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# Russian Fighter Aircraft Industrial Base: Parallels with the United States?

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## Summary

There are many differences between the fighter aircraft industry in the United States and in Russia. The United States has traditionally produced its weaponry within a capitalist framework which allowed free enterprise and competition between companies in private industry. The former Soviet Union's economy, and its fighter aircraft industry was based on a Marxist, command economy, where the central government dictated the type and number of aircraft produced and allocated resources for construction.

Once among the most glamorous components of the Soviet military industrial complex, the Russian military aircraft industry has been described by some analysts as being on the verge of collapse. Russia's civilian aircraft industry has faced similar pressures, which does not bode well for the military aviation infrastructure. It may be difficult for fighter aircraft companies to find employment in Russia's beleaguered civil aircraft sector.

The Russian government has attempted to reform its fighter aircraft industrial base and make it more efficient and competitive with western industry. It has initiated several reforms aimed at reducing the stratification and compartmentalization of industrial processes, as well as improving access to financial resources. These reforms have had mixed success. While Russia's military aviation infrastructure has consolidated dramatically, the overall effectiveness of these reform efforts still remains to be seen.

Russia's remaining fighter aircraft design and manufacturing enterprises, Sukhoi and Mikoyan, appear to be struggling to stay alive. Both companies have sought to make up for decreased domestic demand by increasing their export of fighter aircraft and by winning contracts in the civilian aviation sector. Success in both areas has been limited, and many analysts doubt that Russia can support more than one fighter aircraft company for much longer. The potential for a merger between the two companies has been discussed for some time. Each company has its own strengths and weaknesses, and it is unclear which would survive a merger.

As Russia reforms its fighter aircraft industrial base, there appear to be many parallels between their experience and what is happening in the United States in terms of declining domestic demand and pressure for consolidation. By examining the events in Russia's military aviation industrial base, especially the experience of the Sukhoi and Mikoyan aircraft design bureaus, policy makers in the United States may gain insight into current and forthcoming domestic fighter aircraft industrial base issues.

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## Introduction

There are many differences between the fighter aircraft industry in the United States and in Russia. The United States has traditionally produced its weaponry within a capitalist framework which allowed free enterprise and competition between companies in private industry. The former Soviet Union's economy – and its fighter aircraft industry – was based on a Marxist, command economy, where the central government dictated the type and number of aircraft produced.[1]

Yet, as Russia emerges from the Soviet Union and westernizes, there appears to be many parallels between Russia's fighter aircraft industrial base and what is happening in the United States. These potential parallels include decreased domestic demand for fighter aircraft, and increased competition between companies. Forced to adapt to these changing circumstances, companies in both Russia and the United States have tried to increase the efficiency of their industrial processes, and more aggressively pursue export markets. Also, the military industrial base in both countries has experienced a dramatic consolidation, as weaker companies are acquired by stronger companies.

It may be that by examining the Russian experience, policy makers in the United States may gain insight into current and forthcoming fighter aircraft industrial base issues. A sample of these questions include:

- How many aircraft manufacturers are needed to support military needs?

- To what extent should the survivability of these firms be taken into account in deciding which aircraft programs to pursue?

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[1] Many experts have commented that the U.S. weapon procurement process is not as sensitive to market pressures as other parts of the U.S. economy, and therefore perhaps not as dissimilar to the Soviet model as many have portrayed. For instance, the Washington Post reported " In a speech earlier this year to Navy admirals, he (Secretary of the Navy Richard Danzig) elaborated on his notion that the Pentagon is the last genuine communist system, complete with five-year plans and a command economy, run not by market pressures but by directives from the top. 'It didn't work for the Soviet Union, and I think that it doesn't work very well' for the Navy, he said." (Ricks, Thomas E. "Churning the Waters." *Washington Post*. September 9, 2000:1.

- Which aspects of the aerospace industry are really unique and vital to production of tactical fighter aircraft?

- How can competitiveness among defense contractors be maintained with fewer firms, particularly regarding different design concepts and cost-reduction innovations in the development and production of aircraft?

- Should foreign sales of military aircraft be factored into decisions on which tactical aircraft programs to pursue?

- How might decisions on tactical aircraft programs affect export earnings and international competitiveness of the aerospace industry?

## Russia's Economic Backdrop

Once among the most glamorous components of the Soviet military industrial complex, the Russian military aircraft industry has been described by some analysts as being on the verge of collapse.[2] Domestic orders for Russian military aircraft have fallen off due to a dramatic decrease in the Russian Defense budget. This in turn has had a strong effect on the fortunes of Russia's military aviation industry.

**Table 1. Estimated Russian Defense Budget**

| | 1993 ($Billion) | 1999 ($Billion) |
|---|---|---|
| Total | 75.1 | 4.41 |
| Procurement | 13.73 | .96 |
| R&D | 5.42 | .56 |

Source: *The Military Balance 1995-1996.* London: Oxford University Press. 1999. The Military Balance 1999-2000. London: Oxford University Press. 1995.

