



DEPARTMENT OF THE AIR FORCE
NATIONAL AIR & SPACE INTELLIGENCE CENTER (AF ISR AGENCY)
WRIGHT-PATTERSON AFB OHIO

AUG 25 2009

Colonel Mark E. Hess
Vice Commander
National Air and Space Intelligence Center (NASIC)
4180 Watson Way
Wright-Patterson AFB OH 45433-5648

John Greenewald, Jr.
[REDACTED]

Dear Mr. Greenewald

This letter is in reference to your Freedom of Information Act (FOIA) request for a copy of the document entitled *From the History of the Creation of Jet Aviation*, our case number 2009-01110-AF.

After reviewing the document you requested, it was determined that it is releasable. We have reproduced a copy of the document for you as a result of your Freedom of Information Act request, however, the document is copyrighted and later copying of the document by you may be an infringement of the owner's copyright. Our reproduction for purposes of the Freedom of Information Act is a so-called "fair use" exception to copyright infringement. Your later reproduction may not be subject to a fair use exception. We recommend that you receive permission from the copyright owner prior to any further reproductions of this document.

Your request was processed in the "All Other" category. The document we are providing contains a total of 16 pages. All fees have been waived.

Sincerely

A handwritten signature in black ink, appearing to read "Mark E. Hess".

MARK E. HESS, Colonel, USAF

Attachment
Requested Document

From the History of the Creation of Jet Aviation

FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OH

10 NOV 1981

**Distribution authorized to U.S. Gov't. agencies only;
Proprietary Information; 28 DEC 1981. Other requests shall be
referred to Foreign Technology Division, ATTN: STINFO,
Wright-Patterson AFB, OH 45433.**

FTD-ID(RS)T-1205-81

FOREIGN TECHNOLOGY DIVISION



FROM THE HISTORY OF THE CREATION OF JET AVIATION

by

B. Danilov



DTIC
ELECTE
S DEC 28 1981 **D**
D

Distribution limited to U. S.
Government Agencies Only; 28 DEC 1981
Proprietary (Copyright) Information;
Other requests for this document
must be referred to FTD/STINFO.

AD B061581

DTIC FILE COPY



81 12 23 041

Accession For	
NTIS GRA&I	<input type="checkbox"/>
DTIC TAB	<input checked="" type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
B	

FTD-ID(RS)T-1205-81

EDITED TRANSLATION

FTD-ID(RS)T-1205-81

10 November 1981

MICROFICHE NR: FTD-81-C-001034L

FROM THE HISTORY OF THE CREATION OF JET
AVIATION

By: B. Danilov

English pages: 12

Source: Voenno-Istoricheskiy Zhurnal, Nr. 3,
March 1981, pp. 70-75

Country of origin: USSR

Translated by: Bernard L. Tauber

Requester: FTD/TQTM

Distribution limited to U. S. Government Agencies
Only; Proprietary (Copyright) Information; Other
requests for this document must be referred to
FTD/STINFO.

THIS TRANSLATION IS A RENDITION OF THE ORIGINAL FOREIGN TEXT WITHOUT ANY ANALYTICAL OR EDITORIAL COMMENT. STATEMENTS OR THEORIES ADVOCATED OR IMPLIED ARE THOSE OF THE SOURCE AND DO NOT NECESSARILY REFLECT THE POSITION OR OPINION OF THE FOREIGN TECHNOLOGY DIVISION.

PREPARED BY:

TRANSLATION DIVISION
FOREIGN TECHNOLOGY DIVISION
WP-AFB, OHIO.

