THE RUSSIAN AEROSPACE FORCE

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ABSTRACT
The Russian Air-Space Force (VKS) retains great capabilities for both defensive and offensive operations. Despite difficulties acquiring 5th-generation stealth technology, the VKS has replaced aging Soviet jets with 4++-generation fighters and fighter-bombers such as the Su-34 and Su-35 that will continue to provide it a powerful edge over its immediate neighbours while it develops its space policy and completes the modernization of its other services.

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Since 1 August 2015, the Russian Federation has combined its Air Force with its Space Forces, creating the Aerospace Force[1]. In Russian, this is called the *Vozduzhno-kosmicheskiesily*,[2] or VKS. The 2014 *Military Doctrine of the Russian Federation* defines the main missions and responsibilities of both the air and space dimensions[3] not only as air-delivered degradation of a potential enemy,[4] but also providing timely information of enemy threats[5]. Recognizing that modern warfare involves the entirety of the depth of the country's aerospace,[6] the VKS possesses considerable early warning capacities on the ground, in the air, and in space. The next mission is to provide security to critical civilian and military infrastructure and to prevent attacks coming from air and space spheres[7]. The doctrine specifically requiresimproving the systems available to the VKS during peacetime to fulfil these missions[8].

The importance of the air dimension

Doctrinally, the VKS is tasked with air and space defence, communication systems, intelligence assets, electronic warfare, unmanned aerial vehicles, automatic weapon systems, military transport aviation, and personal protective equipment. These represent a rather large set of tasks, though only air and space defence and long-range military transportation aviation are exclusively in the domain of the VKS. Russia faces numerous diverse threats against which the VKS must prepare. Russian military expert Ruslan Puchow formulates that *Russia has problems almost from all sides. Japan denies ownership of the Kuril Islands, the political system in China is getting more unforeseeable; the withdrawal of*

1 "Russia establishes Aerospace Forces as new armed service – Defense Minister," TASS, 3 August 2015, http://tass.com/russia/812184 [accessed: 10 October 2017].
2 Воздушно-космическиесилы
3 Военнаядоктрина Российской Федерации (Military Doctrine of the Russian Federation), Moscow 26 December 2014, section 15, 32, 35, and 46,http://news.kremlin.ru/media/events/files/41d527556bec8deb3530.pdf [accessed: 17 January 2017].
4 Military Doctrine, Article 32.F.
5 Military Doctrine, Article 32.D.
6 Military Doctrine, Article 15.C.
7 Military Doctrine, Article 33.
8 Military Doctrine, Article 35.C.

the US from Afghanistan could destabilize the entire Central Asia. I do not know how the conflict with Ukraine will progress, and we must take this into account"[9] Consequently, Russia continues its force build-up as it is "'*capabilities, not intentions' which count*" according to the traditional Russian maxim[10]. Whereas other aspects of Russian government spending have been cut due to its current economic woes, defence spending has been preserved from cuts as best as possible, only finally starting to reduce in 2017[11]. Continued defence spending has been especially important for the VKS as its programs are expensive require long-term resources to preserve advantages over other major developing Asian nations. The operational acceptance of China's 5th-generation J-20[12] before Russia's Su-57[13] has mounted concern about Russia's traditional technological edge.

Russian aerospace modernization is a priority within the Armed Forces, which bitterly remember observing NATO air forces decimate the Yugoslavian and Iraqi militaries in the years since the end of the Cold War. Russia has also prioritized the VKS because of the huge firepower capabilities it possesses along with its ability to deliver it across a country as enormous as Russia. Large-scale Russian military modernization began in 2008 under former Defence Minister Anatoly Serdyukov. Some 19tn roubles (400bn Euro; 650 bln USD) were dedicated with the objective of keeping the military budget at 3% of GDP through 2020. Recent economic contraction has simplified this goal with 3.6% of GDP spent in 2016, though this represented a slight reduction from the allocation in 2015[14]. The Russian procurement plan envisions "*100 military use space devices, more than 600 modern aircraft, including 5th generation fighters, over a thousand of helicopters, 28 regiments of air defence weapon system S-400, 38 battalions of air defence weapon system 'Vityaz', and 10 brigades of theatre ballistic missile system Iskander-M*"[15] will be deployed, and all of them meeting the requirements of the future battlefield. To support the modernized of the air fleet, "*about 50 military airfields will be repaired and supplied with modern equipment in Russia by 2020*" as stated by the Commander-in-Chief of the Russian Air Force, Colonel General Viktor Bondarev16. Such developments are causing some concerns in Europe, which is also struggling with funding shortfalls. In Asia, major military powers such as the PRC, India, and Japan are increasing the speed of their military modernization and the US presence is being reinforced. While some Asian nations are deepening their ties with the Kremlin, the general trajectory of military developments in Asia worries the Russian leadership.

[9] Rosja sięga po broń, (Russia grasps for weapon) Rzeczpospolita, Portal BIZTOK.pl, Warsaw 08 October 2014, http://www.biztok.pl/gospodarka/rosja-siega-po-bron_a18031 [accessed: 08 October 2017].

[10] A. Calvo, No Place for China in Russia's New Military Doctrine? 30 December 2014, http://www.academia.edu/Documents/in/Sino-Russian_Relations [accessed: 08 January 2017]. Alex Calvo is a guest professor at Nagoya University in Japan and member of the Center for International Maritime Security.

[11] "Minfinpredlozhilsokratit' byudzhetnyeraskhodyna 2018 god v ramkakhstat'I 'Natsional'nayaoborona','' VPK, 18 September 2017, http://vpk-news.ru/news/38977 [accessed: 10 October 2017].

