DISTRIBUTION A:
Approved for public release; distribution is unlimited.

# Russia's Military Aviation Industry

## Strategy for Survival

MAJ DAVID R. JOHNSON, USAF

AT THE 1996 Farnborough Air Show, Sukhoy's SU-37 astounded international observers with maneuverability previously unseen in a combat aircraft. The thrust-vectoring SU-27 variant stole show headlines with flight demonstrations widely described in the aviation press as "spectacular."[1] One air show reporter opined that the SU-37 shows that the Russian aviation industry "is still alive." Sukhoy's new aircraft is convincing reaffirmation of the world-class and, in some areas, unique capabilities of Russia's military aviation industry. However, though still "alive," Russia's military aviation industry is struggling for survival.

The situation is serious enough that a committee of the Russian legislature examining the problem in 1995 concluded that the aviation industry could collapse by the turn of the century if energetic action to reverse current trends were not taken.[2] The main source of the industry's problems is easy to find: orders from the Russian Federation Air Force (RFAF) are down to almost zero. The same is true of orders from former Warsaw Pact nations. Because RFAF purchases have nearly ceased, production lines have gone idle, and workers are laid off or unpaid. A related problem, which may have greater long-term impact than the closure of some production lines, is a steady decline in the number of new scientists and engineers beginning work in the military–industrial complex. The trend points toward a future shortage of trained specialists in the science-intensive aviation industry.

It appeared during the first several years after the Soviet collapse that the government had no coherent policy on how to reform and preserve the military aviation industry. The evidence now suggests that Russia's federal government and senior military leadership are not blind to the problems of the military-industrial complex as a whole and have outlined a policy for preserving its high-tech components through the country's economic crisis. Because of its high-tech orientation and its importance to na-

*A Stalin-era aviation poster showing a Red Square parade. Aviation was a top priority of the Soviet Union. The poster caption reads "Long Live the Mighty Aviation of the Socialist Countries!"*

tional security, aviation is given priority consideration in the new policy.

The emerging government-military policy on the military aviation industry and its scientific-technical base is part of a developing policy on the military-industrial complex as a whole. The overall policy is aimed at slowing and reorienting defense conversion, clearly identifying what elements of the military-industrial complex are necessary to Russia's national security, and supporting high-tech dual-use industries which can be profitably sold abroad or can attract investment in the near term and can provide the technical base for a modernized military once Russia has weathered its economic crisis.

The policy pertinent to the military aviation industry has two key elements. The first is an apparent decision for the RFAF to forgo near-term aircraft and weapons acquisition so that sufficient funding can be channeled to aircraft and weapon-development projects to keep advanced-technology capabilities alive. The second is to continue aggressively marketing advanced aircraft and aviation-production capabilities abroad and to use profits from foreign sales to sustain advanced aircraft-development projects and production capabilities. The result will be increased competition on the world military aviation market, the appearance of Russian advanced fourth- and so-called fourth-and-one-half-generation aircraft around the world, despite their not having entered service in the RFAF, and the proliferation of aviation-production technology.

## The Russian Federation Air Force: Wishes and Reality

The SU-37 shows that in some quarters the creativity of Russia's aircraft designers is

*The entrance to the test-pilot school at Gromov Flight Research Institute. In 1995 Russia's test-pilot school graduated only three new test pilots.*

unabated. Nevertheless, Russia's military budget has been hard hit by the country's economic crisis, and this has translated to severe reductions in aircraft orders. Consequently, neither the SU-37 nor any other new aircraft will enter service in the RFAF in substantial numbers in the foreseeable future. In 1995 the RFAF's chief financial officer described the status of pay for aviation production as catastrophic. According to his figures, the Ministry of Defense (MOD) budget in recent years has supplied no more than 35 percent of requirements for purchase of new weapons, research, design, and testing.[3] This translated to the purchase of just 32 aircraft for the RFAF in 1994, and the 1995 budget provided for no new aircraft purchases.[4] By 1996 the RFAF leadership asserted that the defense budget was meeting only 30 percent of its actual budget requirement.[5] This low funding has forced the RFAF to allocate its scant resources toward minimum operational requirements and bare survival, leaving little for purchase of replacement aircraft or development of new aircraft types. The effect on the RFAF is obvious, and the devastating effect on Russia's military aviation industry is also increasingly clear: design bureaus and production facilities are largely idle, their employees laid off or unpaid.

