' in Tu-22K stands for *Kompleks*, i.e. the entire system of aircraft, missile and control systems of this specialised missile-carrying *Blinder-B* variant.

The suffix 'D', short for *Dal'nii* (long-range), for all aircraft indicates an air-to-air refuelling capability.

The suffix 'P' in Tu-22KPD stands for *Protivo-radiolokatsionnyi* (literally anti-radar) and was the specialist anti-radiation missile-equipped variant of the *Blinder-B*.

The suffix 'P' in all the Tu-22P variants stands for '*Postanovshchik Pomyekh*' (literally producer of interference), the numbered variants being explained in detail in the text.

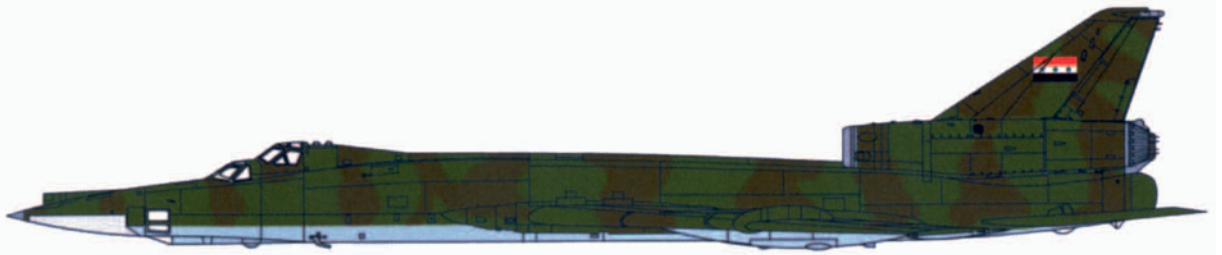
The suffix 'R' stands for '*Razvyedchik*' (literally military scout) and describes all the reconnaissance variants of the aircraft.

The suffix 'K' in Tu-22RDK stands for *Kub* (cube), the specialised Elint system fitted to twelve modified Tu-22RD aircraft at Zyabrovka.

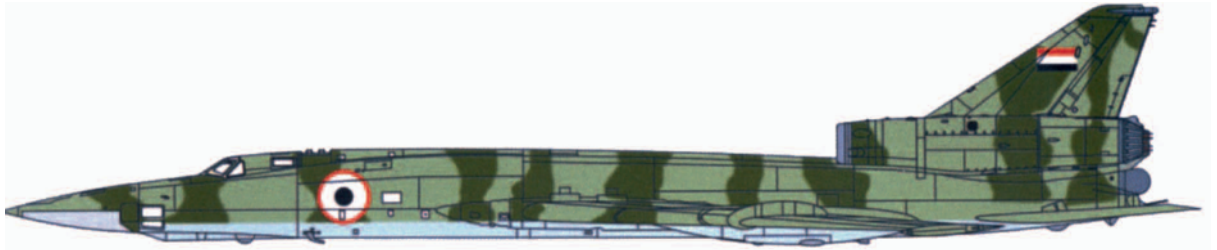
The suffix 'M' in Tu-22RDM stands for *Modifitsirovannyi* (modified).

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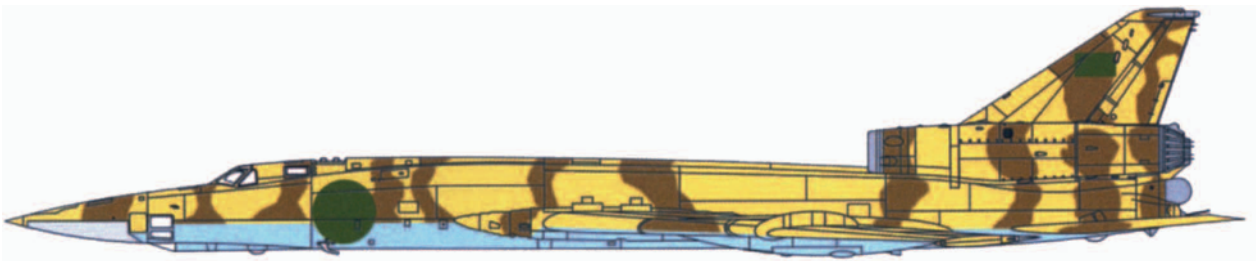
\* A small number of Tu-22R aircraft were modified as 'strike reconnaissance systems', receiving the designation Tu-22RM, although these aircraft were only ever used in trials and did not enter service with the Soviet Air Force.



In spite of access to disabled Iraqi Tu-22s by coalition forces after the 2003 war in Iraq, precise information is still not available on the camouflage colours worn by Iraqi Air Force *Blinders*, the green/brown pattern on this Tu-22U being more demonstrative than definitive. Although some Iraqi *Blinders* are known to have carried the air force's triangular symbol on the rear fuselage, without a serial, the national flag on the fin was usually the only sign of identity carried by these bombers. *Sergey Sidorenko*



This Libyan Air Force Tu-22A Variant 'B' illustrates the location of the red-white-black roundel valid at the time of delivery in 1975. Serial numbers are not thought to have been assigned to any of the Libyan Tu-22 fleet, at least none that were externally visible. *Sergey Sidorenko*



As with Iraqi *Blinders*, details of the actual camouflage colours of the aircraft operated by Libya are not known and those illustrated should be regarded as notional, rather than definitive. In 1977 Libya changed its name to the Socialist Libyan Arab Peoples Jamahiriya and adopted a plain green flag, (signifying devotion to Islam), as its national emblem and used in roundel form to identify Libyan military aircraft and helicopters. The roundel on Libyan Tu-22A Variant 'B' bombers is possibly one of the largest ever worn by a modern military aircraft. *Sergey Sidorenko*

The Tu-22U (*Uchebnyi*) was the training variant, and although later aircraft were modified to carry an in-flight refuelling probe, they were not 'plumbed' to receive fuel and were used solely as procedural trainers. (The designation Tu-22UD is, therefore, erroneous.)

Although the original NATO codename *Blinder* is used throughout the text of the book, it is a less effective way of describing the numerous variants of the Tu-22 covered, since many sub-variants were never allocated a designating letter or number. The codenames have only been used in the book to avoid ambiguity or unnecessary repetition of the Russian designation.

