

The Russian Air Campaign in Syria

A Preliminary Analysis

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A handwritten signature in black ink that reads "Ken G. Gause".

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Abstract

In this CNA Occasional Paper, Anton Lavrov, a noted Russian expert on military air operations, examines the successes and failures of Russia's air operation in Syria. He identifies the key structural changes and capability upgrades that made the operation possible. The operation allowed the Russian military to test new equipment and to rotate personnel through the theater of operations in order to gain battle experience. As it continued, the force became more effective, as its leaders learned how to operate in a battle environment for the first time in almost 30 years. The Russian Aerospace Forces' actions in the conflict increased the combat effectiveness of Russia's small contingent of forces in Syria and allowed government forces to attain success on the ground. The conduct of the operation can be used as a means of understanding the capabilities and tactics that the force may be expected to use in future operations.

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Introduction

During the "New Look" military reform of the Russian armed forces, the development of Russian military aviation became a priority. In addition to vast structural changes, its aircraft inventory was significantly updated. From 2008 to 2015, the air force received more than 350 new combat planes and about 1,000 new helicopters, as well as hundreds of air defense systems.¹

Russia's intervention in the Syrian civil war was the first military operation in which these tectonic changes were tested. The observation of this lengthy military campaign made it possible to understand in detail the current capabilities of the Russian Aerospace Forces, based on their equipment, armaments, and tactics, and thereby to assess the success of the reform.

Campaign preparation

The agreement between Russia and Syria on the deployment of a Russian aviation group to Khmeimim was secretly signed on August 26, 2015, in Damascus.² On September 7, 2015,³ the first ground-based engineering units arrived at Khmeimim airfield in Syrian Latakia and began preparations for the deployment of military aircraft. On September 18, four Su-30SM fighter aircraft from Domna air base in Siberia landed there. The next day, a squadron of 12 modernized Su-25SMs arrived. In the next two weeks 12 Su-24M and four advanced Su-34 bombers joined them. In addition to these 32 aircraft, several military transport and reconnaissance aircraft were located at the base.

¹ "Deliveries of combat aircraft to the Armed Forces of Russia in 2016," BMPD, Jan. 5, 2018, <https://bmpd.livejournal.com/3036294.html>.

² Agreement text on official law information portal, <http://publication.pravo.gov.ru/Document/View/0001201601140019>.

³ "The military first told how they built an air base in Syria from the scratch," Zvezda TV, June 10, 2016, <https://tvzvezda.ru/news/forces/content/201706100839-damx.htm>.

IL-76s and An-124s from the Military Transport Aviation Command made more than 280 flights to bring necessary supplies to Khmeimim.⁴ Included in the 13,750 tons of their cargo were about 20 transport and attack helicopters. The few obsolete Mi-24Ps were initially used exclusively for patrolling the vicinity of the Russian air base, which was only 24 kilometers from the front line.

The Russian Aerospace Forces had many assets but little real combat experience in modern warfare. The active use of airplanes in the Second Chechen War ended in 2000. During the five-day conflict in 2008, the air force carried out fewer than 200 air strikes. Since then, the Russian Aerospace Forces have received about 1,000 new and modernized aircraft and helicopters but had no experience operating them and little understanding of the new capabilities. In addition, there were very few precision weapons.

The Russian military had high hopes for the SVP-24 Gefest—the new digital sighting and navigation system for all modernized Su-24s and Su-25s sent to Syria (it was installed on long-range Tu-22M3 bombers as well). The military stated that with these technologies old aircraft would be able to use unguided bombs with a degree of accuracy comparable to that of guided weapons.⁵

First attacks

The first month of the campaign in Syria showed that Russia would not limit itself to striking only ISIS, Al-Nusra, and other internationally recognized terrorist groups. According to independent estimates, about 80 percent of the air strikes in October were carried out on other armed opponents of Assad,⁶ including CIA-vetted groups of rebels, such as the Free Syrian Army, that had received TOW missiles from the United States.⁷ Later, depending on the strategic situation, Russian aviation continued to shift the focus of its efforts from one opponent of Assad to another.

⁴ "Russian aviation delivers 14,000 tons of cargo to Khmeimim airfield in Syria," RIA Novosty, Jan. 9, 2016, https://ria.ru/syria_mission/20160109/1356691910.html.

⁵ "The new "Gefest" system allows the use of unguided ammunition as a precision weapon," TASS News Agency, Aug. 25, 2017, <http://tass.ru/armiya-i-opk/4507779>.

⁶ "Four-fifths of Russia's Syria strikes don't target Islamic State: Reuters analysis," Reuters, Oct. 21, 2015, <https://www.reuters.com/article/us-mideast-crisis-syria-russia-strikes/four-fifths-of-russias-syria-strikes-dont-target-islamic-state-reuters-analysis-idUSKCN0SF24L20151021>.

⁷ "Official: Russia 'deliberately targeting' US-backed forces in Syria," Fox News, Oct. 14, 2015, <http://www.foxnews.com/politics/2015/10/14/official-russia-deliberately-targeting-us-backed-forces-in-syria-dozens-killed.html>.

The updated Aerospace Forces did not have real combat experience. Faced with a real enemy, they gradually changed their old tactics as they adapted to the battlefield and to the capabilities of new aircraft. But from the start, it was clear that unguided weapons would be a mainstay of its arsenal.

The very first videos of Russian air strikes in Syria made public by the Russian Ministry of Defense demonstrated low accuracy when using unguided weapons.⁸ Unlike in training and exercises, in Syria aircraft were prohibited from descending below 4 kilometers. No sighting device can provide accuracy of more than over a few dozen meters, given such height.