The RFAF's curtailment of combat-aircraft purchases has been forced by a lack of funds, not for lack of a requirements road map. Gen Pyotr Deynekin, RFAF commander-in-chief (CINC), has clearly outlined force requirements for the next 10 to 15 years. These include a new next-generation fighter, a new frontal-aviation bomber, a new theater bomber, and substantial transport acquisitions. Deynekin and other RFAF senior officers have been equally frank in admitting the financial problems which prevent timely enactment of the modernization and acquisition plan. The domino effect of the RFAF's woes on the military aviation industry is increasingly clear.[6]

*The new MiG-AT. MiG has high hopes for domestic and foreign sales of its new trainer. (Photo by Artur Sarkisyan.)*

## The Military Aviation Industry and Its Scientific-Technical Base

The aviation industry's externally driven problems are compounded by its own lack of purposeful reform, which has left its development, testing, and production complex nearly as large and disjointed as it was in Soviet times, despite the steep decline in state orders. An individual who had closely observed the Soviet aviation industry from 1945 to 1991 and then had taken a five-year sabbatical would find the Russian aviation industry comfortably familiar. Russia inherited 85 percent of the Soviet Union's aviation industry. All the familiar design bureaus, MiG, Sukhoy, Yakovlev, Tupolev, and Ilyushin continue, at least nominally, to function in Russia. The associated engine- and radar-design bureaus and component manufactures also remain in operation. All told, the military component of the aviation industry comprises half the country's vast military-industrial complex of seventeen hundred industrial enterprises and research institutes and their 3 million employees.[7] In Soviet times, they were subordinate to the

*A SU-30MK. Sukhoy has enjoyed a major success with the sale of this aircraft to India. Future versions will include thrust-vectoring engines.*

Ministry of Aviation and now answer to its successor, the Department of Aviation in the Ministry of Defense Industry.

Russia probably inherited an even greater percentage of former Soviet aviation test facilities and research institutes since that component of the industry was heavily concentrated in the Moscow and Leningrad (Saint Petersburg) regions. Certainly, the core group of State Scientific Centers which oversee various aspects of development and testing remained in Russia. The six institutes primarily associated with aircraft development are the Central Aerohydrodynamics Institute (TsAGI), the Central Institute of Aircraft Engine Building (TsIAM), the All-Russia Institute of Aviation Systems (GosNIIAS), the Gromov Flight Research Institute (LII), the All-Russia Institute of Aviation Materials (VIAM), and the Siberian Aeronautical Research Institute (SibNA). They conduct fundamental research in aerodynamics, strength, flight dynamics, aircraft stability and controllability, navigation, guidance and control systems, aeroelasticity, gas dynamics, aviation materials, durability, and testing methods.[8] These are joined by a large cadre of institutes engaged in advanced research that ultimately contributes to aviation development.

Though the aviation industry retained its massive size, aircraft orders have declined drastically. In January of 1996, industry output showed a 33.7 percent decline compared to January 1995 levels—the sharpest decline for any sector of the military-industrial complex. Eight months later, industry figures for August showed production at 61.8 percent of production in August 1995.[9] Overall, aviation production in 1994–1995 showed a 60–70 percent drop compared to output in the mid-1980s. The resulting situation at the Komsomolsk-Na-Amur production plant, which produces Sukhoy fighters, was typical of the aviation industry throughout the country.[10] The plant's three thousand aircraft workers suffered a six-month layoff in early 1995. Even workers engaged in the

plant's defense conversion program producing color televisions worked only part-time in the first half of 1995.[11]

The industry's financial problems are compounded by government nonpayment for some of the few orders which are placed. RFAF debt for unpaid 1994 orders amounted to 500 billion rubles (the 1996 exchange rate was approximately 5,550 rubles to the dollar). Interest payments ate into the 1995 RFAF budget and still the debt rose to 765 billion rubles by mid-1995. Not surprisingly, some enterprises began to refuse to fill orders under such conditions. In 1995 the Perm Motor Company refused to fill further orders from its biggest debtor, the MOD, for MiG-31 engines. The plant was forced to lay off one thousand employees and go to a three-day work week.[12]

The scientific-technical base of the aviation industry—its design bureaus, test facilities, and research institutes—has suffered as well. One telling sign of significant decline in their funding was the reported graduation of the 32d class of test pilots by the Gromov Flight Research Center's test-pilot school in mid-1995. The class comprised just three pilots. By comparison, the school used to graduate classes of 11–13 test pilots on average. With design bureaus and production facilities occupied at a fraction of their capacity, funding for test-pilot training has dropped as well.[13] As a result of the precipitous decline of aviation production, the volume of work at scientific and test facilities has been reduced to critically low levels—one-twelfth of pre-1991 activity.[14]

In addition to the aviation design bureaus, production plants, and five main test research facilities, hundreds more institutes engage in fundamental, advanced, and applied research contributing to the advancement of aviation. These organizations have found themselves in even more serious financial difficulties than have the core aviation enterprises.[15] Work is at a near standstill, and pay was several months in arrears by October 1996 before large protests forced government action. Hunger strikes by prominent scientists protesting pay arrears have further underscored the problems in Russia's scientific community.