FTD-ID(RS)T-1205-81

Date 10 Nov 19 81

UNCLASSIFIED LIMITED
14/100

U. S. BOARD ON GEOGRAPHIC NAMES TRANSLITERATION SYSTEM

Block	Italic	Transliteration	Block	Italic	Transliteration
А а	<i>А а</i>	A, a	Р р	<i>Р р</i>	R, r
Б б	<i>Б б</i>	B, b	С с	<i>С с</i>	S, s
В в	<i>В в</i>	V, v	Т т	<i>Т т</i>	T, t
Г г	<i>Г г</i>	G, g	У у	<i>У у</i>	U, u
Д д	<i>Д д</i>	D, d	Ф ф	<i>Ф ф</i>	F, f
Е е	<i>Е е</i>	Ye, ye; E, e*	Х х	<i>Х х</i>	Kh, kh
Ж ж	<i>Ж ж</i>	Zh, zh	Ц ц	<i>Ц ц</i>	Ts, ts
З з	<i>З з</i>	Z, z	Ч ч	<i>Ч ч</i>	Ch, ch
И и	<i>И и</i>	I, i	Ш ш	<i>Ш ш</i>	Sh, sh
Й й	<i>Й й</i>	Y, y	Щ щ	<i>Щ щ</i>	Shch, shch
К к	<i>К к</i>	K, k	Ъ ъ	<i>Ъ ъ</i>	"
Л л	<i>Л л</i>	L, l	Ы ы	<i>Ы ы</i>	Y, y
М м	<i>М м</i>	M, m	Ь ь	<i>Ь ь</i>	'
Н н	<i>Н н</i>	N, n	Э э	<i>Э э</i>	E, e
О о	<i>О о</i>	O, o	Ю ю	<i>Ю ю</i>	Yu, yu
П п	<i>П п</i>	P, p	Я я	<i>Я я</i>	Ya, ya

*ye initially, after vowels, and after ъ, ь; e elsewhere.
When written as ѣ in Russian, transliterate as yē or ē.

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

Russian	English	Russian	English	Russian	English
sin	sin	sh	sinh	arc sh	sinh ⁻¹
cos	cos	ch	cosh	arc ch	cosh ⁻¹
tg	tan	th	tanh	arc th	tanh ⁻¹
ctg	cot	cth	coth	arc cth	coth ⁻¹
sec	sec	sch	sech	arc sch	sech ⁻¹
cosec	csc	csch	csch	arc csch	csch ⁻¹

Russian	English
rot	curl
lg	log

FROM THE HISTORY OF THE CREATION OF JET AVIATION

Candidate of Technical Sciences, Colonel (reserve) B. Danilov

From the first days of Soviet power the Communist Party has displayed tireless concern for the development of science and technology, seeing in this the guarantee of the successful building of socialism and the strengthening of the country's defensive might. It created all conditions for the fruitful work of scientists, and it inspired them for creative searches.

In implementing the party's instructions, figures of science have solved the most varied problems. At the end of the 20's - beginning of the 30's a number of young scientists concentrated attention on problems of jet movement. It should be said that by this time the theoretical foundations for the possibility of creating a jet aircraft had already been given. This idea was put forth and developed by outstanding Russian and Soviet scientists and inventors N. I. Kibal'chich, K. E. Tsiolkovskiy, F. A. Tsander, B. S. Stehkin, and others. As early as the 1880's N. I. Kibal'chich had drawn up a diagram of a jet flight vehicle.

The works of the scientist and inventor, K. E. Tsiolkovskiy, occupy an exceptional place in working out problems of jet motion. In 1903, he published a famous theoretical work, "Study of World Spaces by Reactive Instruments," in which, in essence, he was the first to mark the beginning of the science of jet movement and laid the foundation for contemporary jet technology. In 1930, in the work,

"Jet Airplane," Tsiolkovskiy demonstrated the advantages of such an aircraft in comparison with the piston aircraft and expressed the assumption that the era of propeller-driven airplanes should be followed by the era of jet airplanes."¹

The foundations of the creation of jet engines of various types was laid by Professor B. S. Stechkin. His work, "Theory of Jet Engines," was the first scientific work in this field in world literature.