These videos show the initial tactics of Russian aviation—dropping several unguided HE-fragmentation bombs, usually two to four bombs weighing 250 or 500 kilograms,⁹ simultaneously.¹⁰

In the first days, the number of declared targets was usually half the number of sorties. This indicates the typical textbook Russian tactics—strikes by pairs of aircraft. In October, the above indicators became equal. The air force switched to single aircraft raids in order to increase the number of targets hit per day. By the end of the year, the ratio had changed even more. From then on, three to four targets were hit during one sortie. This represents a significant change in tactics during the operation. The strike aircraft began to receive much more complex flight plans.

At the campaign's initial stage, Su-25SM attack aircraft were mostly used in the non-traditional role of light bombers. As noted above, they usually flew more than 4 kilometers high, carried four HE-fragmentation bombs weighing 250 kilograms, and used "one unguided bomb on one target" tactics that relied on their new sighting devices. The strike results were monitored by drones in real time and, if necessary, the strike was repeated by the same aircraft in five to six minutes.¹¹ Such close interaction between aviation and drones was completely new for Russian aviation. The same tactic was used by Su-24Ms, but their bomb load was heavier—up to four 500-kg bombs or RBK cluster bombs. Even the use of old guided missiles such as the Kh-25 and Kh-29 remained very sparse.

⁸ "Russian aviation performed high-accuracy strikes against international terrorist organization ISIS," Russian MOD, Sep. 30, 2015, <https://youtu.be/hiA0JUdWR6M>.

⁹ "At night, Russian aviation struck four sites of the "Islamic state" in Syria," Russian Ministry of Defense website, Oct. 1, 2017, <http://syria.mil.ru/news/more.htm?id=12059333>.

¹⁰ "Russian Aerospace Forces engaged another four ISIS facilities in Syria this night," Russian MOD, Oct. 1, 2015, https://youtu.be/s_h8YISqJRQ.

¹¹ "Su-25s in action in Syria," BMPD blog, Mar. 16, 2017, <https://bmpd.livejournal.com/2495624.html>.

Due to lack of air threats, from late October on, Su-30SM fighters were also used as bombers, carrying 250-kg and 500-kg unguided bombs.

Even in the carefully selected videos that Russian Ministry of Defense public affairs office demonstrated at the start of the campaign, the attacks were made mostly using unguided bombs. Only 1 in 15 videos clearly stated the use of guided bombs.¹² Therefore, the October 7 attack by the Caspian fleet ships with 26 cruise missiles was quite a major event, with symbolic and practical importance. It may well be that the fleet used more precision weapons in this one salvo than the Russian Air Force (RuAF) had used during the entire first week of the campaign.

Initially, only the Su-34 is referred to as aircraft equipped with high-precision weapons, which can be used from altitudes over 5 kilometers.¹³ During the first campaign stage, KAB-500S GLONASS satellite-guided bombs were mainly used. A few years earlier, the Russian Defense Ministry had refused to buy them, finding them too expensive. Therefore, in Syria a lower-accuracy export modification¹⁴ may have been used. At the beginning of the campaign, RuAF did not have sizable KAB-500S reserves, and the System for Differential Correction and Monitoring (SDCM) was probably not deployed in Syria yet. This system can significantly increase the accuracy of GLONASS-using weapons.

Initially, most attacked targets were planned well in advance. Information on their coordinates was received by the Russian Ministry of Defense from both the Syrian side and Russia's own reconnaissance—ground, air, and satellite.

In just the first month, the Russian group of 32 combat aircraft carried out 1,292 combat missions on 1,623 targets.¹⁵ From the very beginning, the official press reports declared each strike successful, and any target hit by even a close explosion of the single bomb was claimed as “destroyed.” Thus, the number of officially destroyed terrorist targets was rapidly inflated to fantastic totals.

¹² “Strike on command centers of ISIS with guided bombs,” Russian Ministry of Defense website, Oct. 4, 2015, <http://syria.mil.ru/video/more.htm?id=5962>.

¹³ “Large IED factory destroyed in Idlib by Su-25s”, Russian Ministry of Defense website, Oct. 2, 2015, <http://syria.mil.ru/news/more.htm?id=12059507>.

¹⁴ “Patent for self-guided stabilized bomb,” ak_12 blog, Oct. 10, 2015, <https://ak-12.livejournal.com/27756.html>.

¹⁵ “Russian air group in Syria has destroyed more than 1,600 objects of terrorists in Syria in a month,” Interfax, Oct. 30, 2015, <http://www.interfax.ru/russia/476571>.

The Russian military has denied and continues to deny any damage to civilians and civilian objects.¹⁶ But these statements cannot be true: with the predominant use of unguided weapons in urban areas, significant collateral damage is inevitable.

"Retaliation campaign" against ISIS

The campaign began quite slowly. Then, a month and a half later, on October 31, came the largest ISIS terrorist attack against Russian citizens yet: Russian Metrojet Flight 9268, carrying tourists from Egypt to St. Petersburg, crashed over the Sinai Peninsula due to an ISIS explosive device on board. Two hundred twenty-four people died, making it the largest catastrophe in the history of the Russian civil aviation.¹⁷ As a result of the attack, the campaign in Syria surged unexpectedly: the number of sorties per day increased two to three times.

On November 3, even before the public announcement of the preliminary investigation results, the RuAF significantly increased the strike intensity of ISIS objects. On that day alone, it made more than 20 attacks on ISIS facilities in the "Caliphate capital" of Rakka. Heavy bombs were used, including KAB-1500Ls with laser guidance.