*The SU-37. Sukhoy's thrust-vectoring fighter created a sensation at its debut during the 1996 Farnborough Air Show.*

***The Ministry of Defense (MOD) budget in recent years has supplied no more than 35 percent of requirements for purchase of new weapons, research, design, and testing. This translated to the purchase of just 32 aircraft for the RFAF in 1994, and the 1995 budget provided for no new aircraft purchases.***

The apparent lack of opportunity in scientific work and the strong financial attraction of Russia's developing business sector are creating a problem which could have long-term effects on the aviation industry. Fewer and fewer young people are choosing to go into science, opting instead for more lucrative fields. According to statistics published by Russia's Science Ministry, 61 percent of people working in scientific research are 40 years of age or older. Twenty-five percent of scientific researchers are between 31 and 39, and only 13 percent are under 30. Meanwhile, Science Ministry statistics show a steady decline in output of new scientists by Russia's universities and scientific institutes. Other figures also appear to indicate that people with less than Russia's most advanced degrees (and hence less time invested in their field) are abandoning scientific work.[16] The trend indicates that the scientific fields supporting the aviation industry and the scientist-and-engineer-dependent design bureaus, where average salaries are half the national average and one-tenth the salaries in some developing commercial fields, will have an increasingly difficult time attracting the best and the brightest of Russia's youth.[17] The qualitative aspect of this problem would be difficult or impossible to measure. However, the quantitative problem is straightforward in a country where the average male life span is down to 57 years. If the trend continues, a large percentage of the aviation industry's professional cadre will soon reach the end of its productive life without a cohort of young replacements. The supply of new scientists and engineers needs to adjust to a shrinking aviation industry. However, current trends seem more in line with collapse than contraction. Furthermore, the qualitative question may prove more severe than the quantitative one as bright youths with initiative are forced to choose between the relatively lucrative business professions and life in Russia's struggling scientific-technical community.

## The New Policy for Survival

Given the facts outlined above, unanimity regarding the critical state of Russia's military aviation industry formed early in government, military, and industry circles. Less easy to arrive at was a consensus view of how to deal with the problem. Most efforts fell roughly under the catchall phrase "defense conversion." In most cases, this amounted to some easing of government control on aviation enterprise facilities and uncoordinated efforts on their part to produce consumer goods for the domestic and export market. Television production by the Komsomolsk-Na-Amur aircraft-production plant is one example of this policy in action.

It is now clear that a new policy of key importance to the future of Russia's military aviation industry emerged during 1996. The new policy is based on recognition early in 1996 of the failure of existing defense-conversion policy and the resulting desperate state of the military-industrial complex. The policy represents the consensus view of key government, military, and military-industrial leaders of the long-term importance to Russia's national security of the "science intensive" advanced-technology sectors of the military-industrial complex. It also recognizes the marketability of high-tech military capabilities in the near term. The importance of the military aviation industry and its scientific base to national se-

curity and the importance of nursing its capacity through Russia's economic crisis are a major component of the policy.

Several events during 1996 appear to have contributed to the evolution of this policy. First, an expanded session of the air force's military council was held in February. RFAF commander Deynekin, other senior officers of the air force, Air Defense Aviation, and Naval Aviation participated, as well as leaders of the aviation industry and representatives of the State Committee of Defense Industry. Nikolai Yegorov, President Boris Yeltsin's chief of staff, also attended. A broad range of issues was discussed at the meeting, but press reports make clear that the problems of the military aviation industry were at the forefront. The three main questions relating to the aviation industry and its scientific-technical base included: preserving design, research, and production capabilities despite funding cuts; choosing areas to which the air force and the aviation industry should give priority; and determining Russia's aviation export policy.