## CHAPTER ONE

# Development History of the Tu-22

Any work dealing with the introduction of the Tu-22 into the Long-range Aviation regiments of the Soviet Air Force must first of all consider the personality of General Designer Andrei Nikolayevich Tupolev himself. Tupolev was considered by many to be a true genius of aeronautics, who commenced his life in aviation in Tsarist times alongside Igor' Sikorsky, another of Russia's famous aircraft designers and a world-renowned helicopter pioneer. Like many geniuses, Tupolev was self-assured, ambitious and possibly even a little authoritarian, but highly respected by friends and colleagues. He was well known before the Second World War for his heavy aircraft designs, but during the war Tupolev became a victim of the widespread Stalinist repression of the time and ended up in prison. [*Stalin's purges of the Soviet Air Force and the Soviet aircraft industry, designed to eliminate all military and political opposition to his dictatorship, are really the subject of a separate study. However, it is relevant to mention here that Andrei Tupolev was arrested on the quite astonishing suspicion of having supplied Germany with information enabling Messerschmitt personnel to design the Bf 109 and Bf 110 fighters! Some sources have suggested that as many as four hundred and fifty aircraft designers, engineers and other specialists were interned under Stalin's orders between 1934 and 1941, of whom around three hundred were set to work in NKVD-supervised design bureaux. It is also thought that about a hundred senior aviation industry personnel died in labour camps and at least fifty were executed.* AD]

It was while he was a prisoner in the Special Technical Department of the People's Committee for Internal Affairs (STO NKVD – *Spetsial'nyi Tekhnicheskii Otdyel Narodnovo Komiteta Vnutrennikh Dyel*) that he designed the well-known and elegant Tu-2 (*Bat*) light bomber. (The NKVD was, of course, the predecessor of the universally feared KGB – *Komitet Gosudarstvennoy*

Andrei Tupolev (1888-1972) in his office in the 1960s. Tupolev was a legendary figure who led his design bureau with great skill and concern for his staff, surrounding himself with a highly talented team to create some of Russia's most important civil and military aircraft of the Soviet era. *OKB Tupolev*



*Bezopasnosti*, or Committee for State Security). After release from imprisonment he was once again allowed to run his own design bureau, and with the war now ended, the Soviet Union needed new heavy bombers to carry the nuclear weapons which underpinned Russia's post-war defence philosophy. Tupolev was full of bold ideas with which to meet this need, but his ambitious dreams clashed with Stalin's continuing distrust of the designer, and the Communist Party leader instead assigned Tupolev the task of creating a copy of the American Boeing B-29 to spearhead Russia's new bomber force. (*Three B-29s had fallen into Russian hands intact, after making forced landings on Soviet territory in 1944, following bombing raids on Japanese targets*). Tupolev's resulting copy of the B-29 became the Tu-4 *Bull*, and was built in spite of Tupolev's attempts to convince Stalin that he could create a much more modern and advanced aircraft than one based on the US design. The decision was deeply wounding to Tupolev's pride, but the end of the 1940s was a difficult period for many Russian design bureaux, and under Stalin's arbitrary rule many of them were closed down while new ones, acceptable to the dictator's whim of the moment, were opened up.

Thus, at the end of the 1950s, the Sukhoi Design Bureau was also closed down, and the vast majority of Sukhoi designers ended up in OKB-156, led by Andrei Tupolev. Still in these less than ideal conditions, under the continuing shadow of Stalin's interference, OKB-156 carried out work on the development of a truly modern nuclear-capable bomber, the twin-jet Tu-16 *Badger*. However, at the same time, Tupolev's pride was dealt yet another blow. In 1951, by order of the Ministry of Aircraft Production (MAP), a new design bureau, OKB-23, led by Vladimir Myasishchev, was formed specifically to design long-range strategic bombers, hitherto the 'province' of Tupolev himself. In order to staff the new design bureau a large number of designers were transferred by order of the MAP from Tupolev's OKB-156 to the newly created OKB-23. Particularly damaging to Tupolev was the fact that the design teams working exclusively on undercarriages and hydraulic systems were transferred from OKB-156 to OKB-23 in their entirety.

Therefore, the two design bureaux ended up struggling somewhat unequally for the right to design the long-range strategic bomber necessary for the Soviet Union to implement its post-war defence plans for an air-delivered nuclear capability. The first large jet bomber accepted for service was, not surprisingly in the circumstances, the four-engined Myasishchev M-4 *Bison*, and Tupolev had to 'pull out all the stops' to promote his own submissions for this role – the twin-jet Tu-16 *Badger* and the four-engined Tu-95 *Bear* four-turboprop bombers. This was the situation when the Soviet government declared a competition for the design of a supersonic long-range bomber, and Tupolev, probably wishing to exact a certain revenge for his less than honourable treatment, hurriedly set to work on designing the new aircraft. The first direction taken in pursuit of this objective was to develop the basic 'theme' of the Tu-16, in the guise of Aircraft '103', powered either by four VD-7 turbojets developed by V.A. Dobrynin (OKB-36), or AM-13s developed by A. Mikulin.

However, quite early in the preliminary design stage, it became obvious that it would not be feasible to develop a supersonic bomber based on the general layout of the Tu-16, so the OKB-156 design team set to work on an entirely new aircraft. The designers were possibly encouraged by the example of Myasishchev's team, which had designed 'quite a good bomber' (the M-4 *Bison*) in a relatively short time frame and practically from a 'blank sheet of paper'. After examination of a range of preliminary projects within the OKB-156 design offices, a design offered by a team under the leadership of Sergey Mikhailovitch

Yeger (1914–87) was accepted for development. Yeger, a future corresponding member of the Academy of Sciences of the USSR, a Doctor of Technical Sciences and Hero of Socialist Labour, had commenced his aerospace career in 1932 at the world-renowned Central Hydro-dynamics Institute (*Tsentral'nyi Aero-gidrodinamicheskii Institut* – TsAGI) at Zhukovskii. Then, from 1933, he worked at Factory 39 as a designer and then as head of a general design team, and completed his aeronautical studies in 1936 at MAI (Moscow Aeronautical Institute). In 1938 he was arrested by the NKVD and was forced to work in the NKVD's special technical office (TsKB-29) with A.N. Tupolev in a general design team engaged in the design of the Tu-2 (PB – *Pikiruyushchii Bombardirovshchik*) dive-bomber and its derivatives. In 1943 Yeger was appointed Head of the Department of Technical Projects of the Tupolev OKB, and from that moment practically all aircraft carrying the 'Tu-' designation resulted from the creative inspiration at Yeger's desk and drawing-board. It was he and his department colleagues who decided, in the initial stages of the existence of any project for a new Tupolev aircraft, how it should look and perform. Sergey Yeger was the 'author' of all of Tupolev's post-war aircraft designs and, in