At the beginning of the 1930's the problem of the development of jet technology became especially urgent. The striving to increase flight speed and altitude for combat aircraft forced scientists and designers to look for new ways for it. The chief of the Air Forces Directorate of the RKKA [Workers and Peasants Red Army], Y. I. Alksnis, reported to the chairman of the Revolutionary Military Council of the USSR in January 1933: "It is necessary to speed up work on gas turbines and jet engines in experimental and research work."² The chief of armaments of the Red Army, M. N. Tukhachevskiy, wrote that "the use of jet motors in aviation will lead in the final analysis to the resolution of problems of flights in the stratosphere and with tremendous speeds."³ Considering this, the Party and the government are adopting measures to accelerate work in this field.

On 9 July 1932 the Defense Commission with the SNK [Council of People's Commissars] of the USSR adopted a decree which provided for the conduct of broad research and practical work on questions of the gas turbine, jet engine, and an aircraft with this engine.⁴ In September 1933, by the decision of the Council of Labor and Defense, the first Jet Scientific Research Institute (RNII) in the world was organized in Moscow.⁵ An enthusiast of jet technology, I. T. Kleymenov, was assigned as its head and its deputy was S. P. Korolev. Intense scientific research and design work was begun in the institute on the creation of jet engines and aircraft. In the second half of the 1930's, the first attempts to install these engines in an aircraft were accomplished.

In 1937-1938 the designer, S. P. Korolev, constructed the SK-9 rocket-propelled aircraft (RP-318) with a liquid-jet engine designed by L. S. Dushkin. On 28 February 1940 the pilot V. F. Fedorov accomplished the first flight in the USSR on a rocket-propelled aircraft.

Work on the creation of high-speed jet aircraft acquired an ever greater scope with each passing year. On 12 July 1940, the Defense Committee with the USSR SNK adopted a decree which defined the prospects for the further development of jet aviation equipment. The plan which was approved by the Committee envisioned the study of the question of "employing high-power jet engines for supersonic stratospheric flights and the conduct of work on turbojet engines (TRD) designed by A. M. Lyul'ka so as to conduct the bench test of an engine as early as December 1940."⁶ It was namely the work on the creation of the TRD that formed the basis for the future development of aviation.⁷

The war which had begun greatly hindered the work but it was not stopped. Already on 1 August 1941 the State Defense Committee (GKO), by a special decree, required the designer V. F. Bolkhovitinov to construct a jet interceptor fighter with powerful armament.⁸ The airplane was created. On 15 May 1942 test pilot G. Ya. Bakhchivandzhi accomplished the first flight in it. However, the test program could not be completed - the airplane suffered a catastrophe on one of the flights. The valiant pilot - communist died accomplishing an exploit in the interest of scientific development.

In July and November 1942, the GKO adopted a decree requiring the People's Commissariat for the Aircraft Industry (NKAP) to design and construct a new jet interceptor with a flight duration of 20 minutes and to produce 30 such aircraft serially.⁹ To accomplish this mission, a special design bureau was organized in the RNII. However, the difficult situation at the front of the struggle with the fascist aggressors hampered the accomplishment of the contemplated plan.

The decree of the GKO of 18 February 1944 served as new impetus in the development of jet aviation technology.¹⁰ With the NKAP, a special scientific research institute was organized (NII-1) which was to undertake research-design work. Groups of designers headed by V. P. Glushko, L. S. Dushkin, A. M. Lyul'ka, A. M. Isayev, and M. M. Bondaryuk who had worked previously on jet engines and who, prior to this, were in different organizations and at different plants, were assembled in NII-1. The creation of the new institute marked the end of the separate nature of individual collectives and persons who are engaged in jet technology. The decree required the NKAP to present specific proposals on the construction of jet engines and jet aircraft within a month.