It appears that during this council session the decision was made to forgo substantial purchases of existing aircraft in the near to midterm in favor of supporting the scientific-technical base and new aircraft development. The council also reached the conclusion that the critical period for the survival of the aviation industry and its scientific-technical base is the nine-year period from 1996 to 2005. This is based in part on the anticipated service life of the RFAF's fourth-generation fighters—the MiG-29 and SU-27—to which the council specifically referred. The council concluded that the aviation industry's downward trend would mean that in 10 years no capacity would remain to equip the RFAF with modern aircraft, even if acquisition funding returned to normal levels.[18]

Press statements by the council indicated that one aim of the meeting was to inform the government, MOD, and State Committee for Defense Industries of the need to preserve the aviation industry. In fact, subsequent events during 1996 indicated that the concerns raised at the February council meeting resonated with government leaders. First, apparently in response to widespread dissatisfaction in the government and the military-industrial complex with the course of defense conversion, President Yeltsin issued a decree on 8 May turning the State Committee on Defense Industry (GosKomOboronProm) into the Ministry of Defense Industry.[19] The decree put Zinoviy Pak, then chairman of GosKomOboronProm into the cabinet as minister of defense industry and expanded his organization's authority.

***Sukhoy's new aircraft [the SU-37] is convincing reaffirmation of the world-class and, in some areas, unique capabilities of Russia's military aviation industry.***

The move, taken during the run-up to Russia's presidential elections, signaled government concern for the state of the defense industry and its millions of workers but was scoffed at in some quarters as electioneering. However, it soon became clear that the decree creating the new ministry was more than political window dressing. In a series of interviews subsequent to his appointment as minister of defense industry, Pak indicated that the creation of his ministry was part of a government plan to reorient defense-conversion policy. Significantly for the military aviation industry, Pak immediately made clear that a major part of the policy reorientation was renewed emphasis on preser-vation of the "science intensive" and advanced-technology sectors of the military-industrial complex. He also reported that, since the official adoption of a post-Soviet military doctrine in 1993, the first time the Economic Ministry, MOD, and the State Committee on Defense Industry presented a coordinated weapons development plan to the government was early

1996—the time frame of the RFAF council session outlining air force and aviation industry priorities.[20]

Pak has outlined a policy which will reorient the course of Russian military-industrial conversion if he succeeds in putting it into practice. He has said that his first priority is identifying which of seventeen thousand military-industrial enterprises remain necessary to fill state defense orders. Those enterprises that do meet state defense acquisition requirements will be separated into two groups: enterprises so heavily specialized in defense work that they will remain purely government owned, and those which can be partially privatized due to the dual civil and military nature of their production. What Pak calls the government's former policy of unnaturally cultivating defense industry privatization will be halted. Pak frankly states that a third category of enterprise, those which are found to be obsolete or unnecessary for defense acquisition needs, will be left to sink or swim on their own. In his opinion, the eventual evolution of Russia's military-industrial complex to a mix of a limited number of very large state-owned enterprises supplemented by a cadre of military-industrial commercial firms would best serve the country's defense needs. Significantly for the military aviation industry, he has singled out as effective models for this policy the Voenno-Promyshlenniy Kompleks MAPO (the conglomerate now producing MiG aircraft) and the Sukhoy OKB (design bureau), which have both moved toward consolidation of design and production facilities but along different organizational principles.[21]

The views Pak has expressed closely agree with those of First Deputy Defense Minister Andrey Kokoshin, whose portfolio includes military-technical policy. Kokoshin is a longtime advocate of finding ways to preserve advanced technical capabilities through the current economic crisis. He also weighed in during 1996 in favor of short-term-acquisition belt tightening for the sake of preserving the military's scientific-technical base, saying that the MOD's main budget focus would be on creation of "future weapons" and defense scientific-research test and design work.[22]

The government validated the policy advocated by Pak and Kokoshin in a resolution issued during August 1996 on "The National Technical Base." The resolution was reissued as a presidential decree the following October. A key element of the resolution/decree was the conclusion that defense conversion had failed because it was based on obsolete technology. The document directs a reorientation of conversion to exploit modern dual-use technology. It defines dual-use technology as suitable to equip the military with the most modern equipment and also to use in high-tech civilian products that can compete on the world market.[23]

Key government figures voiced support for the "National Technical Base Policy" in the critical period of legislative consideration of the 1997 federal budget. Yakov Urinson, Russia's deputy minister of economics, laid out his ministry's rationale for husbanding scarce resources in order to support high-tech military-industrial enterprises. Like other important figures involved in formulating the policy, he singled out aviation as one of the priority defense-industry sectors. During the same period when the budget was being considered by a reconciliation committee, Prime Minister Viktor Chernomyrdin also supported increased funding for scientific research and development and increased government support for enterprises producing high-tech goods able to compete on the world market.[24]