Sergey Mikhailovitch Yeger (1914–1987), principal designer of the Tu-22 and 'architect' of the successful introduction to service of this, the Soviet Union's first supersonic medium bomber. Alongside Tupolev himself, Yeger was the inspirational force behind most of Tupolev's post-war heavy aircraft projects. *OKB Tupolev*

addition, devoted much time to questions regarding the operational use of Tupolev aircraft by the Soviet Air Force. It was thanks largely to Yeger that it was possible for the OKB to resolve many problems relating to the effective operation of Tupolev's integrated aircraft and missile systems, and much credit goes to him for the creation of the Tu-22 family and its development into the Tu-22M *Backfire* (Tu-106).

Sergey Yeger's project for Aircraft '105' (the prototype of the Tu-22 *Blinder*) was adopted as the Tupolev candidate to be the Soviet Union's first supersonic long-range bomber, although the '105' had been preceded by Aircraft '98', an earlier unsuccessful supersonic tactical bomber project. In spite of not going into operational service, Aircraft '98' served as a very useful exemplar for the resolution of design problems relating to the larger supersonic bomber. Aircraft '105' was unique at the time in the history of aviation in the former USSR, and indeed in the rest of the world. 'On paper' the design was rather undistinguished, described in typically understated Soviet terms as being 'a cantilevered mid-set swept-wing aircraft, with a tailplane of normal configuration, a tricycle undercarriage and two afterburning turbojets'. However, what did distinguish the '105' from all other preceding bomber designs was that huge improvements in on-board electronics systems had enabled the designers to reduce the crew complement to three

men – pilot, navigator and radar operator. The entire crew was housed in a single common pressurised cabin, where all essential conditions for normal flight operations were controlled automatically (i.e. temperature and pressure, etc.). Reduction of the crew size, by dispensing with the need for a second pilot, had both a political impact and an aerodynamic benefit in that the fuselage cross-section could be reduced, which greatly simplified the problem of pressurising the cockpit section. The same route was followed by OKB-23 in the design of the (unsuccessful) M-50 *Bounder* delta-winged strategic bomber. The State Committee for Aviation Technology (*Gosudarstvennyi Komitet po Aviatsionnoy Tekhniki* – GKAT), forerunner of the Ministry for Aircraft Production, approved the design of the ‘105’, allowing work to start without delay.

The ‘105’ was created in extremely difficult circumstances. Three years earlier in 1954, a document entitled ‘General Technical Requirements of the Air Force’ (*Obshchiye Tekhnicheskiye Trebovaniya Voенno-vozdushnykh Sil* – OTT VVS) had been drawn up for the Tu-16. The OTT VVS for the Tu-16 contained observations and recommendations relating to the aircraft’s introduction to service, which would be embodied subsequently in the aircraft’s flight operations and servicing manuals. However, no such document existed for a newly built aircraft, still in the early flight test stage, which led to long discussions between the customer (a Soviet-era euphemism for the Soviet military) and the developer, concerning the appearance and layout of the future supersonic bomber. These discussions dwelt particularly on the question of defensive cannon armament, the Tu-16’s four such weapons perhaps being seen as the baseline standard for self-defence. The most weighty problem for consideration, however, turned out to be the achievement of supersonic speed. Even the Soviet jet fighter force was still only at the threshold of the supersonic era, and the TsAGI and LII (*Lyotno-Ispytatel’nyi Institut* – Flight Test Institute) personnel had only just started to study the behaviour of fighter aircraft at transonic and supersonic speeds. This little-researched area of aerodynamics was still shrouded in mystery and hid many puzzles from researchers. Yet another huge problem at this time was the provision of a suitable powerplant. Three types of engine were proposed for the new aircraft, two of which, the VD-5 and the VD-7, were close to entering series production under the supervision of V.A. Dobrynin’s OKB-36, albeit only the VD-7 had actually demonstrated the level of thrust required. The third engine, the Kuznetsov NK-6, exhibited the best potential performance, but was only at the preliminary development stage. As a consequence of the possible shortfall in available engine power for the ‘105’ it was decided to exploit all existing possibilities to achieve supersonic performance.

In the first instance, it was decided to use a thin ‘clean’ wing, with a sweep angle at the quarter chord line of 52°–55° and main undercarriage bogies which retracted into the fuselage, only the main legs retracting into the wings in order to preserve aerodynamic ‘cleanliness’. Research conducted at this time on the Lavochkin La-160 by engineers and designers at the LII at Zhukovskii revealed that an aircraft with a swept wing and tailplane showed a tendency to ‘pitch up’ at speeds around Mach 1. Evidently, the Tupolev design team decided to mount the engines above the fuselage in order to compensate for this pitching moment at transonic and supersonic speeds. Apart from this, such an engine location resulted in the achievement of a lower overall drag coefficient, and the short intake ducts of the engine nacelles permitted internal pressure losses to be reduced to a minimum. Unfortunately, this particular airframe layout was unlikely to impart very good take-off and landing performance, and as a consequence it was decided to base the aircraft only at ‘first-class’ airfields. (This is usually taken to mean airfields with a concrete

runway of at least 3,000m/9,840ft length). At the time it was the inevitable price to pay for the achievement of the performance demanded by the Soviet government for the new generation of supersonic bombers. The other important features of the new bomber, the integral pressure cabin, crew life support systems and new emergency escape systems, were all developed jointly, with OKB-156 working closely with industry and the Scientific Research Institutes of the Soviet Air Force. At the time, the majority of Soviet Air Force bomber regiments were still equipped with the piston-engined Tu-4 *Bull*, and yet the same design bureau was now preparing to introduce a supersonic bomber to the Long-range Air Force. In August 1957, the first prototype of Aircraft '105' was handed over to the Flight Test and Development Base (*Lyotno-Ispytatel'naya I Dovodoch'naya Baza*) of OKB-156 at Zhukovskii, although it was almost a further year before OKB-156 test pilot Yuri Alasheyev was able to complete its maiden flight, on 21 June 1958.

