

To the 120th Anniversary of the Birth of Semyon Lavochkin: “I Am the Chief Designer and I Am Responsible for All!”

Kh. Zh. Karchaev^{a, *}, P. V. Primakov^{a, **}, and N.V. Galich^{a, ***}

^a *Lavochkin Association, Khimki, Moscow oblast, Russia*

**e-mail: kar@laspace.ru*

***e-mail: pavel.primakov@laspace.ru*

****e-mail: galich@laspace.ru*

Received June 29, 2020; revised June 29, 2020; accepted June 29, 2020

Abstract—September 11, 2020 marks the 120th anniversary of the birth of Semyon Lavochkin, a renowned designer of aircraft and missile technology. This article presents a brief summary of the life and working career of this outstanding personality, the founder of a unique team of technology designers and the world-famous enterprise.

Keywords: Lavochkin, engineering school, development design bureau, fighter aircraft, antiaircraft guided missile

DOI: 10.1134/S0038094621070091

“Could you believe it? I can’t put this machine aside even in my sleep. Sometimes I see drafts, I see calculations...”

Semyon Lavochkin

Leaning over drafts, surrounded by models of aircraft and missiles, framed by solemn banners, Semyon Lavochkin “greet” visitors at the museum of the Lavochkin Association. The reconstructed study room of the renowned designer forever remains the heart of the exposition.

The history of achievements in science and technology, undoubtedly, influences the worldview of modern people, as well as their life stance. Thousands of eyes—those of curious children, of pensive youth, of wise veterans. Some of them were lucky enough to know Lavochkin personally; others only recently learned about him from textbooks; but no one can stay indifferent to the gifts of his truly many-sided personality. The many generations of designers raised by Lavochkin cherish sincere respect and memory of this extraordinary man. Since 1960, our enterprise has born his name, the name of a highly qualified professional and talented leader.

In everyday life, however, Lavochkin was a very modest person. This is what he wrote about himself in his autobiography (Ivanovskii et al., 2000):

{I was born in 1900, on August 29 (under the Julian calendar), in Smolensk. I spent the years of my youth in the town of Roslavl, Smolensk province. In 1917, I graduated from the gymnasium. Then I volunteered for the Red Guard.

I served in the ranks of the Red Guard until 1920, in the second frontier division. I was a private and was elected to various social service posts. In 1920, I was sent to continue my education at the Moscow Higher Technical School. I graduated from the Moscow Higher Technical School in 1929. In 1927, my father died, and I had to work hard to support my family. This prolonged my stay at the technical school.

From 1927 to the present day, I have been working continuously in the aircraft industry.

I have the military rank of Major General of the Aviation Service; I am a Corresponding Member of the USSR Academy of Sciences; I am a Doctor of Technical Sciences. Twice awarded the Hero of Socialist Labor. Deputy of the USSR Supreme Soviet. I have orders and medals. Four times awarded the Stalin Prize.

Member of the Communist Party of the Soviet Union since 1953.

On December 25, 1959. Lavochkin}

Lavochkin was twice awarded the Hero of Socialist Labor and four times the USSR State Prize; he was Major General of the Aviation Engineering Service and Corresponding Member of the USSR Academy of Sciences, Doctor of Technical Sciences. In 1939–1940, together with V.P. Gorbunov and M.I. Gudkov, he was the Chief Designer of Plant 301. In 1940–1944, he was the Chief Designer of Plant 21 of the USSR People’s Commissariat for the Aircraft Industry in the city of Gorky. In 1944–1945, Director and Chief Designer of Plant No. 81 (Moscow). In 1945–1960,



Fig. 1. Memorial corner in the museum of Lavochkin Association. Elements of the interior of Lavochkin's study room.



Fig. 2. Lavochkin with his family, Roslavl, 1915.

Director and Chief Designer, then General Designer, of Plant No. 301 of the Ministry of Aircraft Industry (currently, Lavochkin Association).

Lavochkin created a unique team of aircraft designers, who achieved, under his leadership, outstanding results in the field of aircraft and missiles: the famous La propeller-driven and fighter jets; Burya, the world's first intercontinental supersonic cruise missile; the first Soviet anti-aircraft guided missiles V-300 for the Moscow air defense system S-25; the Dal air defense system. Under Lavochkin's guidance, a development design bureau turned from a small group of designers into one of the country's largest top aircraft and missile design bureaus. The engineers designed and manufactured more than thirty types of aircraft, of which ten were mass-produced, and more than twenty types of unmanned aerial vehicles. Many of these prototypes were of prime importance for the country's defense.