The decree of the GKO of 22 May 1944 outlined a broad program for the construction of jet aviation equipment.¹¹ The leading aircraft design offices of A. S. Yakovlev, A. I. Mikoyan, P. O. Sukhoy, and S. A. Lavochkin were assigned the task in 1944-1945 where each one individually was to create a fighter aircraft with a jet engine,¹² designers V. P. Glushko, L. S. Dushkin, and A. M. Isayev - experimental models of liquid-propellant jet engines, and designers A. M. Lyul'ka and V. V. Uvarov - turbojet engines. At the same time, one of the engine-building plants was oriented toward the series production of jet engines.

In implementing the assignments of the Party and the government, in 1944 designers L. S. Dushkin and A. M. Isayev created a ZhRD [liquid-propellant rocket engine] with a thrust of 1500 kg which successfully underwent state tests.¹³ In this same year, V. P. Glushko constructed the RD-1khz engine whose installation as a booster on the YaK-3, LA-7, PYe-2, and SU-7 aircraft gave an increase in speed from 100 to 130 km/h.

Thus, as early as the prewar period and during the years of the Great Patriotic War the Communist Party and the Soviet government directed great efforts toward the creation of jet aviation equipment in our country. A specific base was created which subsequently was used for the initiation of jet aircraft building in the postwar period.

At the end of 1945, the prospects for the development of aviation were discussed repeatedly and in detail in the Party Central Committee and in the government. And in February 1946, the Central Committee of the VKP (b) [All-Union Communist Party (Bolshevik)] and the SNK USSR adopted a decree which envisioned an entire complex of measures directed toward the expansion of scientific research organizations which had existed and of the test-design bases of the aviation industry and improving experimental construction of jet aircraft, engines, and special equipment. The Soviet scientists concentrated primary attention on working out theoretical problems in the field of aerodynamics, the theory of jet engines, and aircraft construction. It was necessary to do everything so as to surpass the achievements of science beyond the borders of our country in the shortest time. At the same time, the creation and series production of fighters with flight speeds up to 950 km/h, bombers - 800 km/h, and experimental aircraft for the accomplishment of flights at the speed of sound were planned. Accelerated construction of test plants of designers A. S. Yakovlev, A. I. Mikoyan, and S. V. Il'yushin was planned. The design offices of A. N. Tupolev, P. O. Sukhoy, and S. A. Lavochkin were strengthened. The main motor-building design offices, and primarily those of V. Ya. Klimov and A. A. Mikulin, were involved in work on the creation of jet engines.

Clearly determining the basic directions in the development of aviation science and technology, the Party initiated great organizational work. The necessary conditions for creative activity were created for aircraft designers. S. A. Lavochkin, having in mind the work that had been conducted then, said that in 1946 a leap such as our aviation does not remember had been made in the sphere of equipping experimental installations and their organization.

Special attention was devoted to the creation of a reliable turbo-jet engine. This task proved to be most difficult. But with the active assistance of Party organs of NKAP and the Air Force scientists and designers were able to solve it successfully. Already in 1946 the series production of the RD-10 (thrust 900 kg) and RD-20 (thrust 800 kg) jet engines had begun. These were installed on test jet aircraft

YaK-15 and MIG-9, ¹⁴ which were created in the same year by the collectives of the design offices of A. S. Yakovlev and A. I. Mikoyan. On 24 April 1946, exactly 35 years ago, test pilots communists M. I. Ivanov and A. Ye. Grinchik accomplished the first flights in these aircrafts and on 18 August 1946 a group of jet aircraft took part in the air parade in Tushino air show for the first time.

The design offices of P. O. Sukhoy and S. A. Lavochkin, which had constructed the SU-9 and LA-150 aircraft, successfully coped with their tasks in 1946. In 1947 the LA-160 experimental airplane was created - the first aircraft in the Soviet Union with a swept wing, which played an exceptionally important role in the subsequent development of high-speed aviation.