[12] "China's J-20 fighter jet put into service," Xinhua, 28 September 2017, http://www.chinadaily.com.cn/china/2017-09/28/content_32603456.htm [accessed: 10 October 2017].

[13] "V Minoboronynazvalisrokivnedreniyaseriynykh Su-57 v armiyu," RIA Novosti, 24 August 2017, https://ria.ru/defense_safety/20170824/1501015974.html [accessed: 10 October 2017].

[14] IISS, The Military Balance, 2017, p. 210.

[15] Владимир Путин: Бытьсильными: гарантиинациональнойбезопасностидля России, (Vladimir Putin: to be strong: the guarantee of national security for Russia) Российская газета 20 February 2012, http://www.rg.ru/2012/02/20/putin-armiya.html and also Russia plans $650bn defence spend up to 2020, BBC News, 24 February 2011, http://www.bbc.co.uk/news/world-europe-12567043 [accessed: 14 September 2017].

[16] Russia to upgrade 50 military airfields by 2020, ITAR-TASS 11 August 2012, http://itar-tass.com/en/russia/744503 [accessed: 14 September 2017].

Contemporary Russian Aerospace Force Equipment

The current numbers in the VKS represent a considerable overhaul of the quality of the aircraft deployed, though the overall numbers of combat aircraft continue to decrease overall. In 1991, the Soviet Union featured nearly 5,000 combat aircraft[17]. By 2017, the Russian Federation possesses 1,046[18]. The table below breaks down the numbers for the individual platforms; the numbers in [brackets] represent the generation of the aircraft.

Table 1. VKS aircraft

Type of aircraft	Total number
Bombers	
Tu-22M3/MR Backfire C [4]	63
Tu-95MS6 Bear [4]	48
Tu-95MSM Bear [4+]	12
Tu-160 Blackjack [4]	11
Tu-160M1 Blackjack [4+]	5
Fighters	
MiG-29/UB Fulcrum [4]	70
MiG-31B/BS Foxhound [4]	20
MiG-31BM Foxhound [4+]	60
Su-27 Flanker [4]	50
Su-27UB Flanker [4]	10
Fighter ground attack	
MiG-29SMT Fulcrum [4]	36
MiG-29UBT Fulcrum [4]	6
Su-27SM Flanker [4]	47
Su-27SM3 Flanker [4]	14
Su-27SM2 Flanker [4]	20
Su-30M2 Flanker-C [4]	20
Su-30SM Flanker-C [4+]	62
Su-34 Fullback [4++]	86
Su-35S Flanker [4++]	52
Attack/ground attack	
Su-24M/M2 Fencer [4]	100
Su-25 Frogfoot [4]	40
Su-25SM/SM3Frogfoot [4+]	140
Su-25UB Frogfoot [4]	15
Electronic intelligence	
Il-22 Coot B	32
Intelligence, Surveillance and Reconnaissance (ISR)	
An-30 Clank	4
Su-24MR Fencer	79
Tu-214ON	2
Tu-214R	2
Tankers	
Il-78/Il-78BM Midas	15
Airborne early warning and control (AEW&C)	
A-50/A-50U Mainstay	18
Command and control	
Il-80 Maxdome	4
Il-82	2
Tu-214SR	2
Transport	
An-124 Condor (12); An-22 Cock (4); Il-76MD/MF Candid (118) – heavy	111
An-12/An-12BK Cub- medium	65
An-24 Coke (25); An-26 Curl (80); An-72 Coaler (15); An-140 (5); L-410 (40); Tu-134 Crusty (30); Yak-40 Codling (10) – light	235
Training	
L-39 Albatros (190); Yak-130 Mitten (30)	231

Source: The Military Balance 2017, the International Institute for Strategic Studies, Routledge, London 2017, p. 217.

This table represents a broad standardization of quality across the VKS that had been famously lacking during the Soviet era. Whereas the Soviet Air Force and Air Defence Forces operated a range of aircraft from outdated second-generation Su-15 Flagons to MiG-31 Foxhounds in 1991, today all aircraft are fourth-generation or better. Nevertheless, efforts to reach the stealth requirement of the "fifth-generation" have been long-delayed in Russia, as noted above. This has forced Russian propaganda to extol the equalizing effects of their technological advances without achieving stealth, requiring the invention of the term "4++ generation."[19]

Nevertheless, VKS assets are also notable in how much equipment is still held over

[17] IISS, The Military Balance, 1991, p. 38.
[18] IISS, The Military Balance, 2017, p. 217.
[19] "Equalizer: How a Russian 4th Gen Su-35S Will Be Able to Defeat 5th Gen F-22s," Sputnik, 14 June 2017, https://sputniknews.com/military/201706141054637332-russian-su35s-vs-f22/.

from the Soviet era. The outdated airframes still in operation at the end of the Soviet Union are gone, but fully 394 or 38% of all VKS assets have been in service since the Soviet era, not counting the Soviet-era aircraft that have since been modernized[20]. These include the MiG-29, MiG-31, Su-24, Su-25, and Su-27. New aircraft continue to trickle out to replace the old models, but this process will require much more time. In particular, no plans are in development to replace the aging Su-25 ground-attack aircraft beyond service life extensions.

The VKS also lags behind in terms of tankers and AEW assets. From a Soviet-era total of 79 and 15 respectively, the Russian Federation today possesses only 15 and 18. The enormous size of the Russian Federation poses enormous demands on these assets, compounded by the fact that these particular aircraft are based near Moscow on the edge of the country[21]. Recovering to auxiliary airfields to exercise survivability and deployment are regularly practiced,[22] but economies taken in sustaining current assets have made these assets more vulnerable to attrition in the early phases of a war. Russia is currently developing a successor to the A-50 AEW aircraft in the form of the A-100, but this is only scheduled to begin flight testing in 2017 and is optimistically predicted to enter service with the VKS in 2020[23].