The air support for the Syrian troops fighting against ISIS also became more robust. For the first time, Russian aviation was involved in attacks not on rear targets and infrastructure facilities, but on defensive positions on the front line in close coordination with ground troops. Against ISIS, Su-25SMs were used in a more "traditional" way—in direct attacks, using unguided rockets and guns.

Five or six MI-24P attack helicopters were transferred from Khmeimim to the government's heavily fortified Tiyas Military Air Base (T4), and took part in attacks against ISIS in the region of Palmyra, in the heart of Syrian desert, acting as close air support (CAS).

With active support from RuAF, the elite Syrian "Tiger Forces" managed to achieve their first major and significant victory since the beginning of the Russian air campaign. On November 10, they managed to lift the three-year-long ISIS siege of

¹⁶ "Russia Has Denied Carrying Out Air Strikes That Killed Dozens of Civilians in Syria," *TIME*, Nov. 28, 2017, <http://time.com/5038762/russia-denies-airstrike-syria/>.

¹⁷ "Egypt plane crash: Russia says jet was bombed in terror attack," *The Guardian*, Nov. 17, 2015, <https://www.theguardian.com/world/2015/nov/17/egypt-plane-crash-bomb-jet-russia-security-service>.

Kveiris air base. This became the first step towards subsequent restoration of government control over Aleppo and its surroundings.

On the evening of November 16, 2015, President Putin made the official announcement that the crash of Metrojet Flight 9268 had been caused by an ISIS terrorist attack. A new phase of the Syria campaign began—an unofficial four-day-long "retaliation campaign." On November 17, the intensity of tactical aviation air strikes spiked to the maximum possible for 32 aircraft. They performed 98-100 sorties daily for four days. For the first time, strategic aviation operating from Russian territory was additionally involved, in order to increase strike potential.

At 5 a.m. on November 17, twelve long-range Tu-22M3 bombers from Mozdok air base in the Russian North Ossetia staged strikes at ISIS facilities near Rakka and Deir-ez-Zor, dropping twelve 500-kilogram bombs each. In the evening, the same planes carried out a second raid. During the next three days, a dozen Tu-22M3s continued to carry out two sorties per day out to a combat radius of over 2,000 kilometers. Later, Tu-22M3s over Syria become a sure sign of Russia's peak aviation activity and most fierce ground battles. But the intensity record was set on November 17-20, 2015.

The first "trial by fire" for the Tu-95MS and Tu-160 strategic bombers was on November 17. These bombers had never been used in real combat. After taking off from the air base and traveling over 6,500 kilometers, the two Tu-160s fired 16 X-101 missiles and the three Tu-95MS-8s fired several X-555¹⁸ missiles. For both types of cruise missiles, Syria was the first combat test.

Most of the Russian air strikes were transferred from targeting the opposition and Islamist groups to targeting ISIS. The main problem was that it was difficult to annihilate ISIS's small mobile detachments from the air. ISIS did not control large cities and had no large stationary facilities. Only the Syrian oil industry, which was under ISIS control in the captured desert areas, was vulnerable.

For the first time since the beginning of the campaign, Russian planes were sent to "free hunt" for terrorists in the desert. Instead of undertaking pre-planned missions, they were allowed to search assembly points of oil carrier trucks that transported oil from the oilfields controlled by ISIS and immediately attack them.

On November 20, the final day of the operation, eight Su-34s also joined air strikes and made 16 flights to Syria from the Krymsk air base. This allowed them to increase

¹⁸ "Long-range aircraft of the Russian Aerospace Forces carried out strikes with air-based cruise missiles on the ISIS terrorist objects within the air operation," Russian Ministry of Defense website, Nov. 17, 2015, http://eng.mil.ru/en/news_page/country/more.htm?id=12066124.

the number of sorties per day, to the still unbeaten record of 143. On the same day, “the next stage of the campaign” was announced. In fact, this meant a decrease of activity and a return to the normal number of about 40 sorties per day. In just four days of the “retaliation campaign,” the planes carried out 522 sorties on 826 targets. They used 85 air-based cruise missiles, 18 sea-based missiles, and 1,400 tons of air bombs.

The operation did not lead to changes in the front line but it did cause significant damage to ISIS oil facilities. Simultaneously with Russia’s “retaliation campaign,” the U.S. started attacks on ISIS oil trucks, during Operation Tidal Wave II.¹⁹ This move was in retaliation for the November 13, 2015, Paris terror attack and was not coordinated with Russia. But to guarantee safety of air operations, the deconfliction line between Russian and U.S. air forces was used, for the first time.²⁰

The destruction of oil infrastructure and hundreds and then thousands of oil carriers by Russian and American aircraft was deemed as a very effective measure against the terror group. As early as December 2016, ISIS was forced to cut militants’ wages in half.²¹

Finding the targets for such a large number of sorties became a serious challenge for the Russian military. Even more difficult was to process and double-check the information about potential targets received from different sources. The highest number of reliably confirmed errors in identification were made during this period. For example, on November 26, the Ministry of Defense published video strikes on the “militant tent camp.”²² In fact, it was a granary, with stacks of grain sacks covered with sailcloth. This was enough to cause several Russian bombers to raid with high-explosive bombs.

¹⁹ “U.S. Warplanes Strike ISIS Oil Trucks in Syria,” *New York Times*, Nov. 16, 2016, <https://www.nytimes.com/2015/11/17/world/middleeast/us-strikes-syria-oil.html>.

²⁰ “Department of Defense Press Briefing by Col. Warren via DVIDS from Baghdad, Iraq,” Nov. 18, 2015, <https://www.defense.gov/News/Transcripts/Transcript-View/Article/630393/department-of-defense-press-briefing-by-col-warren-via-dvids-from-baghdad-iraq/>.