The enormous military aircraft infrastructure that Russia inherited from the USSR was designed to produce over 500 combat aircraft per year. However, the currently meager number of domestic orders combined with the modest numbers of recent aircraft exports, do not amount to one fifth of this figure. Some project that between 2002 and 2008 Russia will only produce 98 Su-27s and MiG-29s for domestic use.[3] This is an average production of 14 per year. While Russia has had some success with exports in the past, its future does not look as bright. Former Soviet client states are now free to purchase Western fighter aircraft, and Russia's

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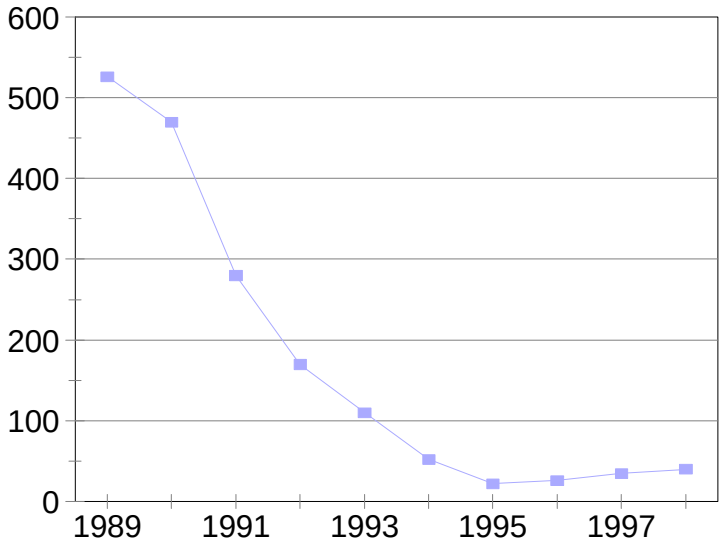
[2] For a more comprehensive discussion of Russia's military and industrial base, see *Russian Conventional Armed Forces: on the Verge of Collapse?* CRS Report 97-820 F, by Stuart Goldman.

[3] Aboulafia, Richard. *World Civil and Military Aircraft Briefing*. Teal Group, Inc. January 2000.

domestic economic and political situation may deter other countries from purchasing Russian fighter aircraft, regardless of their relatively low cost. In light of this very modest internal demand for fighter aircraft, and the intense competition for exports, the Russian military aircraft industry has been faced with dramatic pressures to consolidate, privatize or otherwise transform itself.

**Figure 1. Combat Aircraft Procured by USSR/Russia 1989-1998**




Source: *The Military Balance 1999-2000.* London: Oxford University Press. 1999.

Russia's civilian aircraft industry is facing similar pressures. Since the early 1990s Russia has experienced a strong downturn in domestic commercial air traffic. In the past decade, passenger traffic in Russia has fallen approximately 77%.[4] Of the roughly 320 regional airlines in Russia today, 50 of them perform 98% of the work. Of these 50 companies, only the 20 largest offer regular passenger service.[5] This dwindling air traffic has resulted in reduced revenue, profits, and resources for recapitalizing Russia's aging airliner fleet. The larger airlines are trying to win passengers by increasing the level of service, establishing partnerships with western airlines, and acquiring new planes.

Ilyushin and Tupolev are the two main established manufacturers of civilian aircraft and produce the Il-96 and Tu-204. Ilyushin and Tupolev currently have firm orders from domestic and international clients for 25 Il-96s and 30 Tu-204s respectively. Yet, few deliveries have been made to date.[6] While there is some domestic demand for civilian aircraft, financial constraints make it difficult for the

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[4] Duffy, Paul. Uncertain Road. *Flight International.* July 18-24, 2000: 136.

[5] Titova, Yekaterina. Magic Carpets. *Moscow Profil in Russian.* August 7, 2000.

[6] Aboulafia, Richard L. *World Military and Civilian Aircraft Briefing*. Teal Group Corporation. January 2000.

airlines to purchase or lease new planes. Russian civilian aircraft producers are hampered not only by economics, but also a lack of experience financing aircraft sales and marketing their aircraft.[7] Russian civil aircraft manufacturers have had less success than military aircraft manufacturers in making up for a lack of domestic demand through export. This is often due to the fact that Russian products do not meet western standards. Currently, Russian aircraft represent less than one percent of the global market for commercial airliners.