With the Russian government struggling to meet huge needs with a very limited budget, the 1997 budget debate was contentious. Despite this, the air of unanimity among key government and military leaders on preserving the scientific-technical base of high-tech industries seemed to carry the day. Increased funding for scientific-technical and design work was announced as the budget debates drew to a close. The budget figures also made it equally clear that the RFAF's budget problems and long dry spell of new aircraft acquisition would continue. However, the key policy issue for the MOD

*The Russian air force plans to rely on the MiG-29 and SU-27 until at least 2005. The slogan on the wall behind the aircraft reads, "In war, he who has the most powerful equipment and best machines wins." Above, a MiG-29; below, an SU-27.*

However, the key policy issue for the MOD and RFAF during 1996—the preservation of its high-tech capabilities by submitting to current realities in the hope of a brighter future—seemed to have been resolved.

***The quantitative problem is straightforward in a country where the average male life span is down to 57 years.***

Gen-Lt Yuriy Klishin, RFAF deputy commander for weapons, may have best summed up the new funding priority and its motivating factor in an August 1996 interview:

> The greatest danger is not the reduction of deliveries of combat aircraft to units. We rely today on the MiG-29 and SU-27, which are considered to have thirty year service lives and so have another ten years of service left. *The worse* [sic] *possibility is the loss of advanced aviation technology, the total suspension of development of priority items of future aviation* equipment and weaponry including a long-range bomber, fifth generation fighter, a tactical reconnaissance aircraft, and other aircraft with characteristics which, by our estimates, will not be exceeded in the next decade and a half. (Emphasis added)[25]

## Export—The Means to Survival

Considering the events of 1996, it is clear that leaders of Russia's government and military-industrial complex have agreed on a program to preserve priority elements of the military aviation industry. However, simply diverting the RFAF's meager acquisition funds to support scientific research test-and-design work (NIOKR) is not equal to the task. The only substantial source of money for this is foreign sales. One of the so-called nonbudget income sources, foreign sales is, according to RFAF commander Deynekin, the main supplement to MOD and RFAF development funds.[26] In this sense, the government policy outlined above appears to formalize practices which have been developing over the last several years and also seems aimed at funneling more of the benefits of foreign sales to development programs. The policy will mean that large numbers of modern Russian-made fighter aircraft will appear in various world regions during the same period that RFAF fighter purchases are suspended.

The export side of the policy will be supported by a large and effective arms-export complex which developed in post-Soviet Russia well before the coalescence of the policy of supporting future development programs at the expense of current acquisitions. Its activities are sufficiently important to merit the direct attention of President Yeltsin, who takes "strategic decisions on weapons export policy" and handles them through his special assistant for foreign military-industrial cooperation, Boris Kuzik. Executive decisions on export policy are formulated by Kuzik's office in the presidential administration; the government, under Prime Minister Chernomyrdin and First Deputy Prime Minister Aleksey Bol'shakov (who has the industry portfolio); and the State Committee on Military Technical Policy. The Military-Industrial Council, composed of representatives of the major enterprises of Russia's military-industrial complex, reviews applications for export licenses. Weapons-export policy is executed by Rosvooruzhenie, the large and growing state-owned weapons-export corporation, and a handful of other weapons producers licensed for export—most notably the VPK MAPO financial industrial group (FIG), which produces MiG fighters. Despite the apparent success of this system, there has been grumbling over Rosvooruzhenie's 12 percent commission on sales and its apparent disinterest in marketing parts and components. Minister of Defense Industry Pak has indicated he might support expanding the list of enterprises licensed for export of weapons and weapon components.[27] The existing system was put in place in 1994; since

then, Russia's weapons exports have grown from $1.7 billion in that year to $2.7 billion in 1995, with sales for 1996 projected to be $3.3 to 3.5 billion.[28]

***It is now clear that a new policy of key importance to the future of Russia's military aviation industry emerged during 1996.***