Flight testing of the first prototype revealed that it was not going to be possible to achieve the required speed performance with the aircraft as configured, and the 'struggle for speed' and, therefore, for the large State order for the new bomber, continued. It was unthinkable to fall behind in any way. So, at the same time as carrying out flight tests of the first prototype, OKB-156 engineers continued to work on the design and construction of a second prototype – Aircraft '105A', which embodied a number of significant design changes. These changes affected the pressure cabin, the tail and central fuselage areas, the wing and the tailplane. The main objective of all the changes was to increase the attainable speed by any means possible. Thus, in order to reduce drag at transonic and supersonic speed, the aircraft was built in accordance with the principles of the then recently described 'area rule', a concept originally elaborated by Richard Whitcomb of NACA (more widely known by its later redesignation as NASA). (*The 'area rule' is a rather complex mathematically-derived engineering procedure, albeit with the simple objective of reducing an aircraft's drag at transonic speeds. In essence, this requires the aircraft's cross-sectional shape, including wings and fuselage, to change shape as 'slowly' as possible in order to reduce the number and power of locally generated supersonic shock waves*). The wing root of the '105' was too deep to exploit adequately the requirements of the 'area rule', so it was reduced on the '105A' by adopting a different design for the undercarriage. The main undercarriage was now made to retract fully into cigar-shaped fairings 'set' into the wing trailing edge, similar to those used on the Tu-16, and the tail section was changed to accommodate defensive armament consisting of:

- A trainable 23mm cannon installation comprising a 261P cannon, controlled by a PRS-3 gun-laying radar, with an associated TP-1A television sight (camera) for rear hemisphere protection
- An SPO-3 (Sirena-3) 360-degree radar warning receiver to inform the crew that they were being illuminated by enemy fighter radars.

The wing and tailplane were selected from high-speed profiles of low thickness–chord ratio (6%) with a wing loading of 602kg/m<sup>2</sup> (123lb/sq ft), and along with other measures resulted in the achievement of a drag coefficient of 0.040. The wing was given a relatively high aspect ratio (for a swept wing) of 3.7 in order to obtain good long-range performance, its aerodynamic efficiency being improved by the adoption of –4° of conical twist. The chosen wing design of the '105A' led to the achievement of a very respectable lift–drag ratio in cruising flight of 11.5. Slotted flaps were employed as the wing's

principal high-lift devices, the inner flaps deflecting to  $35^\circ$  and the outer sections deflecting to  $20^\circ$  for take-off and landing. Wind tunnel tests revealed that the angle of attack at which stall would occur with flaps down was  $14^\circ 30'$  and the maximum angle of attack to which the aircraft could be taken on take-off or landing was  $12^\circ 33'$  (limited by the tail skid contacting the runway), giving a  $2^\circ$  margin in these conditions.

The maiden flight of the newly modified '105A' took place on 7 September 1959, enabling flight tests to be carried out simultaneously with two aircraft – '105' and '105A'. Nevertheless, the first stage of State tests of Aircraft '105' probably confirmed in Tupolev the belief that the development path of these supersonic aircraft was leading to a 'dead end'. Using the chosen aerodynamic layout and engines, it seemed that the maximum potential of the aircraft had already been reached and little else could be done to improve it. 'I do not think (*Sergey Burdin's comment*) that it is correct to say, as some would have it, that Tupolev regarded the "105A" project rather like an unwanted child.' Nevertheless, it was evident that Andrei Tupolev intuitively understood, after the first few test flights of the '105', that neither a scientific nor a technological knowledge base yet existed in the Soviet Union for the creation of this class of aircraft. The era of new technologies and extensive knowledge and understanding of the dynamics and aerodynamics of supersonic flight had not yet arrived, but the General Designer continued work on this 'theme' (i.e. the supersonic bomber project), while devoting much of his attention to other programmes. These were the more promising programmes for the creation of large strategic bombers (i.e. the Tu-95 family) and civil aircraft for Aeroflot – the civil air fleet of the USSR. This was a perfectly reasoned view to take, since these projects would be guaranteed considerable financial backing by the Soviet government and promises of long-running State orders. Tupolev would only return to the subject of producing a new supersonic long-range bomber in earnest after a further seven or eight years.

In the first half of the 1950s, the LII at Zhukovskii had been conducting research into the stability and control of swept-wing aircraft at supersonic speeds. The flight tests involved the use of the MiG-17 *Fresco* fighter (capable of Mach 1.17) in 1952, a MiG-17NBU with hydraulically boosted elevators and ailerons in 1954 and a MiG-19V *Farmer-B* (capable of Mach 1.46) in 1956. Among the LII test pilots involved in this research was Yuri Alasheyev, and his experience in supersonic flight was one of the main reasons for his being invited to join the Tupolev team at OKB-156. However, in spite of the high-speed research programmes being performed by the LII, design of the control systems of Aircraft '105' was being carried out virtually blindfold. At that time the behaviour of lightweight fighters at supersonic speeds was insufficiently well understood, and research into the performance of supersonic bombers had certainly not been planned. The error of such an approach to the design of a large supersonic aircraft was exacerbated by the fact that the heads of the design teams at OKB-156 did not have access 'to the outside world'. In this case the 'outside world' was not what lay beyond the Soviet Union, but simply the Scientific Research Institutes of the Soviet Air Force and other Soviet aircraft design bureaux! Consequently, the Tupolev team had to go through the exercise of 'reinventing the wheel', and everything that had been discovered in designing supersonic fighters had to be 'rediscovered' by the Tupolev designers – a costly and wasteful process. As a consequence of this lack of shared knowledge between the fighter design community and Tupolev as a bomber specialist, the Tupolev designers ended up using an adjustable tailplane with elevators for pitch control, when it had already been established that this combination was inadequate for supersonic flight. The entire pitch

control system of the new aircraft was virtually analogous to that used on the subsonic Tu-16, but after the destruction of the first prototype (Aircraft '105') on 21 December 1959, killing test pilot Yuri Alasheyev and navigator I Gavrilenko, significant changes were made to the flight control system of the remaining prototype.