The status of Russia's civil aviation sector does not bode well for the military aviation infrastructure. If the civil aviation sector were healthy, it could potentially offer a "safe haven" for under employed military companies. However, because the civilian industrial base is struggling with its own transformation, any movement by Sukhoi or Mikoyan into the civil sector will only cause additional problems for Ilyushin and Tupolev.[8]

## Russia's Fighter Aircraft Infrastructure

> *"The complexity of the Russian aviation industry is sometimes hard for Western observers to understand..."*[9]

Traditionally, the Russian aerospace industrial base, inherited from the Soviet Union, has been set up in a different manner than the European or American practice. Unlike the western system, the Soviet/Russian Military Industrial Complex was highly stratified and organized into distinct components: R&D, design and prototyping, direct manufacture and some indirect sub-contracting factories supplying the main factories. All these units were much larger than their Western counterparts. In practice, this system could build large numbers of aircraft, but it proved to be extremely wasteful and inefficient.[10]

By the 1970s, the Soviet Ministry of Defense realized that the compartmentalization and stratification of the R&D- production process had serious drawbacks, particularly the separation of experimental design bureaus and production facilities. To obviate these shortcomings, the Soviet government created (in 1968) Research-Production Associations (NPOs, Nauchno-proizvodstvennoe obedinenie) which have grown increasingly influential over time. The NPO system is patterned on Western corporations. NPOs usually consist of an experimental design bureau (OKB) and one or more production facilities. NPOs (such as Sukhoi AVP and RSK MiG) manage a weapon system's development from the engineering development stage through production and system modernization.

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[7] Rubtsov Interviewed on Aviation Industry. *Novyye Izvestiya*. August 6, 1999.

[8] This bleak market has not stopped Sukhoi, for instance, from trying to enter the civilian sector. It has recently established a civilian aircraft division and is expected to fly its first civil airliner; the 20-passenger S-80 in the fall of 2000. *Flight International*, July 18-24, 2000: 136.

[9] Walters, Brian. Russia: Radical Solutions Needed. *Aerospace America*. October 1998.

[10] Kennaway. Prof. A. The Military Industrial Complex. Conflict Studies Research Centre. March 1998.

In addition to better linking R&D with manufacturing, the Soviets also hoped this reorganization would help achieve a number of goals, including: (1) concentrating lead factories with subsidiaries to emulate the western practice of widespread sub-contracting; (2) improving NPOs access to financing and presumably to financial management skills through Financial-Production Combines; (3) designating lead priority areas which would supposedly receive preferential financing and privileges; and (4) facilitating the design and manufacture of civilian products.[11]

One constant throughout this period of transition has been the role of TsAGI (the Central Aero/Hydrodynamic Research Institute) which is located near Moscow. Although its size, goals and methods have evolved, its role – to guide the entire Russian aircraft industry – has remained the same since 1918.[12]

## Reform Trials and Tribulations

The transformation of the Soviet/Russian aerospace industry has been underway since the 1970s. The Soviet-era reforms were largely ineffective, but have received greater attention in the 1990s. However, the process has been uneven and not altogether successful.[13] In 1993, TsAGI and four other major aerospace research centers (The Zhukovsky Flight Research Center (LII), the Central Institute of Aviation Motors (TsIAM), the All Union Institute of Aviation Materials, and the Central Aviation Systems Institute) failed to win support from Boris Yeltsin to consolidate aeronautics research facilities, factories, and design bureaus on a regional basis. This plan was to have integrated the Russian aerospace industry using a "common business structure."[14] It was reported that this plan was doomed from the start because it was under-funded and each organization was forced to try to survive in its own way.[15]

Following the 1993 industry consolidation failure, TsAGI underwent a painful downsizing and an especially difficult period in the late 1990s. From a high of about 14,000 personnel in the mid-1980s, TsAGI was forced to cut nearly three quarters of its workforce to its current level of 5,500 employees. Facilities were also closed.

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[11] Kennaway. Prof. A. The Military Industrial Complex. Conflict Studies Research Centre. March 1998

[12] Russian Aerospace Industry Organization. *Aviation Week & Space Technology*. January 11, 1999:311

[13] Although the NPO concept was first authorized in 1968, by 1975 there were only 97 NPOs in the entire Soviet Union. The biggest jump came in the late 1980s by which time over 500 NPOs had been formed. The NPO organization is still less common in the aircraft industry than other fields, such as missiles or space. Russian Aerospace Industry Organization. *Aviation Week & Space Technology*. January 11, 1999:311

[14] Covault, Craig. Yeltsin to Review Russian Aerospace Plea. *Aviation Week & Space Technology*. May 24, 1993: 22.

[15] Covault, Craig. TSAGI's comeback. *Aviation Week & Space Technology*. May 15, 2000:50.