Half the 1996 sales were in aviation equipment.[29] In fact, exports have been the one bright spot in the last several years for the struggling military aviation industry. Russian fighters have had a surprising string of successes in a shrinking and highly competitive world aviation market. Asia has been an especially lucrative region for Russian manufacturers. MiG had a major success with its MiG-29 Fulcrum sale to Malaysia in competition against British, French, and US fighters. Sukhoy has had two very significant sales in Asia, first with the sale of some 40 Flankers to China in 1992 and then in 1996 a subsequent sale of another 40 SU-27s and an agreement for licensed construction of the fighters by China.[30] The China deal was followed within the year by India's purchase of 40 of Sukhoy's SU-30MK, reportedly of the latest thrust-vectoring type—if true, the first foreign sale of Sukhoy's thrust-vectoring technology. This sale, according to one report worth $1.8 billion over five years, is also expected to include future production rights for India.[31] Russia's ambitions for foreign sales are not limited to China and India, as made evident by the ubiquitous presence of Russian fighters at every major international air show during 1995–96 from Santiago, Chile, to Seoul, Korea, and culminating with the SU-37's debut at Farnborough. Russian military aviation will try to lengthen its list of buyers in Latin America and has expressed willingness to go head-to-head with US aviation companies in the South Korean market.[32] Leaving no doubt as to Russia's future export policy, Rosvooruzhenie general director Aleksandr Kotelkin has said that Sukhoy aircraft will soon become the most purchased in the world.[33]

## Present Trends and Future Impact

One clear-eyed representative of Russia's military aviation industry said of the sale of SU-27s to China, "It won't save the industry but it will keep the Novosibirsk, Komsomolsk-Na-Amur, and Irkutsk plants and a couple of hundred of their parts suppliers in production for the near term."[34] It does seem highly doubtful that foreign sales alone could sustain a world-class military aviation industry indefinitely. However, it is clear now that Russia's military-industrial policy takes this into account and has a more limited aim for foreign aircraft sales. Defense Industry Minister Pak has made clear that government policy is no longer aimed at preserving the status quo in the VPK but at judiciously trimming away the old and obsolete while targeting limited funds at the "science intensive" industries and research base, such as aviation, which can compete on the world market and which will form the basis of a smaller, modern, automated military. Confirming this view, the RFAF leadership, along with the key design bureaus, has stated its support for channeling profits from foreign sales toward development of future aircraft at the expense of near-term and midterm fighter purchases.

The policy will clearly have a painful impact on large sectors of the military aviation industry. Defense Industry Minister Pak has been fairly explicit in identifying the MiG and Sukhoy design bureaus and their associated production facilities as key players in policy. Their status is made even clearer by the RFAF leadership's repeated statement of priority fighter projects, which lean heavily on Sukhoy products and, to a lesser extent,

on MiG. Other long-familiar names in Russian aviation have not been as clearly singled out for government support and apparently face a difficult future under Pak's "sink or swim" policy. The pain, in human terms, of this industrial contraction will be compounded by economic and cultural factors. People who will be displaced will find few opportunities for new employment in Russia's struggling economy. Also, even in the few cases when there might be opportunity elsewhere, Russian society has not yet adapted to a mobile lifestyle. An oft-repeated phrase describes the mind-set: "Where you are born, there you'll die."

In terms of military aviation, the 10-year plan adopted by the air force military council points toward delay of significant aircraft purchases until 2005. Nevertheless, some new modifications and entirely new aircraft are likely to appear during this period. There will be several reasons for continued development. First, the main stated goal of the policy is to preserve the scientific-technical capability to design and build new aircraft. Second, exports will rely on keeping competitive modern aircraft available for sale. Last, production of new aircraft, even in quantities so small as to be only technology demonstrators, can be used to boost the industry and promote foreign sales. This pattern has been established in the last several years by Sukhoy, with its family of SU-27 variants, and by MiG, with the MiG-29M and MiG-AT trainer.

Obviously, a 10-year near suspension of aircraft purchases indicates that a serious contraction of Russia's aviation industry is in the offing. The process is likely to be accompanied by the continued trend of formations of FIGs uniting design bureaus, their associated production facilities, and a financial partner. In terms of fighter aircraft, the latest statements and marketplace developments point toward a future with Sukhoy and VPK MAPO (MiG) emerging as the government contractors of choice and perhaps the two main combat aircraft designers in a very small circle of competitors. The consolidation trend appeared to be gaining even more momentum in late 1996, when Sukhoy, Tupolev, Beriev, and Yak were reported to be forming a FIG.[35]

In terms of stability, the policy seems to indicate satisfaction with and support for the current structure of the scientific-technical base that supports Russia's aviation industry. The policy indicates that, to the extent possible, the six core aviation research-and-development institutes will be preserved. The policy also aims to tackle perhaps the most difficult long-term problem facing Russia's aviation industry—preserving its scientific-technical cadre.[36]