Semyon Lavochkin was born on September 11, 1900, in Smolensk in the family of a gymnasium teacher.

In 1916, he graduated from the gymnasium with a gold medal. In 1917, he volunteered for the Red Guard and served for two years in a frontier division, from which he was demobilized and sent to study in Moscow.



Fig. 3. Semyon Lavochkin, a student of the Higher Technical School, 1920s.

In 1929, he graduated from the Bauman Moscow Higher Technical School.

Lavochkin took his undergraduate internship training at A.N. Tupolev's design bureau, where he participated in the development of the first Soviet ANT-4 bomber.

After graduating from the Moscow Higher Technical School, he worked at several aircraft design bureaus.

At the beginning of 1939, the government announced a competition for the development of new combat aircraft, and Vladimir Gorbunov (head of the 4th department of the First Chief Directorate of the People's Commissariat for the Aircraft Industry), together with Semyon Lavochkin and Mikhail Gudkov (engineers of this department), took part in this competition. Their project of the high-speed K fighter was supported by the People's Commissar for the Aircraft Industry M.M. Kaganovich. The K fighter was an all-wood airplane, and Plant 301 in the town of Khimki near Moscow with its advanced wood production facilities was suited perfectly for the construction of a prototype. Thus, in September 1939, a new development design bureau (DDB) was organized at the plant, under the leadership of three chief designers: Gorbunov, Lavochkin, and Gudkov (Efanov et al., 2017).



Fig. 4. In the study room, 1940.



Fig. 5. At the aerodrome of Plant 21 in Gorky, 1942–1944.

Since 1940, he was the chief designer at Aircraft Plant 21 in Gorky.

During the Second World War, he largely modified the LaGG-3 aircraft, i.e., replaced the engine and considerably strengthened the wings of the plane, which sharply increased the aircraft's combat capabilities. Meanwhile, he designed ten serial and experimental fighters, including La-5, La-5F, La-5FN, and La-7. When developing them, Lavochkin reasonably combined a wooden airframe based on a particularly durable material, i.e., delta wood, with a reliable engine with high technical characteristics in a wide



Fig. 6. Lavochkin makes a speech at a meeting with the workers of Plant 21 in Gorky, 1943–1944.

range of flight altitudes. The design of the La-5 and La-7 aircraft ensured reliable protection for the pilot in the front hemisphere of fire.

When flying Lavochkin's fighters, the combat pilot I.N. Kozhedub shot down 62 German aircraft. In total, during the Second World War, the plant produced 22435 LaGG and La fighter aircraft of all modifications were produced. A total of 6528 LaGG-3, 10002 La-5, and 5905 La-7 fighters were manufactured and delivered to the front. More than 22000 aircraft! This means that every third fighter aircraft that fought in the Second World War was created by Lavochkin. His machines are believed to have been among the best fighters of the Second World War.

For outstanding services in the development of aircraft technology in the difficult wartime conditions, Lavochkin was awarded, by the Decree of June 21,

1943, of the Presidium of the USSR Supreme Soviet, the title of Hero of Socialist Labor with the "Hammer and Sickle" Gold Medal and the Order of Lenin.

By the decree of the USSR Council of People's Commissars of August 19, 1944, Lavochkin was awarded the military rank of Major General of the Aviation Service.

In 1945, Lavochkin's bureau was transferred to Khimki, where they created in the postwar years the last piston fighters: the La-9 all-metal aircraft, the La-180 trainer aircraft, and the La-11 long-range fighter. Then, the Lavochkin's bureau switched to the development of serial and experimental fighter jets because Lavochkin had been engaged closely with the problems of development of jet engines and their applications in aviation since 1944.

In 1947, they developed La-160, the first domestic aircraft with a swept wing, and La-15, a Soviet fighter jet, which was in operational service with the USSR Air Force from 1949 to 1954.

In December 1948, an La-176 with a swept wing of 45 degrees achieved, for the first time in the Soviet Union, a flight speed equal to the speed of sound. The Lavochkin's bureau also developed the La-190 supersonic fighter and La-200 all-weather two-seat fighter with a powerful radar onboard.

Lavochkin supervised the development of several prototypes of missiles. In 1950, Lavochkin's bureau was commissioned to design, construct, test, and transfer into serial production the latest prototypes of surface-to-air missiles, whose extremely demanding tactical and technical specifications had yet been unattained by any country worldwide.