Although TsAGI has nearly 60 wind tunnels and other test facilities, about half have been mothballed.[16]

In 1997, the Russian government made another attempt at streamlining the aircraft industry. At that time, the Russian military and civilian aviation industry consisted of 335 enterprises, 133 of which were devoted to the development and testing of new aircraft, systems and components, while 131 were engaged in serial production. The Ministry of Economy planned a two phase consolidation. The first phase was to integrate aircraft developers and producers into a few major corporations supported by a second tier of subsystem producers. Multipurpose associations would be created in the second phase which would include design bureaus, test facilities and production facilities.[17] Also part of the plan, Presidential Decree #880 of July 14, 1997, designated certain scientific organizations and enterprises "Russian Federation State Scientific Centers " that would receive support from the government. All other enterprises and research organizations were forced to show a profit or convert to non-aviation products.[18]

The progress and success of the 1997 plan is difficult to assess. Four of the five state-sponsored Scientific Centers, for instance, appear to be beyond TsAGI's control, and the potential for significant redundancy and inefficiencies in the Russian system still exist. Also, The various restructuring plans often seem to merely move components of the industry around without any real reduction in their size or change in their relationships. For instance, the 1997 presidential decree also converted Sukhoi AVPK into a single, true joint stock company. Yet, the various factories under the Sukhoi AVPK umbrella operate more or less independently. The respective plants generate their own income from their own exports and development contracts. Predictably, each wants to retain its own profits as well as control over its business development. Sukhoi AVPK leadership, however, views centralized control as necessary to pursue coordinated research, development, and sales; mandatory attributes for prosperity in a market economy. RSK MiG has had similar difficulties breaking down traditional stratification and compartmentalization of their design and manufacturing processes.

Despite these challenges, some progress has been made in transforming Russia's military aviation structures. TsAGI has been placed under the Russian space agency – now called the Russian Aviation and Space Agency (RASA) which has helped prioritize Russian aeronautics research projects and resources and reinvigorated the faltering industry consolidation. However, one constant in this process has been a lack of capitalization. In 1998, it was reported that despite an upturn in the Russian

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[16] Covault, Craig. TSAGI's comeback. *Aviation Week & Space Technology*. May 15, 2000:50.

[17] Stark Numbers Drive Russian Plan to Slash Aviation Industry. *Aerospace Daily*. September 10. 1997.

[18] In addition to TsAGI, the other State Scientific Centers included Central Institute of Aviation Engine Building imeni P.I. Baranov, All-Russian Scientific Research Institute of Aviation Materials, State Scientific Research Institute of Aviation Systems, Flight Research Institute imeni M.M. Gromov. (FRI). *Russian Aviation Industry*. Michael Nikoulichev. U.S. Embassy - Moscow, January 1998.

aerospace industry, the lack of hard currency was still a powerful impediment to reconstructing the aviation industry along western lines."[19]

**Figure 2. Theoretical Structure of the Russian Fighter Aircraft Industrial Base, October 2000**


# Russian Aviation Corporation MiG (RSK MiG)

Formerly known as the Military Industrial Complex "Moscow Aviation Production Assn." (VPK MAPO), RSK MiG was created by Presidential decree #92 in January 1996 in order to bring together leading Russian civilian and military aviation concerns. RSK MiG consists of several industrial enterprises, each with its own network of affiliated branches and subsidiary establishments. VPK MAPO was originally a controlling marketing superstructure until restructuring united it with MiG MAPO. Its main products are MiG airplanes, Kamov helicopters, aircraft engines, aircraft accessories and airborne equipment. In December 1999, Nikolai Nikitin, formerly with OKB Sukhoi, was appointed the corporation's General Director and General Designer.

Recently, there has been tension within RSK MiG over the future direction of the company. Since economic conditions have led to a severe reduction of military orders, Nikitin is redirecting the corporation towards the commercial aircraft sector. It is estimated that 20% of its production capacity will produce military products and the remainder will be slated for civilian goods.[20] Nikitin has focused most of the company's resources on the development of the Tu-334 passenger aircraft at the

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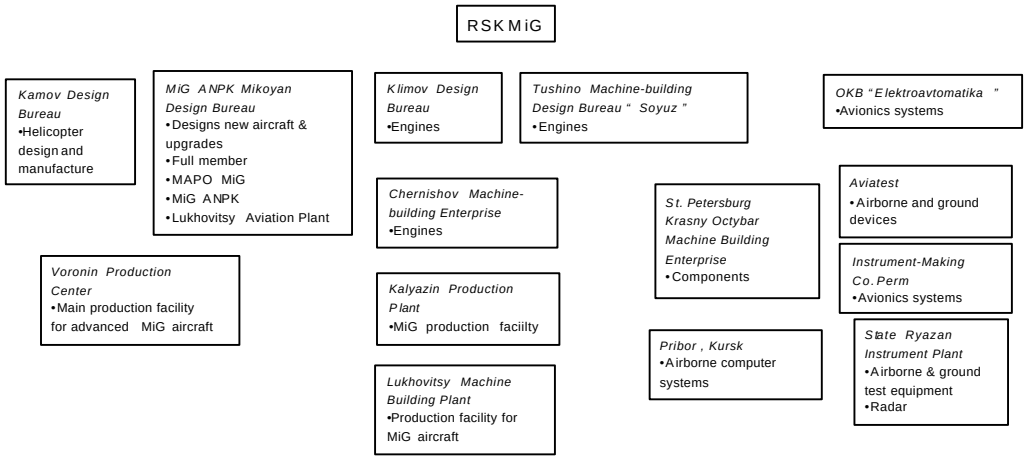
[19] Walters, Brian. Russia: Radical Solutions Needed. *Aerospace America*. October 1998.