[20] Russian strategic bombers, like US ones, all date from the Cold War, but have been extensively modernized for continued service. Some new Tu-160 Blackjacks, with designs from the end of the Cold War, have also reentered production.

[21] The tankers are based at Dyagilevo in Ryazan Oblast and the AEW aircraft at Ivanovo, both considerably west of the Ural Mountains.

[22] A recent example is "V Khabarovskomkraeletchiki VVO otrabotalidozapravku v vozdukhe," Russian Ministry of Defence, 10 October 2017, http://xn--d1acaykgvdf0he1a.xn--90anlfbebar6i.xn--p1ai/news_page/country/more.htm?id=12145343@egNews [accessed: 11 October 2017].

[23] "Noveyshiy samolyot-razvedchik A-100 podnimetsya v nebo do kontsagoda," VPK, 4 October 2017, http://vpk-news.ru/news/39253 [accessed: 11 October 2017].

Russian heavy transport capacity, by contrast, is relatively abundant. This capability is significant, especially for three areas: the Arctic, Kaliningrad, and Crimea. Russian aircraft also possess the advantage of being domestically produced, enabling simpler maintenance, provision of spare parts, unification of airfields and infrastructure, etc. This allows redeployment of aircraft within the country during combat operations and emergency situations with relative ease. Nevertheless, geography imposes enormous requirements upon the VKS and its aircraft may be insufficient to cover operations from Europe to the Pacific and from the Arctic to Central Asia.

Table 2. VKS helicopters

Attack	
Ka-52A Hokum B	90+
Mi-24D/V/P Hind	100
Mi-28N Havoc B	90+
Mi-35M (Hind-E)	60+
Transport	
Mi-26 Halo - heavy	32
Mi-17 (Mi-8MT) Hip H/Mi-8 Hip – medium	306
Training	
Ka-226 (19); Ansat-U (20)	39

Source: The Military Balance 2017, the International Institute for Strategic Studies, Routledge, London 2017, p. 217.

Russia's large number of attack helicopters is a great advantage. Their capability has been verified in combat and peace support missions across the world. Recent years have seen continued improvements in technology and deployment, increasing their combat efficiency and survivability on the battlefield. Russia'scombat experiencefrom Afghanistan moved helicopters into a central role in its military exercises. As a consequence, helicopters are major force multipliers during Russian joint operations.

In recent years, the VKS has received a considerable number of modern aircraft,

including Su-30SM[24], Su-35S[25], Su-34[26], and MiG-31BM[27], while removing outdated aircraft from service such as the original Su-24[28]. The number of helicopter has also increased by delivering: 46 combat helicopters and as many as 72 assault support helicopters. The modernized Mi-8AMTSh has been deployed in most of the country as a standard transport helicopter for regular exercises and inspections,[29] including an Arctic variant[30]. The VKS is also responsible for high-altitude and long-distance air defence. 88 S-400 launchers have already been introduced[31]. Such the forces will be supported by early warning radars 'Voronezh' located in Kaliningrad, Irkutsk, and Krasnoyarsk[32] plus two radar stations entered operational trail in Yeniseysk and Barnaul. Modernized equipment now comprises 52% of Russian long-range air defence.The long-awaited fifth-generation Su-57 (previously PAK-FA or T-50), long predicted by Dr Carlo Kopp and Peter Goonof *Air Power Australia*to be a 'game changer' remains in development[33]. Though it would give Russia a significant advantage over other Asian nations, China has now already achieved this milestone.

Figure 1. The Sukhoi PAK-FA (T-50) concept

Source: PAK FA (Perspektivnyj Aviacionnyj Kompleks-Frontovoj Aviacii), PAK FA (Future Aviation Complex of Air Force), Hitechweb, http://www.hitechweb.genezis.eu/fightersSF04.htm [accessed: 30 January 2015].

Research comparing the aircraft with the US Air Force's history of stealth development, claimed that *The available evidence demonstrates at this time that a mature production PAK-FA design has the potential to compete with the F-22A Raptor in VLO performance from key aspects, and will outperform the F-22A Raptor aerodynamically and kinematically. Therefore, from a technological strategy perspective, the PAK-FA renders all legacy US fighter aircraft, and the F-35 Lightning II Joint Strike Fighter, strategically irrelevant and non-viable after the PAK-FA achieves IOC in 2015*[34]. Next,

[24] "SMI: Vozdushnoeprosranstvonad Barentsevymmoremprikoetnoviypolk Su-30SM," Flot.com, 6 December 2016, http://flot.com/2016/Северный Флот79/ [accessed: 11 October 2017].

[25] "V Primor'ye Su-35S otstrelyalis' raketami," Russkoyeoruzhie, 14 October 2016, https://rg.ru/2016/10/14/reg-dfo/v-primore-su-35s-otstrelialis-raketami.html [accessed: 11 October 2017].

[26] "Hellducks: Russia's Far East Air Regiment Got 16 Su-34 Strike Fighters in 2016," Sputnik, 24 March 2017, https://sputniknews.com/military/201703241051917242-su-34-russia/[accessed: 11 October 2017].

[27] "V Primor'yeaviatsionniypolkpoluchil tri istrebitelya-perekhvatchika MiG-31BM," RIA Novosti, 30 November 2016, https://ria.ru/defense_safety/20161130/1482463974.html [accessed: 11 October 2017].