²¹ “ISIS cuts fighters’ salaries due to ‘exceptional circumstances,’” Jan. 20, 2016, <https://www.cnn.com/2016/01/20/isis-cuts-fighters-salaries-due-to-exceptional-circumstances.html>.

²² “Video of Russian aviation strike on the base camp of militants in RAKKA,” Russian Ministry of Defense YouTube channel, Nov. 26, 2015, <https://youtu.be/mp9-7ncYck8>.

The water treatment plant near Aleppo occupied by ISIS was erroneously classified as an oil refinery, and its tanks were bombed with guided missiles.²³ As a result, both the government-controlled areas and the occupied territories experience water problems.²⁴

Conflict with Turkey

Immediately after the "retaliation campaign," the Russian Aerospace Forces experienced a new problem that significantly changed the whole nature of the Russian operation. On November 24, a Turkish F-16 shot down a Russian Su-24M, which briefly violated Turkey's airspace during an attack in the Latakia border region.

The incident put Russia and Turkey on the verge of armed conflict. Russia did not exclude the possibility that the confrontation might escalate, that Turkey might launch strikes at the Russian air base in Syria, or of an attempt to forcefully establish a no-fly zone over parts of Syria. Russia's immediate reaction was to strengthen its air defense in Syria. The day after the incident, President Putin approved the deployment of the cutting-edge C-400 (SA-21 Growler) long-range SAM system. On November 26, the first launchers began arriving in Khmeimim on heavy AN-124 transport planes.²⁵

The aircraft based in Syria began to receive more-advanced air-to-air missiles. In addition to the obsolete AA-10 Alamo that was used originally, Khmeimim fighters were equipped with RVV-SD. After the incident, the Su-34 bombers, which were modifications of the Su-27, began to be equipped with short- and medium-range air-to-air missiles for self-defense.²⁶

Although tensions and the odds of a direct conflict soon diminished, the long-term consequences of the incident included a rethinking of the Russian Khmeimim group. Initially, Russia had tried to position itself as a useful ally for the U.S., in a fight

²³ "Air strike on the oil refinery near the settlement HAVSA-KEBIR," Russian Ministry of Defense YouTube channel, Dec. 2, 2015, https://youtu.be/vKbA_g-4zEE.

²⁴ "Syria Feature: Russia's Bombed "ISIS Oil Refinery" is a Vital Water Treatment Plant," *EA Worldview*, Dec. 4, 2015, <http://eaworldview.com/2015/12/syria-feature-russias-bombed-isis-oil-refinery-is-a-vital-water-treatment-plant/>.

²⁵ "Video of the S-400 surface-to-air missile system in Syria," *Zvezda TV*, Nov. 26, 2015, https://tvzvezda.ru/news/vstrane_i_mire/content/201511261535-m6hb.htm.

²⁶ "Russian Su-34s in Syria began to equip with air-to-air missiles," *RIA Novosti*, Dec. 2, 2015, https://ria.ru/syria_mission/20151130/1332865115.html.

against a common enemy, but it had not expected direct military confrontation. Now the environment was regarded as hostile. This changed the aircraft escort procedures and increased the number and vigilance of air defense systems. The fighters were used mainly for conducting air patrol and escorting attack aircraft, not for bombing.

The early success of the Syrian army

After December 2015, the RuAF efforts focused on anti-ISIS actions in Palmyra and Rakka, as well as strikes against the Free Syrian Army and pro-Turkish rebels' operations in the mountainous regions of Latakia. On December 6, the group was enlarged for the first time: four additional Su-34s flew to Khmeimim air base from Russia. Four more Su-24M bombers came too, which increased their number in Syria to 16. Also in December, the new Mi-35M strike helicopters were first spotted over Khmeimim. Compared to the already existing Mi-24P, their night performance was significantly better. On January 30, it was reported that four more brand-new Su-35S multipurpose fighter aircraft were sent to Syria. This was the trial by fire for the new plane.²⁷ The active radar homing AA missile (an improved AA-12) was first used on these Su-35Ss.

For 60 days, from December 24, 2015, to February 22, 2016, the air group conducted about 6,500 sorties in Syria—on average, 107 flights per day—which is at least 50 percent more than the group had conducted before the increase in numbers of aircraft.²⁸

While all airplanes stayed in Khmeimim, small groups of Russian helicopters were spotted on main airfields used by the Syrian army, most often at Shayrat air base.²⁹ A typical group consisted of four Mi-24P/Mi-35M attack helicopters and one or two Mi-8 transport aircraft. Apparently, these were combat search and rescue teams for the evacuation of downed pilots. During this period, Russian combat helicopters were still rarely seen in military operations.

Improving the interaction with the elite Syrian troops and attaching more Russian forward air controllers to them continued to display good results. In late January 2016, the militants' front was battered in northern Latakia: Salma, a fortress that had

²⁷ "Four Su-35S fighters were transferred to Syria," BMPD blog, Jan. 31, 2016, <http://bmpd.livejournal.com/1710222.html>.

²⁸ "Guardians of the sky of the Motherland," Red Star website, Feb. 19, 2016, <http://www.redstar.ru/index.php/newspaper/item/27839-strazhi-neba-otchizny>.

²⁹ "Helicopter strike force in Syria: Mi-35M, Mi-24P, Mi-17" @bm21_grad on Twitter, https://twitter.com/bm21_grad/status/700000307183489024.

remained unapproachable for a long time, was retaken, as was strategic Rabiah. Quelling resistance of pro-Turkish rebels in Latakia's border regions with Turkey was to some extent "revenge" for downing the Russian bomber. But it also had a practical result—the front line was moved farther from the Russian air base. The militants no longer could threaten it with "Grad" type missiles, because of these missiles limited range.