[20] Aircraft Builders Throw Dead Weight Down. *Segodnya*. December 9, 1999.

expense of military programs. This prompted the resignation in December 1999 of many of its leading military aircraft designers, including the chief designers and their deputies for the MiG-29 and MiG-31 programs.

The December 1999 Presidential decree which gave the corporation its current name also restructured the corporation. In the planned restructuring, the Kamov Company will be withdrawn from the corporation and set up as the Kamov Helicopters Association. The Ryzan Instrument Plant will also be withdrawn and used as a base for creating the Russian Instrument Corporation. The engine companies within RSK MiG, Klimov Scientific Production Association, Soyuz Machine Building Plant in Tushino, and the Chernyshov Machine Building Enterprise, will become an integrated company.[21] RSK MiG is exempt from privatization by the July 12, 1996 Decree of the Government #802.

**Figure 3. Approximate Organization of Mikoyan, October 2000**




The following enterprises are major members of RSK MiG:

- **A.I. Mikoyan Aviation Scientific Production Complex (ANPK "MiG"), Moscow** Originally established December 8, 1939 as the Pilot Design Department of the Aviation Plant #1 and headed by A.I. Mikoyan and M.I. Gurevich. It was responsible for the design and development of MiG fighters. It was later renamed "Experimental Design Bureau named after A.I. Mikoyan" otherwise know as Mikoyan Design Bureau or Mikoyan OKB. In 1995, Mikoyan OKB was merged with two production facilities to form Moscow Aviation Production Assn. "MiG" (MAPO-MiG). The company continues to specialize in the design of fighter aircraft, but has also broadened its focus to include the design of jet trainer aircraft and civilian aircraft. The Mikoyan Design Bureau is at the center of RSK MiG.

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[21] Jet Maker MAPO Military Industrial Complex Renamed. *Interfax News Agency Weekly Business Report*. December 28, 1999.

- **Lukhovitsy Machine Building Plant (LMZ), Lukhovitsy**. The plant was originally founded in 1953 as a subsidiary of Moscow Machine Building Plant "Znamya Truda" and served as its test-flight base. It is currently an aviation complex for MiG products with facilities for manufacturing their parts and units, and assembly. It also conducts ground and in flight testing of the MiG-29, the light civil aircraft Il-103, I-11 and other middle sized aircraft.

- **P.A. Voronin Production Center, Moscow**. The lead serial manufacturing plant for MiG aircraft in Moscow. The Center also develops and manufactures prototypes and aircraft upgrades.

- **Kalyazin Production Plant, Tver**. Manufacturing facility for MiG aircraft.

- **Kamov Company, Lubersy**. The Kamov Company, established in 1948, develops and produces helicopters of various types. The company consists of a design bureau, experimental production facilities, flight test center, and auxiliary services. Kamov helicopters are produced at Ukhtomsk factory (Strela) in Orenburg, Kumertau Aviation Complex (KumAPO), and Progress Complex. The Kamov Company is a joint-stock company.

- **Klimov Scientific Production Association, St. Petersburg**. The enterprise was established in 1944 as a design bureau for aircraft engines, headed by Chief Designer Vladimir Yakovlevich klimov. The Klimov Plant, together with its own experimental prototype plant, the Klimov Machine-Building Plant, form the Klimov Scientific Production Association. The Klimov enterprise continues to concentrate on development and production of aircraft and helicopter engines, including engines for the MiG-29 fighter and Il-114 civil transport. Klimov engines are produced at the Krasnyy Oktyabr Plant. The Klimov Plant is exempt from privatization by the July 12, 1996 Decree of the Government #802.

- **Soyuz Machine Building Plant, Tushino**. Consists of a design bureau and production facilities for aircraft engines. The company is exempt from privatization by the July 12, 1996 Decree of the Government #802.

- **V.V. Chernyshov Machine Building Enterprise, Moscow**. Producer of aircraft engines.

- **State Ryazan Instrument Plant, Ryazan**. Originally established in 1935, it manufactures airborne and ground test equipment as well as fighter radars.

- **Electoavtomatika Scientific Production Association, St Petersburg**. Design Bureau and manufacturing facility for avionics

systems. The association is exempt from privatization by the July 12, 1996 Decree of the Government #802.

- **Pribor Association, Kursk**. Currently a joint-stock company, it was originally founded in 1959. The company develops and produces airborne computer systems.

- **Perm Instument Making Company, Perm.** A joint-stock company, originally founded in 1956, which develops avionics systems

- **Aviatest Research and Engineering Enterprise, Rostov-on-Don**. Develops and produces software and hardware for airborne and ground devices.

- **Krasny Octybar Maching Building Enterprise, St. Petersburg**. Currently a joint-stock company, it was originally founded in 1891. It produces engines designed by the Klimov Design Bureau, and aircraft components.