[28] "Rossiyskie VVS prostilis' s poslednim Su-24," Noviy Den', 26 September 2016, https://newdaynews.ru/technology/580548.html [accessed: 11 October 2017].

[29] "Bolee 350 edinitssovremennoytekhnikipostupilo v YuVO s nachalagoda," RIA Novosti, 7 October 2016, https://ria.ru/defense_safety/20161007/1478696518.html [accessed: 11 October 2017].

[30] "Tikhookeanskiyflot RF poluchilnavooruzhenienoviyarkticheskiyvertolet," Regnum, 20 February 2017, https://regnum.ru/news/polit/2241048.html [accessed: 11 October 2017].

[31] IISS, The Military Balance, 2017, London, UK, 2017, p. 217.

[32] "Ekspert: RLS v Sibiripomozhet Rossiizakrit' severo-vostochnoenapravlenie, RIA Novosti, 5 October 2016, https://ria.ru/defense_safety/20161005/1478576421.html [accessed: 11 October 2017].

[33] "Su-57/T-50/I-21/PAK FA," Military Russia, 12 August 2017, http://militaryrussia.ru/blog/topic-254.html [accessed: 11 October 2017].

[34] The detailed analysis of the Sukhoi PAK-FA (T-50)'s design, tactical, operational and strategic impact

according to authors, *detailed strategic analysis indicates that the only viable strategic survival strategy now remaining for the United States is to terminate the Joint Strike Fighter program immediately, redirect freed funding to further develop the F-22 Raptor, and employ variants of the F-22 aircraft as the primary fighter aircraft for all United States and Allied TACAIR needs. If the United States does not fundamentally change its planning for the future of tactical air power, the advantage held for decades will be soon lost and American air power will become an artefact of history*[35]. Even if this assessment is questionable, possessing a stealth aircraft will certainly give Russia a considerable technological boost relative to all countries save the United States and China.

The Structure of the Aerospace Forces

The VKS, as noted at the beginning, only entered existence in 2015. The air domain has faced considerable restructuring in post-Soviet Russian history. In the Soviet era, two separate services existed: the Air Force (VVS) and the Air Defence Force (PVOS). Generally, the latter force was favoured over the former as it was viewed as more central to winning ground campaigns. These two forces were combined in 1998 and the resulting force retained its general structure, if of a reduced size, until a series of major reforms between 2009 and 2011 that saw the mass simplification of maintenance. These reforms, part of the larger set of military restructuring led by Defence Minister Serdyukov, replaced the Soviet air armies with aviation bases. These bases generally aimed to simplify the process of maintaining the aircraft in a region and reduce the operating budget.

However, in the reaction led by Serdyukov's successor Sergei Shoigu, this general process has been reversed in name. The air armies, now awkwardly named Air Force and Air Defence Armies, have returned with one for each of Russia's four military districts[36]. The restoration of the armies was intended to restore some degree of operational survivability rather than tying the assets to a single, vulnerable airbase. Nevertheless, the single bases have largely been retained, though deployment to recovery fields for war games is exercised with some frequency[37].

Each air army consists of an aviation division, one or more air defence brigades, helicopter bases, and some additional ground-based communications nodes. The aviation divisions consist of a number of regiments which serve as the logistical support for the individual aircraft, which are in turn arranged in squadrons and flights. The divisions range from having only regiment to as many as seven. The 11th Air Force and Air Defence Army in the Eastern Military District alone has two air divisions, though one of them has only one regiment. These regiments correspond to the air bases of the abortive reforms of 2009-2011.

Helicopters are constituent elements of the VKS, though they are generally treated

are available at: C. Kopp, P. Goon, Assessing the Sukhoi PAK-FA. Sukhoi/KnAAPO T-50/I-21/Article 701 PAK-FA Перспективный Авиационный Комплекс Фронтовой Авиации, the Air Power Australia 15 February 2010, http://www.ausairpower.net/APA-2010-01.html [accessed: 30 January 2017].

[35] Ibid.

[36] The 6th Air Force and Air Defense Army serves the Western Military District from Voronezh, the 4th Army serves the Southern Military District from Rostov-on-Don, the 14th Army serves the Central Military District from Novosibirsk, and the 11th Army serves the Eastern Military District from Khabarovsk.

[37] One recent example as of this writing occurred on 5 October. It is a typical example: "Ekipazhiistrebiteley Su-30SM i MiG-29SMT aviapolka ZVO, dislotsirovannogo v Kurskoyoblasti, provedutpervyesovmestnyevyletynaboevoeprimenenie," Russian Ministry of Defence, http://xn--d1acaykgvdf0he1a.xn--90anlfbebar6i.xn--p1ai/news_page/country/more.htm?id=12144818@egNews [accessed: 11 October 2017].

as ground weapons (or "tanks in the air") by the Russian General Staff in operational planning. Since 2015, these formations have been known as "army aviation brigades"[38]. These generally collocate several types of helicopters, combining both attack and transport vehicles, again reflecting the original purpose of the reforms of simplifying the supply process.

Russia has long relied upon a robust air defence network as a key part of its military structure. A bewildering variety of systems comprise this network and air defence complexes are embedded in the VKS, the airborne forces (VDV), and the ground forces. The VKS operates only the high-altitude and long-distance systems, namely the S-300s and S-400s. Each air defence brigade oversees between one and five regiments of air defence, which in turn administer up to 40 individual systems. Operationally, these regiments could divide into battalions and operate off individual radar complexes. Determining how many radar complexes a particular air defence regiment possesses is a matter of guesswork as these numbers are not published since they would be the targets of an opposing air force in the case of war, but each regiment has at least one.