Tests had shown that during the transition to supersonic flight the effectiveness of all flying controls was greatly reduced, while the hinge moment was significantly increased. So the '105A' was fitted with an all-moving tailplane in place of the ineffective tailplane and elevators used on the first prototype. It was decided, therefore, that all channels of the flight control system (pitch, roll and yaw) should be modified to incorporate non-reversible hydraulic actuators, although it was not easy to find a suitable actuator for the tailplane. At the time, there were only two types readily available, the first being the unit installed on the Myasishchev M-4 *Bison*, which satisfied the requirement in terms of power, but was too big and too heavy. The second type was the actuator used at the time on fighter aircraft, which was smaller and lighter, but insufficiently powerful for a large supersonic bomber. It would have been impossible to wait for the development of an entirely new actuator since it would have taken too long and could have led to the cancellation of the programme. An eventual solution to the problem came quite unexpectedly, and its originality was absolutely typical of the style of Andrei Tupolev. He decided to use an actuator from the dive-vane controls of one of the Soviet Navy's diesel submarines, which experienced the same type of hinge moment as that of the tailplane of the '105A'! After some small changes the RP-21 actuator was installed in the second prototype.

Also in 1959, Dmitriy Sergeyevech Markov (1905–92) was appointed leading designer of the Aircraft '105A' project. Markov began his aviation career in 1928, and while still a student at the Moscow Higher Technical University (MVTU) was sent to work in Factory N1 as a design engineer, completing his aviation studies at MVTU in 1930. From 1931 he worked as head of the design department at Factory N1, and then from 1932 as Chief Designer. During his employment at Factory N1 he was involved in the design and introduction to service of the Polikarpov I-7 (licence-built Heinkel He-37) and R-5 series of aircraft and their various derivatives. In 1938 he was arrested by the NKVD and sent to work at the OTB NKVD, where he worked on the design of the '100', '102' and '103' series of aircraft, and from 1941 worked with Andrei Tupolev



Dmitri Sergeyevech Markov (1905–92) was Tupolev's chief designer closely involved with the introduction of the Tu-4 *Bull*, design of the Tu-16 *Badger* and Tu-98 *Backfin* and leading designer of the '105' project leading to the Tu-22 and, ultimately, the Tu-22M *Backfire*. OKB Tupolev



The first prototype of 'Aircraft 105', showing its resemblance to the eventual Tu-22, but differing in the nose area and more significantly, in the inward-retracting main undercarriage. *OKB Tupolev*

as Deputy Chief Designer, participating in the development and introduction to service of the Tu-2 (*Bat*). In 1947 Markov was appointed Deputy Chief Designer responsible for the service introduction of heavy aircraft (bombers), and led the work on development and release to service of the Tu-4 *Bull* and its eventual operation by the Soviet Air Force. From 1949, as Chief Designer, he led the programme which resulted in the construction of the Tu-16 and its derivatives, and then later led the design work on the Tupolev OKB's first supersonic aircraft, the Tu-98 *Backfin*. (Later still, he was to lead the design project which resulted in the creation of the Tu-22M *Backfire* variable-geometry supersonic bomber, but that was much later....) The Soviet government was heavily involved at the time in internal discussions about the future of its defence policy, believing that this lay more in the realm of missile defences than in the deployment of large bombers. Since it was the Soviet leader Nikita Khrushchev who had put forward these ideas, rumours about possible reductions in the size and composition of the Soviet Air Force were very real and could not be ignored.

However, in spite of the rumours, the test period for the '105A' was extended, and it was decided to proceed to the second stage of State tests (i.e. in-service trials) as soon as possible. The State Committee for Aviation Technology (GKAT) and the Soviet Air Force understood that introducing such a complex aircraft would be fraught with difficulties, and even before the completion of the first stage of State trials it was decided to lay down the first batch of twenty 'series-production standard' aircraft at Factory 22 at Kazan' in the present-day Tatarstan Republic. This procedure was quite common for Soviet Air Force procurement programmes and had been adopted for the introduction of the Tu-4 and the Tu-16. It was around this time that confusion arose about the naming of the new aircraft, since like the Tu-16, which had been given the 'private' (*zakrytyi*) designation of Tu-16A, the new bomber received the 'private' designation of Tu-22A. ('Private' in this context is a category akin to secret, but probably meaning something like 'for internal eyes only'.) However, in the established rule of the Soviet era, the aircraft was also given the 'open' (*otkrytyi*) designation of 'Article Yu', which could be used in non-classified (i.e. non-secret) documents. [*Evidently, the letter Yu was a purely arbitrary choice and did not signify anything in particular.* AD]. Nevertheless, this first variant of the bomber was often referred to as 'the Tu-22 variant B' (i.e. B for *Bombardirovshchik*, or bomber), which led to the appearance of the incorrect designation of this variant as Tu-22B in some reference sources. [*This was the second use of the designation Tu-22 and was clearly unrelated to the Type '82' (Tu-22 2VK-1)*

*experimental tactical bomber, the first Russian 'heavy' bomber with a swept wing, which made its maiden flight on 24 March 1949. SB]*

Everything relating to the new bomber project then followed the established routine, but in the same year (1959), an event was to occur which would have a profound influence on the future of the Soviet Air Force and on the ultimate 'destiny' of the Tu-22A. In that year, a new branch of the Armed Forces was created, namely the Strategic Rocket Forces (*Raketniye Voiska Strategicheskovo Naznacheniya* – RVSN), equipped with long-range ballistic missiles, comprising twenty-nine 'aviation' regiments, subordinated to three Air Armies. Tupolev understood very well that in these newly emerging circumstances, the Soviet government would probably not provide the Soviet Air Force with finance for the purchase of a new bomber, however much the service wanted it. Indeed, all interested parties backing the procurement of the Tu-22A also understood that the government, promoting the development of the new force, would be unwilling to expend valuable resources on such 'outdated and unpromising means of delivery of nuclear weapons' as aircraft. A rather subtle subterfuge was adopted by OKB-156 and the Soviet Air Force in order to rescue the Tu-22 from potential oblivion. The OKB-156 design team decided to offer the Air Force not just a bomber, but also a long-range supersonic reconnaissance platform which could be re-roled as a bomber by ordinary squadron personnel. Looked at from the sidelines this seemed to be a very reasonable, and indeed reasoned, proposition. A long-range supersonic reconnaissance aircraft was actually needed at that time, and the government was, evidently, ready to allocate procurement funds. Tupolev's solution fully satisfied the 'customer' (i.e. the Soviet Air Force) since the service would then receive a dual-role aircraft. The same approach had been adopted in the procurement of the Tu-16 and had been found acceptable, with a number of sub-variants providing the Soviet Air Force with a very useful multi-role platform.