## Sukhoi Military Industrial Group AVPK (AVPK Sukhoi)

Presidential Decree #1269 established AVPK Sukhoi on August 26, 1996 in order to unite the developers and manufactures of Sukhoi aircraft after the General Designer at Sukhoi design bureau, Mikhail Simonov, objected to his enterprise joining VPK MAPO. The main products of the Sukhoi group are Sukhoi fighter jets and their components, and Beriev hydroplanes.

However, sources indicate that by 1999, AVPK Sukhoi had not yet become fully integrated and remained an artificial formation. As earlier noted, the delay appears to be caused by internal power struggles between directors of the leading manufacturing plants and leadership of the Sukhoi Design Bureau. In January 2000 the Russian government confirmed its December 1997 decree to transform AVPK Sukhoi into a joint-stock company.

Even though Sukhoi fighters are favored by the Russian military, procurement orders have decreased drastically due to economic conditions. In 1999 only 2% of Sukhoi's revenues were generated by Russian military orders.[22] In order to remain profitable, Simonov reports the company has been forced to look actively for foreign contracts. The company is also trying to expand into the commercial aviation market by building a small civil jet liner and by making internal changes to its organization.

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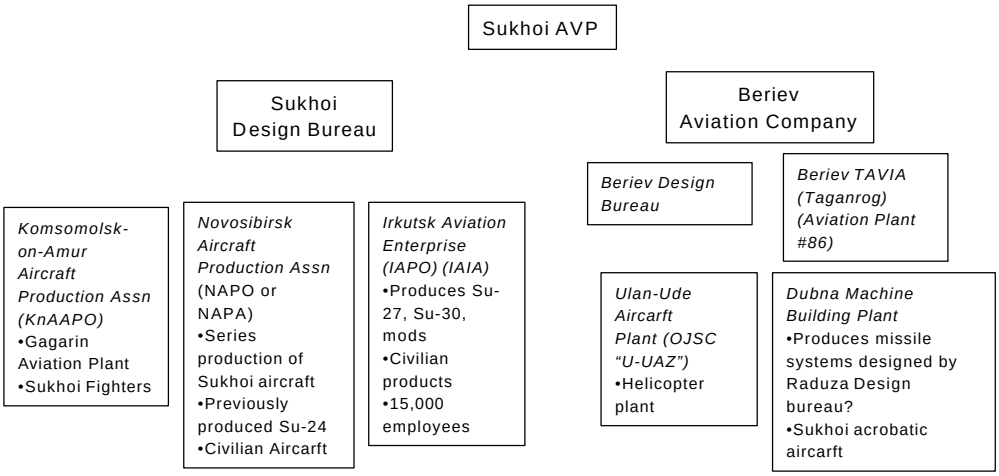
[22] Sukhoi Design Bureau Revenues Shift to Foreign Sales. *Aerospace Daily*. June 23, 2000. Vol. 194, No. 59; Pg. 471.

**Figure 4. Approximate Organization of Sukhoi, October 2000**




The major enterprises within the group are summarized below:

- **Sukhoi Design Bureau, Moscow**. The Sukhoi Design Bureau was originally founded in 1939 by Pavel Osipovich Sukhoi and was responsible for the design and development of Sukhoi fighter aircraft. The company is at the heart of AVPK Sukhoi and continues to design and develop combat aircraft as well as commercial and general aviation aircraft.

- **Beriev Aviation Company, Taganrog**. The company was founded in October 1934 by G.M. Beriev and was originally called the Beriev design bureau (OKB) and specialized in seaplane development. In 1990 it was renamed the Taganrog Aviation Scientific-Technical Complex (TANTK). In 1998 it adopted the name Beriev Aviation Company for international promotion, retaining the TANTK name in Russia. Its products include experimental prototypes of amphibious aircraft and wing-in-ground-effect vehicles. It also undertakes design and development of unconventional aircraft in response to requests for proposals from other companies. Today the company includes an experimental design bureau, experimental production facilities, a flight test complex, economic, financial and logistic support services, and test bases and proving grounds.

- **Novisibirsk Aircraft Production Association (NAPO or NAPA), Novisibirsk**. NAPO, one of the three main manufacturing enterprises in AVPK Sukhoi, was established in 1936 as a production plant and originally worked on a variety of aircraft. Since becoming a part of AVPK Sukhoi, it manufactures the Su-24, Su-34, and AN-38. The Association is exempt from privatization by the July 12, 1996 Decree of the Government #802.

- **Komsomolsk-on-Amur Aircraft Manufacturing Association (KnAAPO), Komsomolsk-on-Amur**. Established in 1934 as a

production plant and originally known as GAZ 416, it is currently one of the three main production centers for Sukhoi aircraft. It also produces the amphibian flying boat Be-103. The association is exempt from privatization by the July 12, 1996 Decree of the Government #802.

- **Irkutsk Aviation Industrial Association (IAPO), Irkutsk**. IAPO, one of the three main manufacturing enterprises in AVPK Sukhoi, is currently a joint-stock company originally founded in 1932 as a production plant. It produces the Be-200, Su-27, Su-30, and their modifications. It is also a partner in the CIS-Swiss joint venture known as Beta Air.