Aware of the danger of a nuclear strike at the national industrial centers, a real threat in those years,



Fig. 7. S.A. Lavochkin and I.N. Kozhedub, 1945.



Fig. 8. Lavochkin with awardees on the day of receiving the “Hammer and Sickle” Gold Medal, the merit badge of Hero of Socialist Labor, Kremlin, Moscow, 1943.

Stalin initiated the decision to develop the first domestic air defense system (S-25 air defense) with anti-aircraft guided missiles (ZUR) in operational service.

In the shortest possible time, a path was covered from the formulation of the concept of an air defense system to its actual implementation. In 1951–1955, Lavochkin developed and tested the ground-based ZUR-205 and ZUR-215, and air-to-air missiles.

In 1955, Moscow was surrounded by the famous protective “rings”—the *Berkut* air defense system. Missiles designed by Lavochkin were on alert until the early 1980s (ZUR-217M and ZUR-218).

Since 1953, Lavochkin was a member of the Communist Party.

For outstanding services in the development of new aircraft technology and labor heroism, by the Decree of the Presidium of the USSR Supreme Soviet of April 20, 1956, Lavochkin was awarded, for the second time, the title of Hero of Socialist Labor and his second “Hammer and Sickle” Gold Medal.

In parallel with missiles, Lavochkin developed in 1950–1954 the La-17 unmanned target aircraft, which remained in production for almost 40 years, until 1993. Moreover, its reconnaissance version was designed and then used as an unmanned front-line photo reconnaissance aircraft (a prototype of modern unmanned aerial reconnaissance vehicles).

Since 1956, Lavochkin was General Designer of Plant 301. In this position, he completed two major works:



Fig. 9. S.A. Lavochkin, Major General of the Aviation Engineering Service.



Fig. 10. With the test pilot I.E. Fedorov, Plant 301, Khimki, the late 1940s or early 1950s.



Fig. 11. In the design bureau, the late 1940s or early 1950s.

— Development of the Burya intercontinental supersonic cruise missile.

— Design of the new Dal anti-aircraft unit based on long-range surface-to-air missiles to destroy high-speed aerial targets.

Since 1958, Lavochkin was a Corresponding Member of the USSR Academy of Sciences. He was a deputy of the USSR Supreme Soviet of the third to

fifth convocations (from 1950 to 1960) (Efanov et al., 2016).

Upon completion of the testing of the Burya missile on June 9, 1960, Lavochkin died of a heart attack at the Sary-Shagan training ground, near Lake Balkhash (Kazakh Soviet Socialist Republic). For reasons of secrecy, newspapers reported that the designer had died in Moscow. He was buried at Novodevichy Cemetery in Moscow.

His name was given to streets in Moscow, Khimki, and Smolensk; bronze busts were created in his honor. In Moscow, a memorial plaque was placed on the house in Tverskaya Street, where the designer lived.

Lavochkin's own published texts provide the best possible picture of him as a personality and will be interesting and useful to a wide range of readers.

Lavochkin wrote: "When I was a boy, I really loved to invent things. I was consumed by the desire for craftwork, for embodying my ideas in metal and wood. But once in a while an awful disappointment would strike me—a great idea of mine would turn into an ugly monster. This is when I realized that an idea as such was not enough; it needs to be put into existence. It is very important from childhood to teach your hands to do what your head has designed."

"You cannot choose your looks; you have to live with those you were born with. You cannot replace your brown eyes with blue ones, no matter how much you want that. But you are able to do a far more important thing—you can create your own character. If you want to be persistent, teach yourself from childhood not to give up in the face of difficulty..." (Lavochkin, 2010).

"I remember that we always sought for more: speed, range, fire ... This principle—more of everything—is not very clever though. Sometimes it's more important that you fly for just 15 minutes but in these 15 minutes, you are a full master of air" (about LaGG-3) (Arlazorov, 1975).