Complicating the picture a bit further, the VKS also operates a separate two Spetsnaz Armies outside of the commands of the individual military districts. These were acquired in the 2015 merger between the older Russian Air Force (VVS) and the Russian Air-Space Defence Troops. The 1st Spetsnaz Army commands the networks of air defence and ballistic missile defence around the city of Moscow. This consists of three air defence brigades (the 4th, 5th, and 6th) as well as the 9th Ballistic Missile Defence Division. These air defence brigades consist in turn of S-300s and S-400s to be retained for defence of the capital. In recent years, these have received a lot of S-400s in the course of the current modernization effort[39]. The 9th Ballistic Missile Defence Division oversees the A-135 anti-ballistic missile system through five complexes around Moscow, using endoatmospheric nuclear-tipped missiles. This is supported by a network of radars along the periphery of the Russian Federation and in Belarus. The potential successor for the A-135, the highly secretive A-235, has long been under development with the primary intention of eliminating reliance of nuclear weapons to defend Moscow. Video emerged in 2016 to indicate that testing is underway,[40] but there seems no sign that this system will be accepted for operational service in the near future.

The 15th Spetsnaz Army, also based in Moscow, oversees the network of cosmodromes and space-monitoring stations at Baikonur, Plesetsk, and Amur, the latter of which is much delayed in entering active operations, still unable to launch rockets until 2021[41]. It is responsible for delivering and monitoring Russia's military satellites, including its positioning system GLONASS.

In addition to these two armies, the VKS also manages Russian Long Range Aviation (LRA) and Military Transport Aviation (MTA). The former is responsible for delivering airborne strategic strikes, nuclear and

[38] Ramm, Aleksey, "Reformy I rezul'taty," VPK, 22 February 2015, http://vpk-news.ru/articles/28606 [accessed: 12 October 2017].

[39] Sedin, Vasiliy, "Podmoskovniy polkpoluchitnoviy komplekt ZRS S-400 'Triumf'," Federalnoye Agenstvo Novostey, 5 December 2016, https://riafan.ru/581407-podmoskovnyi-polk-poluchit-novyi-komplekt-zrs-s-400-triumf [accessed: 12 October 2017].

[40] Litovkin, Nikolai, "Russia successfully tests new missile for defense system near Moscow," Russia Beyond the Headlines, 23 June 2016, https://www.rbth.com/defence/2016/06/23/russia-successfully-tests-new-missile-for-defense-system-near-moscow_605711 [accessed: 12 October 2017].

[41] "Svoyanosha: pochemu Rossiya perestanetza-puskat' voennye sputnik s Baikonura," VPK, 16 August 2017, http://vpk-news.ru/news/38428 [accessed: 12 October 2017].

otherwise,[42] and bases the vast majority of Russia's long-range bombers[43]. The LRA, previously the 37th Air Force Army, were also transitioned from a division to an air-base structure in the 2009-2011 reforms, namely the 6950th Airbase in Engels and the 6952nd Airbase in Ukrainka. In 2015 and 2016, these two airbases were again reformulated as divisions, the 22nd Guards Heavy Aviation Division in Engels and the 182nd Heavy Aviation Division in Ukrainka,[44] but this again came with few results to the literal structure of the LRA. The 22nd Guards Division has two principle auxiliary airbases and the 182nd Division has one, but these had remained attached to the respective formations even when they were technically still singular airbases. The LRA also oversees the Refuel Aviation Group at Dyagilevo in the west where the Il-78 tankers are based.

The Russian MTA is constituted in the 12th Lift Division and bases the majority of its aircraft near Moscow, though it stretches as far east as Orenburg. These aircraft are tasked with large-scale operational deployments from the strategic rear. They exercise regularly with the VDV[45] and carry out regular resupply missions across difficult resupply corridors, such as over the Baltic Sea around NATO members to Kaliningrad[46]. The MTA also administers Russia's A-50 AEW aircraft in the 144th Aerial Early Warning Regiment in Ivanovo.

It should be noted in closing that the Russian VKS is not structured to be able to fight a war on its own and is designed to support the warfighting capacity of the Russian Federation at large. As such, the VKS is largely designed to repel enemy aerial threats. Only recently has precision strike capability been integrated into the VKS' mission;[47] indeed, the emphasis on precision strikes in the Russian Armed Forces remains in the Ground Forces,[48] though this is beginning to transition[49]. Though the VKS has generally readopted the organizational stylings of the Soviet era, it has not reverted its actual organization. Furthermore, as precision strikes are further developed into Russian operational art, it is distinctly possible that the VKS will again be overhauled in the future around enabling these strikes; should that occur, it seems probable from Russian military history that the VKS will be divided into two operational bodies: one for air defence and one for air strikes.

[42] Demerly, Tom, "Russian Tu-95 'Bear' Bombers Hit Daesh Terrorist Camps with Kh-101 Cruise Missiles in Long Range Strike," The Aviationist, 27 September 2017, https://theaviationist.com/2017/09/27/russian-tu-95-bear-bombers-hit-daesh-terrorist-camps-with-kh-101-cruise-missile-in-long-range-strike/ [accessed: 12 October 2017].

[43] The others are the Tu-142 Bear anti-submarine warfare aircraft developed from the Tu-95 strategic bomber. These long-range aircraft are administered by the naval aviation sections of the Northern and Pacific Fleets.