With the consensus support that developed for the policy during 1996, it is likely that budget priority for the policy can be sustained at some level during the next several years. However, it is clear that the government funds available will remain very limited and that financial support for the program will continue to come primarily from foreign sales. Russia's already aggressive program for marketing weapons abroad, based largely on a powerful profit incentive, has combined with an equally powerful survival instinct. The result is fairly clear in the announced sale of thrust-vectoring SU-30s to India. The most modern series aircraft, what RFAF commander Deynekin has described as generation four-and-one-half fighters, will be sold abroad for the sake of funding development of their successors to equip the RFAF. As the Sukhoy-licensed production deals with China and India show, any nations that hope not only to buy aircraft but also to build their own military aviation industries will find willing sellers in Russia. The policy will therefore help create much sharper competition on the international fighter market, drive the spread of advanced fighter aircraft in several regions of the globe, and accelerate the proliferation of advanced aviation-development technology.

The new government-military policy on Russia's military-industrial complex and its military aviation industry defines the problem, sets a period for its solution, and outlines a method to solve it. The elements for some degree of success are present if govern-

ment stability can be maintained and commitment to the plan can be sustained for the long term. If the new policy is adhered to and if it is the beginning of a hard-nosed reform policy and not just another in a series of unimplemented decrees, Russia will emerge from its economic crisis with a much altered but significant military-aviation industry.

**Notes**

1. Alexander Velovich, "Slow Slow, Quick Quick, Slow—The Sukhoy SU-37 Made a Spectacular Impact," *Flight International,* 18–24 September 1996, 41; and David M. North, "Thrust Vectoring SU-37 Demonstrates Agility," *Aviation Week & Space Technology,* 9 September 1996, 24.

2. G. Drugoveiko, "Budet Li Rossiya Letat' V XXI Veke?" *Vestnik Vozdushnogo Flota* 3, 1995, 2.

3. Gen-Maj N. Anisimov, "Voenniy Byudzhet I Neplatyezhi," *Vestnik Vozdushnogo Flota* 3, 1995, 16.

4. Andey Baranovskiy, "Russian Air Force Left without Planes," *Segodnya,* 30 March 1995, 2.

5. Interview with Gen-Col Viktor Kot, "U Nas Est' Moguchiye Krylya," *Krasnaya Zvezda,* 17 August 1996, 1–3.

6. Pyotr Deynekin, "Rossiya Byla, Est', I Budet Velikoy Aviatsionoy Derzhavoy," *Krasnaya Zvezda,* 19 August 1995, 1–2; idem, "Voenno-Vozdushniye Sily," *Vestnik Vozdushnogo Flota,* 1–2, 1996, 20–21; and idem, "Major Trends and Prospects for Development of Russia's Air Power," *Military Parade,* July–August 1996, 16–17.

7. Zinoviy Pak, "Russian Defense Industry Proceeds with Restructuring," *Aerospace Journal,* September–October 1996, 7–8; and Deynekin, 20–21.

8. A. G. Bratukhin et al., *Aviastroyeniye Rossii* (Moscow: Mashinostoyeniye, 1995), 225.

9. Vitaliy Vitebskiy, "Statistika–VPK v Yanvarye I Fevrale," *Krasnaya Zvezda,* 23 March 1996, 3; and "Statistika–VPK v Avguste," 26 October 1996, 3.

10. Drugoveiko, 2.

11. "Novosti," *Vestnik Vozdushnogo Flota* 5–6, 1995, 6; and "Iz Komsomol'ska-Na-Amure—Televizory 'Goldstar' Sobirayut Aviastroiteli," *Krasnaya Zvezda,* 23 March 1996, 3.

12. Anisimov, 16; and "Novosti," 6.

13. "Novosti," 6.

14. V. E. Aleksandrov et al., "Rol' Aviatsii v Obespechenii Geopoliticheskikh Interesov Rossii," *Voennaya Mysl'* 5, 1996, 17.

15. Tat'yana Burtseva and Marina Motova, "Rossiskiye Ucheniye Vybrosheniy Na Obochiny Reform," *Izvestiye,* 26 December 1996, vii.

16. Russian Ministry of Science, *Problemiy Razvitiya Nauchno-Tekhnicheskogo Kompleksa Rossiskoi Federatsii (Moscow: Ecolink, 1995), 9–12.*

17. Aleksandrov, 20.

18. On the February RFAF Military Council meeting, see "Aviatsiya," *Vestnik Vozdushnogo Flota* 3–4, 1996, 6; and Sergey Babichev, "Pochemy Derzhimsa v Vozdukhe," *Krasnaya Zvezda,* 24 February 1996, 3.