The first major success with strategic consequences was the government de-blockade of Nubel and Az-Zahra towns in northern Aleppo. For four years, tens of thousands of residents had been surrounded by Islamists and supplied by air. All attempts made by the government army to free them failed and resulted in heavy losses.

In early February 2016, Russian aviation focused on a narrow sector of the front in this area to support a new offensive by government forces. According to the insurgents, over 100 air strikes were carried out there in just two days. The defense was broken by aviation, and this time the government forces reached the besieged towns without much effort. The counterattacks were also repulsed with strong Russian air support. The nearest and most heavily used supply route between Turkey and the militants in Aleppo city was cut. The situation for them became much more complicated.³⁰

At the same time, at most battle areas, including the suburbs of Damascus and the province of Homs, attacks by government forces quickly failed. There was weaker air support from the Russian Aerospace Forces in these areas, and lower-quality troops were involved. This contrast with northern Aleppo highlights the significance of the role that Russian Aerospace Forces played in changing the situation on the ground in Syria in areas where they were most used.

The first aviation withdrawal

The success of Assad's forces strengthened the government's position in its negotiations with the opposition. Russia tried to become a peacekeeper and mediator of the process. On February 24, 2016, the Center for the Reconciliation of the Warring Parties began to operate at Khmeimim air base, which became the key point

³⁰ "Syria civil war: President Assad's forces cut off last rebel supply line to Aleppo raising fears of huge humanitarian crisis," *Independent*, Feb. 3, 2016, <http://www.independent.co.uk/news/world/middle-east/syria-civil-war-assad-s-forces-cut-off-last-rebel-supply-line-to-aleppo-raising-fears-of-huge-a6851776.html>

for achieving local reconciliation agreements with settlements and small-armed detachments of Assad's opponents.³¹

On February 27, 2016, it was announced that Russian aviation flights would cease, to support the armistice. This was the first and only day of air force inaction in Syria. Like the previous armistice, it did not last long, as fighting with the opposition continued, and the ISIS and An-Nusra terrorists did not fall under the armistice. Nevertheless, the average frequency of flights per day decreased noticeably.

The success achieved was still weak. Therefore, Vladimir Putin's sudden announcement on March 14, 2016, on withdrawal of the Russian faction took most observers by surprise. Apparently, it was caused by a true desire to reduce the Russian involvement in the conflict and to avoid mission creep.

In a few days, all 12 Su-25SMs, one squadron of four Su-24Ms and a squadron of Su-34s returned to Russia. The Russian group in Syria was thus reduced from 44 to 24 combat aircraft (12 Su-24s, 4 Su-34s, 4 Su-30SMs and 4 Su-35Ss). They therefore had slightly fewer than the original 32 aircraft, but strike capabilities were reduced by more than half because of the withdrawal of a large number of bombers and ground attack planes. Judging by the Khmeimim satellite images, the composition and strength of the air group were maintained until the end of 2016.

After the first official withdrawal of aviation assets, the information support of the operation deteriorated significantly. The Russian Ministry of Defense drastically reduced the publication of video materials, as well as both the frequency and the detail of reports on activities in Syria. The situation did not change even after the return of almost all the withdrawn aircraft back early the next year, which had to be done because of the disruption of the reconciliation process and the continued heavy fighting.

Palmyra's liberation from ISIS

The largest city in the Syrian Desert—ancient Palmyra—was the key to controlling the entire desert and the numerous oil and gas deposits. Also, the large ISIS forces there constantly threatened to break through from there to the capital, Damascus. Therefore, the fight against ISIS there was the top priority for the Russian air group

³¹ Raymond Hinnebusch and Omar Imady, *Syria's Reconciliation Agreements*, research paper, 2017, https://research-repository.st-andrews.ac.uk/bitstream/handle/10023/11737/Report_Hinnebusch_Imadi_SyriasReconciliationAgreements.pdf.

during the attempt at reconciliation with the opposition. Intensive Russian aviation strikes began in Palmyra as early as December 1, 2015, but there were simply not enough government ground troops to successfully engage ISIS on this front.

Immediately after the announcement of the withdrawal on March 14, 2016, the airplanes that remained at Khmeimim began to support Syrian forces' offensive on Palmyra. By this time the Syrian government had managed to assemble a force needed for a large offensive there. The main number of Russian strikes focused there. But they remained relatively few, compared to the period before the withdrawal. From March 20 to 23, only 41 sorties were carried out on 146 targets in the Palmyra area. For the first time, Russian helicopters played a much more significant role in the direct air support for the Syrian troops there.

At the same time that aviation and several Mi-24P helicopters were being withdrawn in March 2016, new Russian attack helicopters, Ka-52s and Mi-28Ns, began to arrive at Khmeimim. The military decided to test them in desert conditions against ISIS. Such a favorable terrain and the fact the ISIS had no man-portable air defense systems (MANPADS) made the testing safer. At the end of March there were at least four helicopters of each new type—the Mi-28N, Mi-35M, and Ka-52—in Syria. Most of them were deployed at the main Al-Shayrat air base.³² From there, they could fight both ISIS in the desert and opposition in the Homs province.

On March 27, 2016, Palmyra was liberated with very intensive support from Russian helicopters. On April 4, Al-Qaryatayn,³³ another important city of the Syrian Desert, was liberated. At the same time, helicopters were used both for strikes at the battlefield and for hunting ISIS reinforcements and supply lines through the desert.