[44] Gady, Franz-Stefan, "Russia to Set up Heavy Bomber Division to Patrol Japan, Hawaii, and Guam," The Diplomat, 13 October 2016, https://thediplomat.com/2016/10/russia-to-set-up-heavy-bomber-division-to-patrol-japan-hawaii-and-guam/ [accessed: 12 October 2017].

[45] For example, "Desantniki Ul'yanovskogo soedineniya VDV v khodeucheniyaotrabatyvayutunichtozhenieuslovnykh NVF v Orenburgskoyoblasti," Russian Ministry of Defense, 7 September 2017, http://xn--d1acaykgvdf0he1a.xn--90anlfbebar6i.xn--p1ai/news_page/country/more.htm?id=12141259@egNews [accessed: 12 October 2017].

[46] "MinoboronyotvetiloLitvenaobvineniya v narusheniigranitsy," VPK, 19 September 2017, http://vpk-news.ru/news/38986 [accessed: 12 October 2017].

[47] Demerly, Tom, "New MiG-35 'Fulcrum Foxtrot' Demonstrated for Putin and Foreign Market," The Aviationist, 27 January 2017, https://theaviationist.com/2017/01/27/new-mig-35-fulcrum-foxtrot-demonstrated-for-putin-and-foreign-market/ [accessed: 12 October 2017].

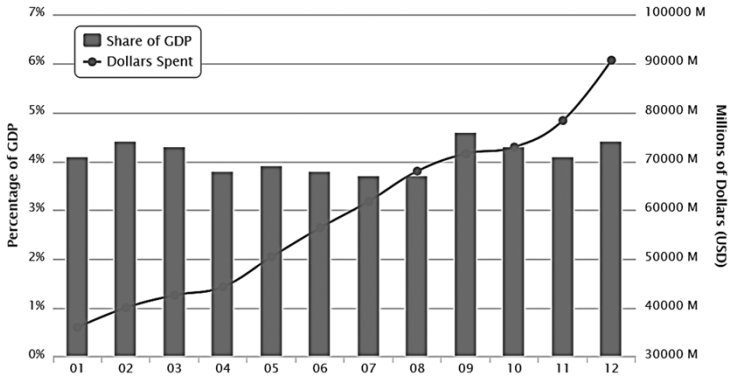
[48] "Vysoko tochnyeboepripasysozdadutdlyabol'shinstvaobraztsovvooruzheniya," Russian Ministry of Defense, 9 October 2017, http://xn--d1acaykgvdf0he1a.xn--90anlfbebar6i.xn--p1ai/news_page/country/more.htm?id=12145334@egNews [accessed: 12 October 2017].

[49] Note in particular the large-scale adoption of UAVs into the Ground Forces to assist in the targeting of heavy artillery. Myers, Nicholas, J., "S-400, New Cruise Missiles, and More: How Russia's Military is Back in a Big Way," The National Interest, 29 September 2017, http://nationalinterest.org/blog/the-buzz/s-400-new-cruise-missiles-more-how-russias-military-back-big-22520 [accessed: 12 October 2017].

The financial support for modernization

In November 2013 President Putin approved the procurement program for military aviation and Air Force was allocated *4,5 trillion RUB (136 bln USD) out of 20 trillion over 10 years* and *further 3 trillion RUB have been earmarked to upgrade and expand defence production facilities*[50]. The defence industry, which is influential in Russia, is important to meet requirements and the export oriented aviation industry is now more nationally focused based on orders from air force and is also more interested toward technological cooperation with international partners to carry promises. India is cooperating within 5th generation fighter concept (50% of costs but only 19% work share) and the Russian Technologies State Corporation signed a deal with China Aerospace Science and Industry Cooperation regarding engine technologies, composite materials, opto-electronics and also C4IRS concepts. Nevertheless, corruption, embargo on military technologies and slow pace of modernization of defence industry are causing that air force program will be delayed.

Figure. 2. Russian Military Budget (2001-2012)



Source: Russian Military Budget, MilitaryBudget.org, http://militarybudget.org/russia/ [accessed: 15 November 2014].

In January 2015 the anti-crisis plan has been introduced envisioning cutting overall budget expenses "*by 5 percent per year over the next three years in order to reach a balanced budget by 2017*".[51]. However, it was announced by the Prime Minister Medvedev that defence expenses will not be affected ensuring continuity of current deployments and modernization of armed forces. Such the message is important for all the services to plan their future status to meet requirements as stated in the 2014 '*Military Doctrine of the Russian Federation*'. According to '*the Military Balance 2014*', the air force reform and development is focused on the three fields as follows: improving command-and-control, modernizing the combat aircraft fleet, and increasing the types and number of air-launched precision guided weaponry[52]. The command and control system, within so called '*Serdyukov military reform*', was promoting the 'air base' (aviabaza) approach, as the basic

[50] E. Kogan, The Russian Aerospace Defense Industry: Modernization Lagging Behind, Military Technology, Vol. XXXVIII, Issue 10, Paderborn 2014, p. 7.

[51] Russia to Cut Budget Costs by 10% in 2015, Defense Expenses Unchanged, Sputnik News 28 January 2015, http://sputniknews.com/business/20150128/1017436243.html [accessed: 29 January 2017].

[52] The Military Balance 2014, op. cit., pp. 162-163.

unit of national air force, to locate multiple types of aircraft at single airfield and he promoted disbanding air armies, divisions and regiments. However, General Bondarev, who took the Air Force Commander position in 2012, based on approval of the new Minister of Defence Shoygu, initiated a shift from aviabaza *towards a 'one airfield, one regiment' formula*[53], meaning also that division and regiment structure was to be re-established.