- **Ulan-Ude Aviation Plant (UUAP), Ulan-Ude**. The Ulan-Ude Plant was founded in 1939 and is a component of the Ulan-Ude Aviation Industrial Association. Its current products include modernization of the Mil Mi-8/Mi-17 series of helicopters, Sukhoi Su-25 combat trainer, and Su-39 attack aircraft.

- **Dubna Machine Building Plant, Dubna**. Founded in 1939. Since 1993 it has produced the Su-29 two-seat aerobatic aircraft and light aircraft. It also produces missile systems.

## Parallels with U.S. Defense Industry

A cursory examination of the Russian military aviation industry suggests that it and the U.S. military aviation industry share similar pressures and experiences. These parallels include increased pressure to secure foreign customers and continuing industry consolidation.

As the domestic demand for Russian military aircraft has declined, Sukhoi and MiG have increasingly depended on exports to keep production lines open, supplement funding for other programs, and keep workers employed. Both companies have been successful in the 1990s, most notably with the sale of 48 Su-27s to China, 40 Su-30Ms and 70 MiG-29s to India, 16 MiG-29s to Malaysia, and 16 MiG-29s to Peru.

But export is not the only method of securing hard currency. TsAGI is marketing a wide range of services offered at its facilities. These include the design of aircraft control systems, fabrication of wind tunnel models, wind tunnel tests, design and testing of propellers, airframe strength testing, software development, and flight simulator experiments. TsAGI continues to conduct research in the following areas: aerodynamics of all types of aircraft at varying speeds, airframe strength, flight dynamics, hydrodynamics, aeroacoustics, and prototype development. However,

TsAGI still continues to provide scientific support to projects carried out in the design bureaus of various domestic companies.[23]

TsAGI has been successful in attracting non-Russian business. Boeing is working with TsAGI scientists in areas such as aerodynamics of wings, computer software, acoustical analysis, materials analysis, and vortex flows behind aircraft. Boeing parts have also been tested in TsAGI wind tunnels[24]. Airbus is working with TsAGI to perform structural analysis for the A3XX high-capacity transport design. TsAGI is also scheduled to conduct supersonic transport research with Japan's National Aerospace Laboratory. Training programs have been established to teach Chinese and South Korean engineers more about aeronautics research and development. China has also sponsored aeronautics work at TsAGI. French government and industry, as well as Deutsche Aerospace in Germany and U.K's defense research agency also have ties to TsAGI facilities.[25] Non-Russian research contracts now make up 32% of TsAGI's work, and only 10% comes from Russian aeronautics companies. The rest is tasked by the Russian Ministry of Science and Technology through the Russian Aviation and Space Agency. Of this, about 30% is for basic aeronautics research, while 28% is for civil aviation. The rest is for Russian military research.[26]

Another way Sukhoi and MiG have attempted to keep production lines open is to expand into civilian aircraft production. As a result of a government decree, MiG won the right to head the Tu-334 medium-haul airliner project which had stalled earlier due to financial constraints.[27] MiG will also produce the light aircraft Il-103.[28] Sukhoi has several civilian projects under development including the S-80 short take-off and landing transport, S-21 supersonic business jet, and KR-860 super large passenger plane.[29] In order to make their aircraft affordable to a financially struggling domestic market both plan to work out leasing schemes.

The Russian Federal Aviation Service (FAS) has estimated that Russia will need to acquire 652 aircraft between 1997 and 2001 to replace an aging commercial fleet.[30] Sukhoi and MiG will face stiff competition from domestic civil aviation production companies (Tupolev and Ilyushin) as well as international companies for

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[23] [http://www.tsagi.rssi.ru].

[24] Lukashina, Regina. Bulgak Speaks on Abilities of Counties' Aircraft-Builders. *Moscow RIA*. June 22, 1997.

[25] Covault, Craig. Yeltsin to Review Russian Aerospace Plea. *Aviation Week & Space Technology*. May 24, 1993: 22.

[26] Covault, Craig. TSAGI's comeback. *Aviation Week & Space Technology*. May 15, 2000:50.

[27] Pronina, Lyuba. MiG Producer Sets Civilian Project. *The Russia Journal*. November 15, 1999.

[28] Designers Resign En Masse from MAPO (MiG). *AeroWorldNet*. December 6, 1999.

[29] Karnozov, Vovick. Sukhoi In For Changes. *AeroWorldNet*. June 7, 1999.

[30] Nikoulichev, Michael. Russian Aviation Industry. January 1998. [http://www.fas.org].

the civilian market. The ability of Russian fighter aircraft companies to compete with commercial companies for market share is unclear. While Russian aircraft may be cheaper to produce, western aircraft generally have lower operating costs and better maintenance and repair services.[31] On the other hand, Russian airlines face strong political and industrial pressure to support the domestic aviation industry. The government is also under pressure to protect the industry against foreign competitors.