However, in the case of the Tu-22, designed from the outset purely as a supersonic bomber, it would have had to undergo significant design changes and new flight tests, already behind schedule, in order to satisfy the proposed dual-role criterion. The main problem which had been encountered during flight testing of the Tu-22 was not the aircraft's equipment, but its performance and inadequate engine power. In terms of performance, the first problem related to the aircraft's complex aerodynamics, particularly affecting its behaviour at transonic and supersonic speeds, and the second was the VD-7M engine, which still exhibited a number of design deficiencies and, like the aircraft itself, was still under development. Added to all of this was the problem of guaranteeing that Soviet Air Force crews could quickly master operation of the Tu-22 in the regiments. At that time, even Soviet Frontal Aviation (i.e. tactical) fighter units had only just entered the supersonic era, and for the bomber crews of the Long-range Air Force the aircraft was truly revolutionary! Therefore, with the joint efforts of the 'customer', in the form of the Soviet Air Force itself, GKAT and OKB-156, it was decided to commence the second phase of State flight testing of the aircraft, with Tu-22As which were already being built in Factory 22 at Kazan'.

At this point it is perhaps appropriate to mention briefly the system used in the former Soviet Union in the procurement and formal acceptance for service of military aircraft and helicopters. Before an aircraft could be accepted for service, it had to undergo two stages of State flight testing. The first stage, which was carried out by the design bureau concerned, under the auspices of the Ministry for Aircraft Production (MAP), involved a

series of general tests designed to evaluate the aircraft's performance and whether it corresponded to the 'customer's' stated requirements and specifications. These tests were conducted at the design bureau's own Flight Test and Development Base, the majority of which was located at the LII airfield at Zhukovskii on the southern outskirts of Moscow. Part of the testing could thus involve LII and TsAGI personnel, if required. After the aircraft had demonstrated performance close to that specified by the Soviet Air Force, it would then be transferred to an operational regiment where it would undergo pre-service acceptance trials (*Voiskoviye Ispytaniya* – literally 'troop trials'). These would constitute the second stage of State trials, with one or two regiments being selected as the first recipients of the new aircraft and the units involved being described as 'Leader Regiments'.

For this phase of testing, support teams and specialists from the design bureau and the relevant manufacturing plants would be permanently assigned to the 'Leader Regiment' to assist the air and ground crews to convert onto the new aircraft. While seconded to the air force regiment, the OKB and factory specialists would maintain contact with designers and engineers 'back at base' so that they could eliminate, in the shortest possible time and with expert advice, any defects noted during the operational trials. Simultaneously with the regimental trials, the aircraft's weapons would be evaluated in trials conducted by the State Scientific Research Institute (*Gosurdastvennyi Nauchno-ispytatel'nyi Institut* – GNI) at Vladimirovka airfield, near Akhtubinsk, at the mouth of the River Volga. The Soviet Air Force Combat Application Centres (*Tsentr Boyevovo Primeneniya* – TsBP), operated by the Long-range Air Force, Frontal Aviation and Naval Aviation as operational conversion units (OCU), would also participate in the 'troop trials'. After passing this stage of testing, the aircraft was usually accepted for service, with appropriate modifications where necessary, and the authorising Certificate (of Airworthiness) was signed. Under this system, by the time an aircraft had been formally accepted for service, it could well have been operated by the Air Force for several years. This often surprises aviation enthusiasts and students of Russian military aviation, but to a Russian, there was nothing strange or unusual about the procedure.

Delivery of the first Tu-22As commenced in 1962 to the 203rd Heavy Bomber Aviation Regiment (203 *Tyazholobombardirovochnyi Aviatsionnyi Polk* – 203 TBAP), subordinated to the 6th Independent Heavy Bomber Aviation Corps (6 *Otdyel'nyi Tyazholobombardirovochnyi Aviatsionnyi Korpus* – 6 OTBAK), this regiment being based at Baranovichi in the then Byelorussian Soviet Socialist Republic. (Following the collapse of the Soviet Union, the Byelorussian SSR became the independent Republic of Belarus'.) In the same year a squadron of Tu-22As was transferred from 203 TBAP to the 290 Independent Long-range Reconnaissance Aviation Regiment (290 *Otdyel'nyi Dal'nyerazvyedyvatel'nyi Aviatsionnyi Polk* – 290 ODRAP), based at Zhabrovka, near Gomel', also in the Byelorussian SSR. These two regiments thus became the 'Leader Regiments' for the Tu-22's pre-service acceptance trials. The second stage of State trials proved very difficult since neither industry nor the Soviet Air Force was anywhere near ready to introduce a heavy supersonic bomber into operational service. Insufficient knowledge of the stability and control problems of the aircraft in the transonic and supersonic flight regimes led to service personnel having a very negative approach to the Tu-22. Moreover, to issue this aircraft to an ordinary squadron pilot was fraught with potential danger since he would not have the test pilot's experience to cope with unexpected handling problems in these flight regimes, which were entirely new for the

long-range bomber force. The first batch of aircraft lacked the device which was later to become an inseparable part of the flight control systems of all supersonic aircraft. Because the control system was non-reversible, the pilot did not feel any loading from the tailplane, and the absence of such sensations led him to make pitch control inputs which could easily lead to excessively large, even destructive, g-loading of the airframe. In flight at high transonic speeds and other specific flight regimes, the aircraft could begin to develop pitch oscillations (pilot-induced oscillations, or PIO) as a result of delays in the aircraft's response to pitch inputs at the control column, often leading to tragic consequences. Additionally, at certain speeds and altitudes, the phenomenon of aileron reversal also manifested itself, and flying the aircraft was likened to 'treading on a knife edge'!