In 1947, the Party and the government assigned the mission to the designers to create a reliable, high-speed fighter and frontal bomber with high combat qualities, which would be one more step forward in the development of aviation technology. For this, it was necessary to construct new, more powerful and economical engines. This task was also successfully accomplished by the designers and scientists. In August 1948, the engine-construction design office of V. Ya. Klimov created and put into series production the RD-45 engine (thrust 2040 kg), and in November - the VK-1 engine (thrust 2700 kg). The development and putting into production of these engines was an important step in improving Soviet jet technology.

Important results in the work were obtained by the design offices of A. M. Lyul'ka and A. A. Mikulin. The former constructed the TR-3 engine (thrust 4600 kg) in 1948, and the latter - the AMRD-2 engine (thrust 4250 kg) and the AM-3 engine which was the biggest as regards the amount of thrust (8700 kg) in 1949-1950. The construction of the latter permitted beginning the production of jet long-range bomber aviation.

The creation of Soviet jet engines of great power advanced Soviet aviation technology to the leading place in the world. At the end of the 1940's - beginning of the 1950's - foreign aviation industry did

not have such turbojet aviation engines. Thus, obtaining more improved engines, the aircraft designers successfully accomplished the task assigned by the party - to construct airplanes whose speed would approach the speed of sound.

The creation of the MIG-15 jet fighter by the collective of the design office of A. I. Mikoyan at the threshold of 1947-1948 became a stage in Soviet aircraft construction. It was put into series production in August 1948. Several years passed and the entire aviation world began to speak about this aircraft. The MIG-15 was not only not inferior in its combat qualities to the similar American "Sabre" aircraft, but also surpassed it, especially in maneuver characteristics - its three cannon proved to be considerably more effective than the six machine guns of the "Sabre." Subsequently, the collective of A. I. Mikoyan's design office substantially improved the aircraft's aerodynamics. Test pilot I. T. Ivashchenko accomplished flights exceeding the speed of sound in May 1951 on a new aircraft which subsequently received the designation MIG-17.¹⁵

In November 1947, A. S. Yakovlev's design office constructed the YaK-23 jet fighter which had good takeoff and landing characteristics and maneuverability. At the beginning of 1948, the design office of S. A. Lavochkin constructed the LA-15 jet fighter which possessed the least flight weight in comparison with other similar Soviet and foreign aircraft.

The problem of creating a front line jet bomber was solved effectively. In 1948, the design offices of S. V. Il'yushin and A. N. Tupolev designed the IL-28 and TU-14 aircraft. The former had high performance data for its time; it became the basic frontal bomber and reconnaissance plane of the 1950's.¹⁶

Thus, three or four years after the completion of the Great Patriotic War Soviet scientists, designers, engineers, and workers under the direction of the Party and relying on the achievements in the economy and Soviet science and technology achieved outstanding successes in the development of jet aviation. A generation of jet

fighters was created whose speed came right up to the speed of sound. The Air Forces received a jet bomber which was incomparably more improved in its performance characteristics than the former aircraft.

The Party and the government considered as the most important task the creation of long-range, high-altitude, high-speed jet bombers. In the beginning of 1950 the design office of A. N. Tupolev began to create a jet bomber with a flight range of 6000-7000 km. The collective coped confidently with the mission. The TU-16 aircraft, the first bomber with a swept wing, was ready, underwent state tests, and was put into series production in 1952. In September 1953 the "M" heavy bomber designed by Myasishchev was also put into series production.

Great credit in the working out of problems in the development of jet aviation belongs to the scientists of the Central Aerodynamic Institute "TsAGI), the Central Institute for Aircraft Engine Building (TsIAM), the All-Union Institute for Aviation Materials (VIAM), and other scientific research institutions as well as to the scientists of the Air Force engineering academies.

An important role in the establishment of jet aviation belonged to the collective of the Scientific Testing Institute of the Air Force (GK NII VVS) [State Red Banner Scientific Testing Institute of the Air Force]. The institute worked out problems in the operation of new equipment, studied and tested all experimental models of aircraft, aircraft engines, armament, and special equipment for aircraft, and conducted a large volume of scientific-research work in the combat employment of aviation equipment. The Aviation Technical Committee of the Air Force which was created on the decision of the Council of Ministers of the USSR in July 1946 was occupied with working out prospects for the development of the Air Force.