Within procurement, the Russian Air Force is supposed to receive 55 Sukhoi PAK-FA (T-50)[54] by 2020 from United Aircraft Corporation (UAC) and the first deliveries are planned already for 2016. The PAK-FA concept is still under development but at the end of 2014 *five PAK-FAs have been produced and three more are now being constructed at the Sukhoi Aviation Holding Company Y.A. Gagarin in Komsomolsk-on-Amur*[55]. Next, the intent is to buy estimated 20 pieces of transport aircraft An-124 'Ruslan' produced by Awiastar SP in the Urals along with such the aircraft as a new IL-112, IL-476, modernized IŁ76MD, and An-70. The procurement would have additional positive aspects as it means new contracts from foreign countries directly supporting military industry and national budget; in 2013 Russia sold military equipment to 80 countries at total value of 17,6 bln USD. Moreover, *Russia exported more than $15 billion worth of military products to more than 60 foreign countries in 2014. New contracts worth almost $14 billion were signed as well*[56] as acknowledged by President Putin, during the session of the Commission for Military and Technological Cooperation with foreign countries. Nevertheless, sustaining the expected military expenses will be rather impossible as a result of international sanctions and also as of dropping prices of oil and soon gas, which are major contributor of funds to national budget. It will influence armed forces development plan 2016-2025, being currently under development, and it will require more careful reconsideration of the level of ambitions.

Figure 3. The Sukhoi Su-34 Fullback

Source: J. Sabak, Kolejne bombowce Su-34 gotowe do dostawy, (Further Su-34 bombers ready for delivery), Defense 24, 15 December 2014, photo: D. Chushkin/CC BY-SA 3.0, http://www.defence24.pl/News_kolejne-bombowce-su-34-gotowe-do-dostawy [accessed: 16 December 2017].

Among deliveries of new platforms 18 aircraft Sukhoi Su-34 twin-seat fighter bombers were delivered in 2014 out of 92 contracted. They were deployed to the 559th regiment at Morozovsk in the close vicinity of the Ukrainian border. The last two aircraft were to be delivered at the very end of 2014 or in January 2015. The Su-34 is very modern construction equipped in new B-004 radar and is capable to deliver variety of air-to-air, air-to-ground, anti-radiation, anti-ship and cruise missiles, along with guided bombs. Its ferry range is as many as 4000km and combat radius 1100km; air-refuelling is enhancing such the range and it is closely related to force projection. The useful load of 12tons is providing differing options of armament. The deliveries to air units in next years will continue. Parallel, in coming years export version called Su-32

[53] Ibid., p. 163.

[54] The PAK-FA (T-50) has been discussed in more details in the chapter when examining the Indian Air Force.

[55] N. Novichkov, Russia Plans to receive 55 PAK-FAs by 2020, Jane's Defence Weekly Vol. 52, issue 1, 07 January 2015, p. 14.

[56] Russia exported over $15 billion worth of armaments to over 60 countries in 2014 – Putin, ITAR-TASS 27 January 2015, http://itar-tass.com/en/russia/773700 [accessed: 30 January 2017].

could be offered to foreign countries, including China.

Another important contract is concerning deliveries of Su-35S and the total number will reach 96 units and it will have very positive impact on overall air force capabilities. within *external load of Su-35S can carry up to eight tons of different weapons. The aircraft can use all existing domestic guided and unguided munitions. There is a built-in automatic gun GSH-30-1 30 mm calibre*,[57] so with the 3600 km range and very good flight characteristics will support closing the technological gap between older and future airframes. The 4++ generation means that it is build based on previous generation concepts but it possesses selected characteristics of the future concepts.

According to General Bondarev also Su-25 has been upgraded to Su-25SM3 standard and it includes navigation system GLONASS with *the possibility of programming the endpoint on the map with an accuracy of up to ten meters, which allows the pilot to operate autonomously without ground support services even in zero visibility* and targets could be engaged from the distance more that 7km decreasing exposition for enemy GBAD[58]. It will be armed with precision guided munition enhancing accuracy of strikes against mobile and stationary targets supported by electronic warfare system 'Vitebsk-25'. The new missiles will include Kh-29 air-to-surface guided missiles and KAB-KR aircraft controlled bombs with television guidance. The important is to mention that Kh-29TE version has maximum range 20-30km and is equipped with a passive TV guidance system allowing targeting to *engage visually observed hardened ground and surface targets, such as big railway and highway bridges, industrial installations, concrete runways, aircraft in reinforced concrete shelters, surface vessels displacing up to 10,000 tonnes*[59]. The first upgraded aircraft were deliver in 2013 to the Southern Military District for the flight tests and the industry "*will continue the modernization of Su-25SM3"* as *"there are no aircraft in the world, which can carry such a load of weapons*" as stated by General Bondarev. Such the decision is based on experiences from the conflict in Georgia in 2008 since the Su-25s were not able to engage targets under any weather and lighting conditions.

The current fleet of 16 Tu-160 *Blackjack* strategic bombers is also under upgrade processes based on 103.5 mln USD worth contract between Russian Defence Ministry and Tupolev Design Bureau and Kazan Aircraft Plant. Initially it has been focused on three aircraft and first of them was re-flown in the middle of November 2014, but details about results were not released; however it is assumed that at least radar and navigation equipment has been upgraded. All the upgraded Tu-160s will be delivered back to 121st Heavy Bomber Aviation Regiment located in 6950th Aviation Base in Engels by 2020. Old fashioned Tu-95MS are also to be modernized and it is supposed to include 43 aircraft allowing them to stay in the service even up to 2035. They will receive new avionics, navigation system based on GLONASS and additional arming options including new Raduga Ch-101 cruise missile or its nuclear-armed variant, Ch-102. The new missile are important factor as they *will be able to hit targets with an accuracy of just 30 feet (10 meters) at*

[57] Su-35S – Waiting for a New Contract, 11 May 2014, Defence Russia WordPress.com https://defencerussia.wordpress.com/category/precision-weapon/[accessed: 24 February 2017].