Continued use of helicopters resulted in the first serious losses to the Russian group. On April 12, during a night flight, an Mi-28N crashed due to pilot error; both crewmembers died in the crash. In May, four Mi-24P or Mi-35M helicopters deployed at the main air base T4 near Palmyra were hit with mortar fire during an ISIS raid on

³² Russia forward deploys new attack helicopters in Syria, Pakistan Defense Forum, Apr. 12, 2016, <https://defence.pk/pdf/threads/russia-forward-deploys-new-attack-helicopters-in-syria.426469/>.

³³ "Syrian forces capture Palmyra city from ISIS militants, state media report," CNN, Mar. 28, 2016, <http://www.cnn.com/2016/03/27/middleeast/syria-forces-capture-palmyra-city/index.html>.

the base and burned.³⁴ Despite the publication of satellite imagery, the Russian Ministry of Defense did not acknowledge this loss.³⁵

The establishment of control over Aleppo and the second aviation withdrawal

After June 2016, Russian aviation shifted its focus to Aleppo, where the Syrian forces had encircled the city. The fierce battles forced an increase in RuAF activity. In August, for the first time since the March withdrawal, the intensity increased to 70 sorties per day.³⁶

August 16 witnessed the first official confirmation of air strikes in Syria from the Iranian Hamadan air base,³⁷ using Tu-22M3 and Su-34 aircraft. The bombers had to fly less than 1,000 kilometers from Iran to the ISIS targets, and the Su-34s were equipped with a full bomb load of 500-kilogram bombs.³⁸ Only a few days later, due to diplomatic issues with Iran, the base stopped being used.³⁹ Subsequently, Tu-22M3s and Su-34s departed for Russia.

In early September, the ring around the part of the city controlled by the opposition and Islamists was finally closed and the surrounded units were deprived of supplies. The RuAF efforts focused on the outer ring of encirclement to the west of the city against targets in the rear of the opposition and Islamists. The goal was to prevent a breakthrough of the blockade and to push the front line as far from the city as possible.

On October 18, 2016, Defense Minister Shoigu announced the termination of Russian air strikes against targets in Aleppo in order to ensure a humanitarian pause and

³⁴ "Syria conflict: IS 'destroyed helicopters' at Russian base," BBC, citing Stratfor, May 24, 2016, <http://www.bbc.com/news/world-middle-east-36368346>.

³⁵ "Ministry of Defense of Russia: rumors about the destruction of helicopters in Syria - the propaganda of the ISIS," RIA Novosti, May 24, 2016, <http://ria.ru/syria/20160524/1439071245.html>.

³⁶ "Russian aviation in Syria in recent days performed at least 70 sorties a day," Interfax, Aug. 9, 2016, <http://www.militarynews.ru/story.asp?rid=1&nid=421895>.

³⁷ "Russia bombs targets in Syria from Iran air base," *Financial Times*, Aug. 16, 2016, <https://www.ft.com/content/7990ffa2-63bc-11e6-a08a-c7ac04ef00aa>.

³⁸ "Su-34s from Iran air base attacked objects of ISIS in Syria," Interfax, Aug. 17, 2016, <http://www.interfax.ru/russia/524003>.

³⁹ "Airplanes at the air base in Iran fulfilled all tasks and returned to Russia," TASS, Aug. 22, 2015, <http://tass.ru/politika/3557574>.

evacuation of civilians.⁴⁰ The fighting for the eastern part of the city finally ceased two months later; all this time, according to the official information, Russian aviation did not strike the inner part of Aleppo. This statement is difficult to verify since undoubtedly the Syrian aviation continued to attack the city during this period. On available Russian video materials, not a single strike has been geo-located inside of rebel-controlled part of Aleppo, although the western external front line witnessed dozens of strikes.⁴¹

By November 15, when the Russian carrier group with the aircraft carrier *Admiral Kuznetsov* approached Syria and the deck aviation began its flights, the fate of Aleppo was already sealed. The eastern part of the city, in which more than 10,000 opposition and Islamists fighters were concentrated, as well as about 100,000 civilians, was in a tight circle. The supply routes were cut. All attempts to raise the blockade were repulsed and in time became weaker. The deck aviation support was not very intense anyway: 15 fighters from the carrier air group made an average of eight to nine sorties per day, which was radically inferior to the performance of 24 Russian combat aircraft located on Khmeimim at that time.

By December 15, the opposition forces defending Aleppo had surrendered and were evacuating themselves and their families from the city, as agreed to with Russia and the government of Syria. Over the next few days, complete control over the country's largest city was restored.

The most marked victory for the entire campaign allowed Russian leaders to announce another withdrawal from Syria. Amidst a new major armistice between the government and the opposition, on December 29, 2016, Putin ordered a partial withdrawal of Russian troops.⁴² This occurred even though on 11 December ISIS had launched an offensive through the desert and again captured Palmyra.

Basically, this statement was an excuse for an early recall of the aircraft carrier and its air group, which did not show much action in combat. The non-naval group did not experience any major changes. Although the withdrawal of eight Su-24M bombers was announced, only four aircraft were actually withdrawn.⁴³ Due to a new

⁴⁰ "Russian Defense Minister General of the Army Sergei Shoigu announced the cease of air strikes in the Aleppo region," Russian Ministry of Defense website, Oct. 18, 2016, <http://syria.mil.ru/news/more.htm?id=12100053>.

⁴¹ According to website "RuAF airstrike videos," <https://sami-r.carto.com/builder/c7f1ea9e-632b-11e6-91a3-0e05a8b3e3d7/embed>.

⁴² "Russia announces ceasefire in Syria from midnight," Reuters, Dec. 29, 2016, <https://www.reuters.com/article/uk-mideast-crisis-syria-ceasefire-idUSKBN14I117>.