The development and putting of new types of aircraft into series production required the complete restructuring of the entire aviation industry. On instruction of the Party Central Committee and the government, aviation enterprises were replenished with special

equipment, technological processes were improved at the plants, flow-line production was introduced, and important work was conducted on raising the qualification of specialists in the aviation industry.

The output of jet equipment increased at high rates. By 1953, the aviation industry had completely changed over to the production of jet fighters and frontal bombers. The production of this type of piston aircraft was stopped.

The re-equipping of the Air Force occurred as new equipment arrived from industry. In January 1947, the government approved a special plan. It defined the sequence for re-equipping, basic initial data, and the direction for further improvement in the performance characteristics of the aircraft. Fighter aviation, as the main means for ensuring the security of our Motherland's aerial borders, was re-equipped first of all with jet equipment. It was intended to end work on jet aircraft suitable for introduction into series production and for the re-equipping of bomber aviation by the end of 1948. A program for the development of long-range aviation was also outlined.

In 1946, the first MIG-9 and YaK-15 jet aircraft arrived in the inventory of the Air Force, in 1947 - the YaK-17, and 1945 the mass re-equipping of fighter aviation with the MIG-15 and LA-15 aircraft was begun. The MIG-15 became the basic fighter in the Soviet Army Air Force. In August 1951, the new MIG-17 fighter was accepted into the inventory.

The re-equipping of frontal bomber aviation with jet equipment became possible after, in the beginning of 1950, the aviation industry began series production of the IL-28 aircraft. At the end of 1953, the TU-16 long-range jet bomber arrived in the inventory of the Air Force.

The technical re-equipping of fighter and frontal bomber aviation with first-class jet aircraft was completed in 1953-1954. The re-equipping of long-range aviation began. Great attention was devoted to improving the armament of the airplanes, ensuring the normal

efficiency of the crew at great altitudes and speeds, increasing the quality of radar and radio-navigation means, the creation of highly productive means for ground servicing, the construction of the appropriate ground bases (first-class airfields), and equipping them with systems for the instrument landing of aircraft.

The jet fighters were armed with the most improved high-speed aviation cannon with calibers of 23 and 37 mm. The defensive armament of the bombers also became cannon-type. New types of free rocket projectiles with which the jet fighters and bombers were armed at the beginning of the 1950's were created. As a result of the installation of new models of armament, the salvo per second of the jet fighter became several times more powerful than the salvo of the fighter of the war period.

In the postwar period, exceptionally great significance was attached to the development of radar equipment, and in particular, radar equipment for airplanes. The Party Central Committee and the Soviet government adopted a number of decisions in this direction. As a result, by the beginning of the 1950's radar sights were created for the armament of jet airplanes and aviation was provided with means which provided the opportunity to accomplish flight under difficult weather conditions day and night.

The re-arming of the Air Force with new, more improved equipment increased its combat readiness and expanded considerably the capabilities for the combat employment of aviation units. The organizational structure of the Air Force was also constantly improved, permitting an improvement in control of aviation and the more efficient solution of problems connected with its mastery, combat employment, and material support.

Soviet aviators often demonstrated high skill in the mastery of new aviation equipment at celebrations in honor of Soviet Air Force Day, in the course of daily combat training, and on tactical flight exercises. On 3 August 1947 individual and group piloting in jet aircraft was demonstrated for the first time by I. P. Polunin,

N. I. Khramov, P. G. Solov'yev, and V. V. Yefremov. For successful mastery of jet equipment, many pilots, engineers, and technicians were awarded orders and medals of the Soviet Union and pilots M. I. Ivanov, I. T. Ivashchenko, P. M. Stefanovskiy, and P. Ye. Fedorov were awarded the title of Hero of the Soviet Union.