"The war made us think of one thing only," wrote Semyon Alekseevich, "a writer, perhaps, would want to create poems about love, but he wrote articles about war. A worker, perhaps, would want to craft things that would make people's life better, but he had to make weapons. Perhaps, a military aircraft designer would think about other machines, not only those that shoot and ram, but he pushed those thoughts away... Once, at the very beginning of our battles, I wrote about the war fought by the aircraft designer. This is a war one can neither hear nor see; there is no roar of shells or whistle of bullets. I did not see my enemy, but I fought with them. I tried to create better planes, surpassing the ones they could create. It was a war of thought... In a fighter, speed is everything, and this is our work... and our manufacturing culture. It is important not only to draw an object and compute it but also to manufacture it accurately. A prototype may show a crazy, exotic speed, but once the machine is put into serial



Fig. 12. S.A. Lavochkin.

production... its speed is not enough. Where is it? It was there! The search begins—who is to blame. No one! No one is to blame, and at the same time—all of

us, and me in the first place. After all, a prototype is our standard, but in a serial machine, this may be due to deviations in production, in the manufacture of units and parts. It is only when the plant has mastered the production process that the serial machines will become closer to the standard. However, by that time we will have a new prototype, but there is not much time for creative thought. The demands from pilots at the front, and our own conscience... And the night turns into day, and this study room, located in the rear, becomes the front. The front line runs here!" (Ivanovskii et al., 2000).

About the day of May 9, 1945: "I spent it on the Moscow streets," wrote Lavochkin, "I could neither stay at home nor in the design bureau. I rejoiced together with everybody else; I laughed and applauded to the front-line soldiers. But then the holiday was over, and suddenly we all felt like students who had passed their last and most difficult exam. And as always after an exam, we were faced with the question: What to do next?" (Ivanovskii et al., 2000).

Lavochkin valued both his time and the time of his employees. Many remember the ritual of obtaining his signature under a serious business letter: "Is it all correct here?" "Yes, it is, Semyon Alekseevich." Lavochkin signed the letter, and in a minute, the employee could leave his office. However, before that, the document was carefully prepared and thoroughly checked, down to punctuation marks. This taught each employee to take responsibility for their work and to be independent and courageous in making decisions (Ivanovskii et al., 2000).

"No matter where I am or what I do, I always keep thinking of aircraft," wrote Lavochkin, "not of the one



Fig. 13. Semyon Alekseevich Lavochkin with his wife Rosa Gertsevna and children—his daughter Alla and his son Aleksandr, 1946–1947.



Fig. 14. With Rosa Gertsevna, his wife, near their country cottage, village of Kryukovo, 1955.

that flies but of the one that doesn't exist but must be there. I may be in the theater, watching a play, and suddenly I catch myself thinking about aircraft. The play disappears; it's far away somewhere, and before my eyes, again the aircraft... I still don't know what it will be like. Its features emerge vaguely. I keep thinking. One might say: What a strange way of working—to stroll around your office from morning till night. Are you really working? But everyone works in their own way. Walking like this, I keep thinking and refining my idea. This is work. This is tedious, strenuous work. And when I finally know what this new machine should be like, I call my workmates over to me. 'This is what I suggest,' I say to them, 'What do you think?' They listen to me attentively; they write things down; they make drawings. A discussion begins. Sometimes I think they like my idea too much. And I can't help it. 'Oh hell, criticize it!' I shout at them. They get excited, and it becomes so loud in my office that visitors in the waiting room may think we are sworn enemies. But we all so believe in our common cause that we get excited and lose our temper. The discussion ends. We are all satisfied. Now, at least, every one of us knows where they are right and where they are wrong. Now we can



Fig. 15. Semyon Alekseevich Lavochkin, 1960.

start. And the first line is drawn. Dozens of people are working on the future aircraft. My well-composed machine seems to be breaking up into pieces: the engine, the propeller group, the weapons, with specialists working on each piece. And everyone is in a rush: faster, faster!" (Ivanovskii et al., 2000).

Lavochkin did not tolerate obscene words in conversation and never raised his tone at his subordinates. His strongest language was: "I scold you!" or "You are a dangerous person." Sometimes he would make remarks like: "That man works like a bee but makes no honey!" These words worked more effectively than any shouting. Considerate and intelligent, he was, at the same time, a resolute and courageous man.

From the memoirs of S.I. Krupkin, a long-service employee of Lavochkin Association, who had worked for 15 years under Lavochkin himself:

{The arrival of the design bureau radically changed our entire life—it opened up broad opportunities for creativity.

We, young engineers, were delighted. We realized that the routine tedious work in our serial design department was over. But worries were there too. Will we be able to cope with the new work, we who have

been doing not particularly creative jobs so far? How will Lavochkin's people treat us? And Lavochkin himself, the rumor around his personality, made us anxious too.