⁴³ "Syria: Russian aircraft unit prepares to depart Syria as scale-back continues," Ruptly YouTube channel, Jan. 17, 2017, <https://youtu.be/Vrd24yVENa4>.

ISIS and An-Nusra offensive, four additional Su-25SMs had to be deployed to Syria instead.⁴⁴

The second battle for Palmyra

In December, a group of about 1,000 experienced ISIS fighters with military equipment and weapons left Iraq for Syria through the Euphrates valley. Most of them conducted an attack on Palmyra. The smaller unit joined the battle for Deir-ez-Zor.

The lightning-fast ISIS raid could not be stopped even with the full mobilization of the RuAF, which again was unable to counter the offensive of highly mobile fighting groups. The reconnaissance and the independent capabilities of the aircraft to locate targets remained weak. All battle-worthy Syrian land forces were focused on Aleppo. Numerous, but poorly trained and poorly motivated pro-government forces in Palmyra area fled without rendering any resistance. ISIS occupied the city and its vicinity, and captured a lot of weapons and ammunition, including about 30 government tanks. The Russian command failed or did not want to destroy the terrorist trophies, hoping soon to repel the attackers and regain them and the lost city. The U.S. coalition's aviation struck several blows at Palmyra. They destroyed 14 captured tanks.⁴⁵ The rest were destroyed by Russian helicopters and Syrian troops in subsequent battles in the desert.

It was possible to stop the ISIS offensive in the desert only on the perimeter of T4. Four Su-25SM attack aircraft based there had to be re-deployed, but the Russian helicopters continued to use the base even when ISIS was just several kilometers away.⁴⁶

The situation for government forces in the Syrian Desert became even more complicated in the last bastion on the Euphrates, Deir-ez-Zor. Surrounded by ISIS, the city was under siege for three years. Reinforcements from Iraq allowed the terrorists

⁴⁴ "Defense Ministry denied reports on the increase in the military presence of the Russian Federation in Syria," TASS, Jan. 12, 2017, <http://tass.ru/armiya-i-opk/3935003>.

⁴⁵ "Airstrikes destroy ISIL's captured tanks," CENTCOM press-release, Dec. 16, 2016, <http://www.centcom.mil/MEDIA/PRESS-RELEASES/Press-Release-View/Article/1032110/airstrikes-destroy-isil-captured-tanks/>.

⁴⁶ "ISIS militants are conducting another powerful attack on the T4 air base in the eastern part of Homs province," *Al-Masdar Al-'Arabi*, Dec. 15, 2016, <https://www.almasdarnews.com/article/isis-militants-launch-another-powerful-attack-strategic-air-base-homs-province-russian/>.

to launch a new big offensive. They managed to cut the government bridgehead into two parts, separating the city and the military base from the airfield through which the population and the garrison of the city were supplied.

The Russian command reacted with a sharp increase in air strikes. Long-range bombers were again involved. In January 2017, Tu-23M3 with free-falling bombs made more than 30 sorties on large targets near Deir-ez-Zor. From January 21 to 25, six bombers were deployed there every day. Tactical aviation focused on direct air support at the front line; the newest helicopter group in Palmyra was strengthened. IL-76 transport aircraft participated in the transfer of reinforcements to Deir-ez-Zor and in the ammunition and supplies drop. The situation in the city was stabilized, and the city resisted until the end of the year and the defeat of ISIS in Syria.

The defeat of ISIS in the Euphrates valley

On March 2, 2017, Palmyra was liberated again. Russian helicopters neutralized all ISIS mortar and ATGM positions around the city. After a bold maneuver, mobile groups of better-trained units of the Syrian army with a heavy presence of Russian advisers quickly surrounded and took the city.⁴⁷

At the beginning of May 2017, during the fourth round of Astana peace talks on Syria, a document established four zones of de-escalation, which included a large part of the territory controlled by the opposition. After May 1, Russian aviation officially stopped air raids against those zones,⁴⁸ at least for a time. Once a lasting ceasefire had been achieved with most of the opposition groups, most Russian aviation forces could concentrate on ISIS terrorists.

The best Syrian troops launched an offensive to break through to the surrounded Deir-ez-Zor in three directions: along the Iraq border, along the Euphrates River valley from the city of Al-Bab, and from Palmyra through a vast desert with main oil and gas fields.

To maintain this offensive, the Russian air group was again reinforced. By September, the number of Su-24Ms had been reduced to just eight. But for the first time since the beginning of the campaign, the number of advanced Su-34s had increased to 12. Three multi-purpose MiG-29SMTs joined to have their “trial by fire.” The total

⁴⁷ “Details of the liberation of Palmyra,” *War and Peace* website, Mar. 4, 2017, <http://www.warandpeace.ru/ru/news/view/119355/>.

⁴⁸ “Russia from May 1 ceased the use of combat aviation in Syria,” TASS, May 5, 2017, <http://tass.ru/politika/4235201>.

number of aircraft increased to 32. In late August and early September 2017, during the two-week offensive, Russian aviation carried out 1,417 sorties. This was the most intensive period since the beginning of the campaign. On average, 100 missions were carried out daily. Each of the 30 combat aircraft had to make three to four sorties a day.⁴⁹ Building force to defeat ISIS continued and by the end of November, there were already at least 41 combat aircraft in Syria: 14 Su-34s, 8 Su-24Ms, 6 Su-25SMs and Su-35s, 4 Su-30SMs, and 3 MiG-29SMTs. The total number, including support airplanes and helicopters, increased to more than 60 units. Most of them were technologically advanced, the best that Russia has now, unlike the situation at the launch of the campaign in September 2015. Apparently, the share of high-precision weapons used also increased.