Thus, fundamental qualitative changes in the development of our country's Air Force which were connected with the transition to jet airplanes occurred in the first postwar period (1946-1953). The re-equipping of fighter and frontal bomber aviation with first-generation jet equipment, the most characteristic feature of which was subsonic flight speed, was completed. These airplanes had more improved armament and equipment than their predecessors.

The history of the creation of jet aviation became an integral part of the history of the Soviet State which reflects the majestic labor and soldierly victories of our people.

Now the Air Force is equipped with qualitatively new aviation equipment. The aircraft which are in the Air Force inventory possess high performance characteristics, contemporary equipment, and powerful rocket and cannon armament. The successes achieved in the development of aviation are the result of the tireless concern of the Communist Party and the Soviet government for the strengthening of the country's defensive capability.

In implementing the decisions of the 26th CPSU Congress, the Soviet aviators are persistently mastering the new generation of jet aircraft, improving their combat skill, raising their vigilance and combat readiness in every possible way, and standing vigilant guard over the interest of our great Motherland.

FOOTNOTES

1. K. E. Tsiolkovskiy, *Sobrannyye sochineniy* [Collected Works], Vol. 2, Moscow, Academy of Sciences of the USSR Publishing House, 1954, p. 338.

2. TsGASA [Central State Archive of the Soviet Army], Archive 29, inventory 50, storage unit 287, sheet 13.
3. V. P. Glushko. Rocket Engines of GDL [gas-dynamics laboratory] - OKB [special design office], Moscow, APN, 1975, p. 14.
4. TsGASA, Archive 29, inventory 35, storage unit 21, sheets 10-12; inventory 69, storage unit 17, sheet 45.
5. The RNII was organized on the basis of two organizations: GDL (Gas-Dynamic Laboratory) and GIRD (Group for the Study of Jet Movement), which at that time were occupied with the creation of jet engines in our country. Prominent party and military figures V. V. Kuybyshev, K. Ye. Voroshilov, G. K. Ordzhonikidze, M. N. Tukhachevskiy, and others were engaged in the organization of the institute.
6. TsGASA, archive 29, inventory 25, storage unit 100, sheet 165.
7. The first test model of a TRD designed by A. M. Lyul'ka (TR-1) with a thrust of 1250 kg was manufactured in April 1945. In its characteristics, the engine was superior to the data of the German TRD YuMO-004 (thrust 900 kg) and BMV-003 (thrust 800 kg). The first Lyul'ka engines were installed in the IL-22 experimental aircraft designed by S. V. Il'yushin in 1946.
8. TsAMO [Central Archive of the Ministry of Defense] USSR, archive 35, inventory 121331, file 1, sheet 50.
9. Ibid. Also see TsGANKh [Central State Archive of the National Economy of the USSR], archive 8044, inventory 1, storage unit 1182, sheet 47.
10. TsGANKh, archive 8044, inventory 1, storage unit 1183, sheet 2. Chief of institute P. Fedorov.
11. TsAMO, archive 35, inventory 119112, file 1, sheet 15.
12. These were primarily modifications of aircraft of the propeller-engine group with jet boosters. Only S. A. Lavochkin was charged with constructing a jet fighter with a TRD designed by Lyul'ka.
13. This engine was superior to the German ZhRD "Walter" which was installed on the ME-163 aircraft and had a thrust of 1200 kg.
14. Series production of the first Soviet jet aircraft MIG-9 and YaK-15 begun in September-October 1946.
15. The MIG-17 aircraft was constructed at the beginning of 1949. However its series production was delayed. It was begun only in 1951.
16. The IL-28 was almost twice as good as the piston-driven frontal bombers for speed and range and three times as good for bomb load. It was equipped with a radar which ensured navigation and bombing at unseen targets under difficult weather conditions.

UNCLASSIFIED / LIMITED

[This page is intentionally left blank.]

UNCLASSIFIED / LIMITED