Semyon Alekseevich met personally with the new employees. He took interest in our qualifications, material situation, and living conditions. The conversation went on peacefully, in a pleasant manner; we could feel his wholehearted interest in us. We could feel the Chief's desire to have by him, not merely subordinates, but like-minded people, passionate about their common creative work.

This first impression proved true in the subsequent years of my work alongside Semyon Alekseevich, especially when I was appointed head of the brigade and then head of the department.

For people to dedicate themselves fully to their work, they, first of all, should have a clear vision of the goal to which they should strive and a clear vision of their role in achieving that goal. That is why they should be informed. This is what I would like to talk about in more detail. When Semyon Alekseevich returned from a government meeting, or a meeting with a minister, a deputy minister, in the military-industrial complex, or a customer, he immediately invited to his room his deputies, heads of departments (brigades), leading designers, the plant director and chief engineer, and other interested employees.

Then, he informed us about the results of his trip, about the most interesting points in the discussions. I think that due to secrecy, he simply could not tell us some of the information, but the overall situation was clear, and we could work with open eyes. We conveyed the information to our people, so that, within the permissible limits, the entire creative team of the design bureau was working mindfully to achieve the goals.

We went to work with a sense of pleasure, looking forward to the exciting and useful creative efforts. This style of work remained for many years even after the death of Semyon Alekseevich, for as long as Lavochkin's people headed the design bureau (Krupkin, 2010).}

Endlessly devoted to his pursuit, Lavochkin built his work around people that were spiritually close to him—and those were highly professional, responsible, and honest people. Timely provided support, the ability to defend and protect the employees, and the trust of the chief designer were the highest reward for the team (Moisheev and Shevaley, 2009).

A widely knowledgeable and creative person, he encouraged in every possible way the expression and development of the same traits in his employees. The

reasonably innovative style of work became the hallmark of his design team (Pichkhadze and Shevaley, 2010).

The research and design school created by Lavochkin continues to live and grow. The memory about the outstanding designer and extraordinary personality lives not only in the name of the organization founded by him but also in the minds of people who pass on their skills and experience to the new generations of designers of the Lavochkin school.

“The chief designer,” wrote Lavochkin, “must push the first stone, the one that sets an avalanche in motion... Can you imagine a thought at rest? It's unnatural. Thoughts, like life, need motion; without motion, they die!... In aviation there is a law—that what is good is not what is good today but what will be good tomorrow...” (Shirshakov et al., 2019).

REFERENCES

- Arlazorov, M.S., *Front idet cherez KB* (The Front Goes through the Design Bureau), Moscow: Znanie, 1975.
- Efanov, V.V., Martynov, M.B., and Karchaev, Kh.Zh., On the scientific potential of Lavochkin Research and Production Association, *Vestn. NPO im. S.A. Lavochkina*, 2016, no. 3, pp. 73–77.
- Efanov, V.V., Martynov, M.B., and Karchev, Kh.Zh., Aerial vehicles developed at Lavochkin Research and Production Association (On the 80th anniversary of the Lavochkin Association), *Sol. Syst. Res.*, 2018, vol. 52, no. 7, pp. 557–569.
- Ivanovskii, O.G., Timofeev, V.N., Serov, G.P., and Shevaley, I.L., *Lavochkin (k 100-letiyu so dnya rozhdeniya)* (Lavochkin (On the 100th Birth Anniversary)), Moscow: BLOK-Inform-Ekspress, 2000.
- Krupkin, S.I., Chief designer Semyon Alekseevich Lavochkin, *Vestn. NPO im. S.A. Lavochkina*, 2010, no. 3, pp. 16–27.
- Moisheev, A.A. and Shevaley, I.L., The role of personality in the history of the design bureau of the Lavochkin Association, *Vestn. NPO im. S.A. Lavochkina*, 2009, no. 1, pp. 19–29.
- Pichkhadze, K.M. and Shevaley, I.L., The creative journey of the founder of a unique design school, *Vestn. NPO im. S.A. Lavochkina*, 2010, no. 3, pp. 3–16.
- Semyon Alekseevich Lavochkin. Fotoal'bom (Semyon Alekseevich Lavochkin. Photo Album)*, Yaroslavl: RMP, 2010.
- Shirshakov, A.E., Karchaev, Kh.Zh., Moisheev, A.A., and Lokhanov, I.V., One step ahead (On the 80th anniversary of the Lavochkin Association), *Vestn. NPO im. S.A. Lavochkina*, 2019, no. 2, pp. 3–18.

Translated by A. Kobkova