19. "Sovershenstvuetsya Ypravlenie Oboronnoy Promyshlennost'yu," *Krasnaya Zvezda,* 12 May 1996, 1.

20. Vladislav Borodulin, "Gosudarstvo Vser'yoz I Nadolgo Povernulos' Litsom k 'Oboronke'," *Deloviye Lyudi* 67 (July 1996): 24–27; and Zinoviy Pak, "Russia's Defense Industry Proceeds with Restructuring," *Aerospace Journal,* Sept–Oct 1996, 7–8.

21. Borodulin, 24–27; and Zinoviy Pak, "'Oboronka'," Nachinaet Zhit' Tsivilizovannoy Zhizn'yu," *Krasnaya Zvezda,* 18 May 1996, 3.

22. Nikolai Ivanov, "Nametki Plana Reformiy Vooruzhonikh Sil Uzhe Yest'," *Nezavisimaya Gazeta,* 24 July 1996, 2.

23. Vladislav Fadeyev and Valeriy Baberdin, "V Teknologicheskoi Gonke Nel'zya Sxodit' C Distantsii," *Krasnaya Zvezda,* 26 October 1996, 3.

24. Aleksander Bekker, "Yakov Urinson-Voennaya Reforma Zatronet Vsyu Economiku Rossii," *Segodnya,* 17 October 1996, 3; and Vladislav Kuz'michev, "AIzmeneny Parametry Byudzheta–97," *Nezavisimaya Gazeta,* 25 October 1996, 1.

25. Igor Kovalenko, "Na Chyom Bzletim v XXI Vek?" *Armeiski Sbornik* 8 (August 1996): 46.

26. Pyotr Deynekin, "Major Trends and Prospects for Development of Russia's Air Power," *Military Parade,* July–August 1996, 16–17.

27. "Russkoye Oruzhiye Vyrvalos' Na Svobodu," *Kommersant* 7 (5 March 1996): 52–53; and "Dmitriy Maslennikov, "Oboronka Sostyazatetsya C Rosvooruzheniyem," *Nezavisimaya Gazeta,* 14 November 1996, 6.

28. Sergey Tsekhmistrenko, "Diktovat' Usloviya Na Mirovom Rynke Ne Pozvoleno Nikomu," *Deloviye Lyudi* 63, 1996, 28; and "Russkoye Oruzhiye Vyrvalos'," 52–53.

29. "Novosti," 1–2, 41.

30. Sergei Trush, "Prodazha Rossiskogo Oruzhiya Pekiny–Rezoniy I Opaseniya," *Nezavisimaya Gazeta Voennoe Obozreniye,* 25 April 1996, 6.

31. "India Zakupayet Rossiiskiye Samolyotiy Eskadril'yami," Kommersant, 16 November 1996, 4; and "40 Russian SU-30s Lend Youth to Aging IAF Fleet," *Jane's Defence Weekly,* 20 November 1996, 14; Vadim Markushin, "Shirokiy Koridor K Tyoplomu Okeanu," *Krasnaya Zvezda,* 13 August 1996, 3; and "India Stala Pervym Pokupatelem Istrebitelei SU-30MK," *Segodnya,* 2 December 1996, 1.

32. Nikolay Novichkov and Lyubov' Milobanova, "Latinskaya Amerika Mozhet Stat' Perspektivnym Rynkom Dlya Rossiiskoy Voennoy Tekniki," *Izvestiya,* 12 March 1996, ii; "Russia, S. Korea Come Together on Defence," *Jane's Defence Weekly,* 20 November 1996, 13; and Nikolay Novichkov, "Desperate for Sales, Moscow Courts Seoul," *Aviation Week & Space Technology,* 18 November 1996, 31.

33. Aleksandr Kotelkin, "Russia Was, Is, and Will Be Competitor Number One for the U.S. in Arms Sales," *Military Parade,* November–December 1996, 11.

34. Igor' Chernyak, "Sukhoy Ostatok," *Komsomol'skaya Pravda,* 5 March 1996, 3.

35. Leonid Zavarskiy, "Aviapromyshlenniki Reshili Coobrazhat' Vtroyem," *Kommersant,* 6 December 1996, 8.

36. Aleksandr Pel'ts, "Sovet Oboroniy: Prioritetiy Na Buduschee," *Krasnaya Zvezda,* 22 November 1996, 1.