[58] Russian Air Force is to continue modernization of Su-25SM3, Engineeringrussia 16 June 2014, https://engineeringrussia.wordpress.com/2014/06/16/russian-air-force-is-to-continue-modernization-of-su-25sm3/[accessed: 24 February 2017].

[59] Kh-29TE and Kh-29L Air-to-Surface missiles, Tactical Missiles Corporation JSC Website, http://eng.ktrv.ru/production_eng/323/513/514/ [accessed: 24 February 2017].

ranges of up to 6,000 miles (10,000 km), giving Long-Range Aviation its first precision-strike long-range weapon[60]. It will enable to strike targets from the safe distance with very high precision especially as Ch-101/102 missiles possess some stealth characteristics. Also long-range strategic and maritime strike bomber Tu-22M3 will be modernized and before 2020 some 30 aircraft will receive new avionics based on advanced electronic system SVP-24-22 to automatically engage targets, an advanced navigation system SNRS-24 and LCD screens[61]. Moreover, it will be modified to carry large, long-range anti-ship missile Kh-32 with operational range 600km. In the future the current but aging fleet of bombers is supposed to be replaced by the PAK-DA[62], a next-generation stealth strategic bomber being under development as well by the Tupolev Design Bureau[63]. However, the bomber will not enter service in next 10 years, so modernisation of current bombers is just required to preserve strategic attack capabilities being an important element of nuclear deterrence. There has been also a contract signed with UAC to initiate designing Il-112V concept of future military transport aircraft both for national use and export.

The country is recognizing the importance of the Airborne Warning and Control Systems (AWACS) as currently new platform A-100 has been designed using upgraded version of the Il-76MD-90A. The first aircraft was delivered at the end of November 2014 to the Taganrog Design Bureau to equip it with specialized devices including new Vega '*Premier'* AESA (Active Electronically Scanned Array) radar. The A-100, with more powerful PS90A-76 turbofans and other enhancements, will replace in the future the current fleet of 20 active duty Beriev A-50U '*Mainstay*' AWACS aircraft. However, the program could be delayed or downgraded based on technological sanctions Russia suffers as a side-effect after annexation of Crimea[64].

Summary

The progress of modernization is questionable, as the industry is suffering as of lack of modernization to meet both quality of products and required quantities of equipment. It could cause that some deliveries will be fulfilled during next armaments programs 2016-2025 causing that required level of possessing 70% of modern equipment by 2020 will not be achieved. Next, the Ukrainian crisis has stopped some deliveries, which are vital for air force, for example engines for most Russian military helicopters, R-27 medium-range air-to-air missiles and other critical components. In that context, an article in the Financial Times discussed military complex and quoting the Royal United Services Institute relations recognized a possible procurement related scenario, as *invasion of Ukraine by Russia to capture production of military equipment would be 'a very 19th-century way of looking at a 21st-century relationship*[65]. The political situation is fragile so it is rather unlikely for Ukrainian companies to continue selling military hardware as of political reasons; it will cause them rather to look for partners

[60] Russian Air Force to Get New Cruise Missile in 2013, Military & Intelligence 26 September 2012, http://sputniknews.com/military/20120926/176233341.html [accessed: 30 January 2017].

[61] „Niedźwiedzie" wiecznie żywe. Rosja modernizuje bombowce strategiczne ('Bears' always alive. Russia modernizes strategic bombers), Defence 24 22 February 2015, http://www.defence24.pl/Analiza_niedzwiedzie-wiecznie-zywe-rosja-modernizuje-bombowce-strategiczne [accessed: 24 February 2017].

[62] In Russian ПАК ДА (перспективный авиационный комплекс дальней авиации).

[63] Russia's First Upgraded Tu-160 Flown, Air Force Monthly January 2015, p. 25.

[64] First Il-76MD-90A Delivered to Beriev for AWACS Conversion, Air Force Monthly January 2015, p. 25.

[65] Read in details: J. Cienski, Russia's reliance on Ukraine for military hardware raises fears, the Financial Times 20 April 2014, http://www.ft.com/cms/s/0/9cc89022-c87b-11e3-a7a1-00144feabdc0.html#axzz3PIe6EUEi [accessed: 12 January 2017].

in the West, Africa, Middle East and Asia, which are still using Russian -build military equipment.

Russia is also putting a strong effort to develop the fleet of UAVs including also heavy combat and reconnaissance systems, next to existing already number of reconnaissance platforms. The modernization of the bombers fleet is important as they important part of the nuclear deterrence being a part of Russian strategy toward external threats. The bombers have been extensively used lately to for overflights in the vicinity of air space borders of European nations to show strike capabilities. Merging them with new cruise missiles, like nuclear-armed Raduga Ch-102, is extending the range of attack as it could be conducted out of range of air defense systems. Russian Air Forces are and will be the important component of any joint operations of armed forces and its growing capabilities ate toward meeting requirements of contemporary battlefields. The service has many advantages when compared with other Asian, but also the West nations, being important element of deterrence including nuclear dimension. The forces are constantly trained and upgraded so they have still been significant contributor of extending power projection reach. The challenge is continuity of budgeting and later of sustaining such the desired level of high-tech systems and it could be disrupted in the long-term.

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