The control difficulties of the Tu-22 forced OKB-156 to find a way of resolving the problem without delay, which subsequently led to the installation of an artificial feel-and-trim system and pitch damper in the tailplane circuit, and a control-column-movement rate-limiter. The tailplane and aileron circuits were also equipped with dry friction dampers. Later, it was decided to provide the Tu-22 with flaperons (described as aileron-flaps – *ehlerony-zakrylki* – by the designers) to serve as high-speed ailerons in order to overcome aileron reversal, and flexible undercarriage mountings to improve flutter resistance (Described in Chapter 4). However, before coming up with a definite solution to the aircraft's control difficulties, Tupolev took the only really correct decision in the circumstances, and imposed limits on the altitude and speed ranges in which it was permitted to operate the Tu-22. The measure was not popular, but it did allow operational trials of the aircraft to continue on the 'Leader Regiments', and reduced to a minimum the likelihood of a squadron pilot ending up with an in-flight emergency resulting from loss of control of the aircraft. The full modification programme, which would lead to the Tu-22 being considered fully operational, was still some way in the future, and the factory at Kazan went ahead with completion of the construction of the basic aircraft already laid down on the production line.

Meanwhile, OKB-156 in Moscow, along with its 'branch' at Tupolev's associated manufacturing plant, Factory 22 at Kazan, was actively involved in the development of the reconnaissance variant of the Tu-22. This development programme was given the cover-name 'Sibir'-1' (Siberia-1) and the integrated system (or 'Complex' in Russian

A rare, albeit slightly retouched, colour photo of one of the first Tu-22R reconnaissance variants at





In the early years of operation, the Tu-22R possessed an extremely energetic take-off performance, allowing experienced pilots to make dramatic 'high Alpha' climb-outs such as this, similar to those of the British Avro Vulcan and Handley Page Victor in their heyday. This photo dates back to the early 1960s and shows a Dobrynin VD-7M-powered Tu-22R of 290 ODRAP departing Zyabrovka. *Sergey Tsvetkov Archive*

parlance) included the Tu-22R (Article YuR) aircraft and its related reconnaissance suite. The Tu-22R was designed to carry out tactical reconnaissance (*operativnaya razvyedka*) in support of the strategic objectives of the Long-range Air Force, for which it was equipped with cameras and electronic intelligence (Elint) equipment and capable of conducting reconnaissance missions in all weather conditions, day or night and at high and low altitude. As on the Tu-22A, the crew consisted of three men, comprising a pilot and navigator, with an airborne operator (*vozdushnyi operator*) replacing the specialist radar operator (*radist*) of the pure bomber version. The bulk of the camera equipment was carried in the payload bay (*gruzovoy otsek*) and dependent upon the mission the Tu-22R could be equipped with one of four camera 'fits' – three day 'fits' and one night. The inclusion of a night-photography capability made it expedient to retain the original bombing equipment, since this option required the use of photo-bombs (flares) for target illumination at night. This meant that the Tu-22R could be converted quite quickly for bombing missions by regimental ground crews, only involving the removal of the camera equipment from the payload (weapons) bay. The military doctrine of the USSR always maintained that global military conflict would inevitably degenerate into nuclear war, and the tactics and strategy of the Soviet Air Force and its training programmes were all predicated on this concept. Consequently, the Tu-22R had a special weapons capability, allowing it to carry nuclear bombs (in Soviet times these were known by the common generic term '*spetsial'niye izdeliya*', or 'special articles'). Apart from nuclear bombs, in the bombing role the Tu-22R could carry conventional bombs from 250kg (550lb) to 9,000kg (19,840lb) calibre. Powered by two Dobrynin VD-7M engines, each of 16,000kg (35,273lb) thrust at take-off, the Tu-22R was able to achieve speeds of 1,200–1,300kph (650–700kts) at altitude and 850kph (460kts) at sea level.

Mention must be made of an often overlooked historical fact about the Tu-22R, which is that it was conceived not for a nuclear dash capability (which many have supposed), but for supersonic cruising flight. In consequence of this design condition, the VD-7M engines had two afterburner modes, namely 'cruising' and 'maximum'. The power-to-weight ratio of the aircraft compared with that of the Tu-16, plus its (eventually) improved aerodynamic efficiency, enabled the aircraft to reach altitudes of up to 13,500m (44,290ft) in the area of the target. Introduction of the Tu-22R greatly increased the potential of airborne strike formations and took the Long-range Air Force to an altogether higher (literally and figuratively) level of operational capability. The aircraft's equipment comprised an integrated system of sub-elements which constituted an entire suite of interrelated units, and it was one of the first Soviet Air Force aircraft to have an integrated navigation-bombing suite, plus integrated defensive and radar warning, flight control, navigation and radio systems. Considerable attention had been paid to the achievement of navigational accuracy on the Tu-22R, and the aircraft was equipped with the 'Put'-4 (Route-4) integrated flight and navigation system, at the time the most advanced of its kind in Russian service. This was still a system based on analogue techniques, but working in conjunction with the navigation-bombing system, mission tasking could be carried out effectively by the three-man crew of the Tu-22R. Of course, it was by no means the fully integrated system to be seen on aircraft in the 1970s and 1980s, but it was the first attempt to achieve the maximum functional integration of different components of the flight control, navigation and weapons systems on a Russian military aircraft. Overall, the aircraft's avionics facilitated:

- Navigation in day and night instrument meteorological conditions (IMC) within a defined range of speeds and altitudes

A Tu-22RDM *Blinder-C2* of 290 ODRAP taxiing at Zyabrovka. Clearly visible under the central fuselage area is the flush-fitting pod housing the antenna of the Shompol (Ramrod) sideways-looking radar of this improved variant. *S Burdin Archive*



- Day and night visual reconnaissance, with position and target location fixing with the aid of aerial photography, as well as photography of the radar screen for the same purpose in any weather conditions
- Electronic reconnaissance (Elint) of the deployment and operating parameters of enemy radar transmissions, with recordings of the latter on a special photo-film
- Bombing of land-based and ship-borne fixed and moving targets, either with or without optical or radar sighting of the target
- Self-defence against enemy anti-aircraft missile or fighter attacks
- Two-way communications with command posts from the limits of the normal operating radius of the aircraft, communication between other aircraft in the formation, plus normal intercom for the crew
- Return to the aircraft's operating base and the execution of an approach to land in limited visibility, day or night.