Russia's federal government and military leadership are aware of the financial problems facing the military-industrial complex. In 1996 a government-military policy was developed in an attempt to reform and preserve the military-industrial complex. In regards to the aviation industry the policy had two key elements. First, the Russian Air Force apparently decided to forgo near-term aircraft and weapons acquisition in order to channel funding to aircraft and weapon-development projects to keep advanced-technology capabilities alive. The second element was to continue aggressively marketing advanced aircraft and aviation-production capabilities abroad and to use export profits to support advanced aircraft-development projects and production capabilities.[32]

Grim market realities in Russian military aviation cause many analysts to suggest that the Russian military industry has yet to complete its consolidation. Mikhail Pogosyan, General Director of Sukoi AVPK, has said consolidation is necessary to ensure survival and prosperity for the Russian aircraft industry in today's economic environment. This consolidation, in Pogosyan's view, goes beyond just a Sukhoi-MiG merger and extends into other design bureaus such as Tupelov and Ilyushin and other components of the aircraft industry.[33]

Various reports indicate that the Russian government is considering merging AVPK Sukhoi and RSK MiG as part of a major overhaul of the country's defense industry.[34] There is debate over which company would benefit the most from such a merger. Some argue that if continued consolidation does occur, it appears most likely that Sukhoi will be the surviving entity. The Su-27 line has enjoyed more domestic success than the MiG-29 variants and appears poised to continue this trend. The latest Russian military aviation plan, designated the Su-34 and Su-35/-37 as the most important Russian fighters for the next decade.[35] Furthermore, exports of Sukhoi fighter/attack aircraft are increasing in both absolute terms, and relative to MiG exports. However, others argue that MiG would benefit more since it has

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[31] Titova, Yekaterina. Magic Carpets. *Moscow Profil in Russian*. August 7, 2000.

[32] Johnson, Major David R.. Strategy for Survival. [http://aeroweb.lucia.it].

[33] Moscow Ekspert, 31 Jan00, Moscow Kommerstnt, 28 Jan 99.

[34] MiG and Sukhoi Merger Heralds Russian Reshuffle. *Jane's Defence Weekly*. February 2, 1999.
Russians Consider Industry Restructure. *Flight International*. January 27, 1999.
Impending Changes in the Defense-Industrial Complex. *Moscow Nezavisimoye Voyennoye Obrozreniye*. September 22, 2000.

[35] Abulafia, Richard. Mikoyan MiG-29 Fulcrum. *World Military and Civil Aircraft Briefing*. Teal Group Inc. January 2000.

traditionally had stronger ties to the federal government and appears to be stronger organizationally.

Several events in the 1990s have combined to make RSK MiG appear the weaker sibling. The Russian military has not procured a MiG since the early 1990s, and does not appear likely to do so soon.[36] Also, MiG's export success in the early 1990s has tailed off. Finally, internal conflicts and defections of key personnel have weakened the organization. In late November 1999 a dozen leading officials including the chief designers and their deputies for the MiG-29 and MiG-31 programs resigned. These officials represented the leadership of RSK MiG's MiG-29 program. Shortly thereafter, most signed on with a new firm, *Russian Avionics*, headed by Nikitin's predecessor, Mikail Korzhuev, that had its own MiG-29 upgrade program. In 1998 the Russian Air Force signed a lucrative contract with *Russian Avionics* to upgrade their MiG-29, relegating VPK MAPO to a subcontractor role.[37]

If MiG isn't absorbed by Sukhoi in future consolidation, another possibility is that Sukhoi and MiG will team up to promote common projects abroad.[38] The Russian Air Force has also indicated it would like Sukhoi and MiG to co-operate on developing fifth generation combat aircraft programs since it is able to financially support only one or two such programs at a low level.[39] Both Nikitin and Pogosyan have argued that faster progress could be made in developing a fifth generation fighter if other countries, such as China and India, were drawn into the project.[40] AVPK Sukhoi spokesman, Yuri Chervakov, noted "We just have to publicly acknowledge that it is more feasible to team up with our strategic partners, just as the United States lures other Western countries into its Joint Strike Fighter project."[41]

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[36] Abulafia, Richard. Mikoyan MiG-29 Fulcrum. *World Military and Civil Aircraft Briefing*. Teal Group Inc. January 2000.

[37] Mosow Times, 11 Dec 99

[38] Sukhoi Courts MAPO on Export Efforts. *Flight International*. May 6, 1998.
Butowski, Piotr. Russia's Aircraft Rivals Set To Become Partners. *Jane's Defence Weekly*. February 25, 1998.

[39] Sukhoi and Mikoyan Told to Co-ordinate Fifth Generation Effort. *Flight International*. April, 22, 1998.

[40] Saradzhyan, Simon. Russia Gears Up for $100 Million Fighter Program. *Defense News*. October 9, 2000.

[41] Ibid.