OKB-156 managed to bring the Tu-22R up to the second stage of State flight tests in a fairly short space of time, and the first operational deployments commenced in 1963. Initially these were to 290 ODRAP at Zyabrovka and then to 15 ODRAP of the Baltic Fleet Air Force, based at Chkalovsk in the Kaliningrad Region (*Oblast'*) of the former Russian Soviet Federated Socialist Republic of the Soviet Union. (The Kaliningrad Region is a small enclave sandwiched between Poland and Lithuania and since the break up of the Soviet Union has been a Special Economic Zone of the Russian Federation.) With the arrival on the regiments of the dual-role Tu-22R reconnaissance bomber, the Tu-22A pure bombing variant commenced its withdrawal from the combat strength of the Soviet Air Force. In 1965, another two regiments started to re-equip with the Tu-22R – 199 ODRAP of the 2nd Independent Heavy Bomber Aviation Corps – (2 OTBAK), at Nezhin, near Kiev in the Ukraine, and a second Naval Independent Long-range Reconnaissance Aviation Regiment, this time subordinated to the Black Sea Fleet Air Force at Saki airfield on the Crimean peninsula. Naval Tu-22Rs replaced the Il-28R *Beagle* light reconnaissance bomber in the same role. By the beginning of the 1960s, a number of changes were introduced into the operating tactics of the Soviet Long-range Air Force after it had become clear that it was essential that the main strike units should include in their number specialised ECM (electronic jamming) aircraft. So, from 1962, trials were carried out under the 'Sibir'-2' (Siberia-2) programme, which stipulated that a specialised jamming variant, based on the Tu-22, should be built, this aircraft receiving the 'private' designation Tu-22P (for *Postanovshchik Pomyekh*, or literally 'producer of interference'), and also known by the 'open' name of Article YuP. The Tu-22P was designed to provide escort jamming of its own force of reconnaissance bomber variants, using a variety of jamming systems to suppress enemy anti-aircraft defences. The aircraft was based on the Tu-22R and had the same engines and flight systems, but since it was designed for a totally different role it lacked the following equipment of the reconnaissance-bomber version:

- The camera equipment in the payload bay and its associated control systems
- The SRS-6 Elint system
- Payload bay (weapons bay) doors
- Bomb racks, with the exception of the integral BD6-105A rack.

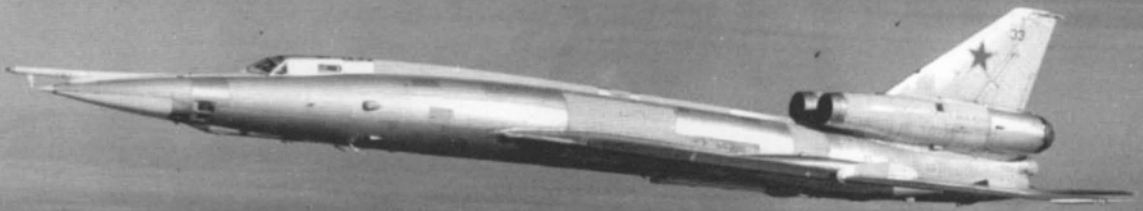


A Tu-22PD of the third squadron of 121 TBAP at Machulishchi undergoing maintenance. When first introduced, engineering support facilities for the Tu-22 included a wide variety of specialised equipment and protective covers, but eventually only the engine servicing towers (seen here) and crew entry steps (*tribunki*) were used regularly. *S Burdin*

The performance of the Tu-22P was exactly the same as the Tu-22R, with the exception of a range reduction of around 180–200km (100–110nm). This resulted from the need to retain an increased level of unused fuel in order to meet the changed centre-of-gravity requirements of the Tu-22P on landing, occasioned by the location of the heavy ECM crates in the payload compartment. Otherwise, the Tu-22P had the same navigation

An elegant study of a Tu-22PD of the third squadron of 290 ODRAP which exhibits the clean lines of the aircraft to good effect. Although modified with an AAR capability and RD-7M engines, it retains the wing-tip anti-flutter weights and therefore does not incorporate the 'flexible undercarriage mounting' of later aircraft. *S Burdin Archive*





A fine study of a 121 TBAP Tu-22PD *Blinder-E*, with the air-intake for the special-equipment crate just visible under the fuselage. *S Burdin Archive*

systems, radar and defensive systems as the Tu-22R, and was capable of unrestricted day and night operations, including take-off and landing in IMC conditions. Most designers involved in developing aircraft for a similar role to that of the Tu-22P have come up against a range of problems associated with the need to find space for large heavy ECM systems, while still providing easy access for ground servicing personnel. Usually added to this is the need to provide special power supplies and, more importantly, to guarantee electronic compatibility of the ECM jammers with the aircraft's own avionics systems.

In the case of the OKB-156 design team, they were able to take advantage of experience gained in the development of specialised electronic variants of the Tu-16, and it was decided to mount the jamming equipment in a removable equipment crate (*konteiner*) which occupied almost the entire area of the payload bay (*gruzovoy otsek*). The heavy crates, raised and lowered on built-in winches, were suspended from the BD6-105A weapons rack, entirely contained within the contours of the payload bay skin-panels, with only the antenna housing projecting below the fuselage. A special APP-22 (*Avtomat Passivnykh Pomyekh* for the Tu-22 aircraft) chaff-dispensing system was developed for the Tu-22P, to sow chaff 'barriers' and 'clouds' for the group protection of attack formations of escorted bombers, the large APP-22 containers being installed at the rear of the payload bay. The Tu-22P was designed for the suppression of those enemy land-based and ship-borne radars which provided surveillance, fighter direction and targeting of air-defence missile systems, working in the frequency ranges of the aircraft's ECM equipment. From the outset, the Tu-22P was to be offered in two different versions, namely the Tu-22P1, equipped with the P1 ECM crate, and the Tu-22P2 with the P2 crate. The P1 variant employed active jamming of radars over a wide range of frequencies, the ECM system itself determining the actual transmitter frequencies being used (i.e. by scanning the frequency spectrum and analysing and identifying those emitters suspected