The desert area where the fighting took place was favorable for army aviation helicopters. The number of their flights in this operation for the first time exceeded the number of airplanes (more than 7,000 helicopter flights and 6,956 airplane sorties).⁵⁰

The desert and small settlements hampered ISIS's attempts at camouflage. Apparently, all Russian reconnaissance assets were concentrated in this region of Syria. Several long-endurance Forpost and Orlan-10 drones were always on duty. The number of flights by unmanned aerial vehicles (UAVs) in Syria reached 300 per week. Most pro-government forces and private military companies were assigned Russian forward air controllers. This led to several cases in which aviation destroyed typical ISIS units consisting of one or two tanks, several armed pick-up trucks, and a few suicide vehicle-borne improvised explosive devices (SVBIEDs).⁵¹

For the first time, videos released by the Russian Ministry of Defense showed destruction of ISIS vehicles, including moving tanks.⁵² The increased effectiveness of aviation allowed ground forces to slowly, but inevitably, advance through the desert and along the Euphrates with minimal losses compared to previous attempts.

⁴⁹ "VKS increased the number of sorties to 100 per day in the Deir-ez-Zor area," Interfax, Nov. 6, 2017, <http://www.interfax.ru/world/577983>.

⁵⁰ "Russian military reported results of the operation in Syria," Interfax, Dec. 11, 2017, <http://www.interfax.ru/world/591335>.

⁵¹ Video with one example of one such destroyed unit, published Sep. 12, 2017, https://youtu.be/f_0g7RtuODQ; "Russian air force didn't allow ISIS to drive their vehicles out of Uqayribat. Their convoys were destroyed," video, <https://twitter.com/Souria4Syrians/status/904754267998883840>.

⁵² "Russian Aerospace Forces strikes near Dei ez-Zor facilitated the SAA offensive along the Euphrates," Russian Ministry of Defense YouTube channel, Aug. 28, 2017, <https://youtu.be/bEwOg-Pleos>.

The successful de-blockade of Deir-ez-Zor on September 6 was the result of intense air support. As in Iraq's Mosul, in the final days ISIS maintained fanatical resistance, detonating several SVIEDs daily; however, it was easier to counter them in the desert. Russian helicopters played an important role in protecting troops from such car bombs. At times helicopters carried out 70 percent of the RuAF sorties, many of which were at night.⁵³ Su-25SMs again were frequently deployed for CAS at low attitudes with unguided rockets and guns.

In the final month of liberation of the Euphrates valley from ISIS, long-range aviation was used extensively. Over a span of 30 days, 14 raids of six long-range Tu-22M3 bombers were carried out.

The growth of the RuAF combat capabilities was an unpleasant surprise for hardline Islamist groups in Idlib. Their opportunistic offensive toward Hama, launched on September 19, ended with rapid defeat for militants with the help of heavy airstrikes.

The lifting of the Deir-ez-Zor blockade and joint cleaning with Syrian Defense Forces of ISIS on both sides of the Euphrates practically put an end to the quasi-statehood of ISIS in Syria. This gave Russia another opportunity to try to reduce its presence in the country. On December 11, 2017, Putin visited Khmeimim base and ordered aircraft withdrawal.

In total, the withdrawal of 23 aircraft and two helicopters was announced. All air defense assets remained in place. In the days that followed, there were confirmations of the withdrawal of A-50s, some of the Su-34 bombers, MiG-29SMTs, and Su-35 fighters. As a result, few more than 20 combat aircraft were left in Khmeimim. Six long-distance Tu-22M3, temporarily based in Mozdok, returned to Irkutsk.

2018 challenges

Russian strike aviation proved invulnerable to the militants' air defenses. Therefore, from the beginning, they tried to strike the air base. But in 2015-2017, all attempts by the opposition, Islamists, and ISIS to hit the Russian base were unsuccessful. By 2018, the front line was moved away from the base by at least 40 kilometers, making it invulnerable even to Grad missiles. The checkpoint system stopped the suicide bombers.

⁵³ "Russian "Alligators" devoured the ISIS," *Izvestia*, Sep. 7, 2017, <https://iz.ru/642258/nikolai-surkov-aleksei-ramm/rossiiskie-alligatory-sozhrali-siriiskikh-barmaleev>.

The December 31, 2017 barrage with a mortar by a mobile sabotage group demonstrated a change of tactics. As a result, two Russian military personnel were killed and several aircraft were slightly damaged. In the following days, Russian bases in Syria experienced even more dangerous attacks by homemade UAV bombers capable of traveling several tens of kilometers to the target.⁵⁴ The raid, using 13 such UAVs, was the first-ever attempt of an attack by strike drones by a non-state armed group. It was successfully repelled by Russian air defense without losses, but demonstrated that the Syria bases are under a new threat. Consequently, Russian aviation's focus shifted to the government operation to free Idlib province. This, it was thought, should push the front line farther away from the air base, to protect it from enemy drones.

Trying to use the same tactics against the rebels that it used against ISIS, the RuAF was met with MANPADS. On February 3, 2018, an Su-25SM was shot down by An-Nusra militants while doing CAS with unguided rockets at low altitude. It was the first Russian airplane in Syria to be lost to ground fire.

The victory over ISIS did not make the situation in Syria less complicated. In late January, Turkey launched Operation Olive Branch against the Kurdish canton of Afrin. On February 7, up to 100 pro-government forces were killed by airstrikes of the United States, including mercenaries from a Russian private military company.

After the failure of Russian diplomatic efforts for a peaceful solution, a new round of hostilities between the government and rebels become inevitable.⁵⁵ On February 22, 2018, RuAF in Syria strengthened again. At the Khmeimim air base landed four Su-35 fighters, four Su-25SMs, one modernized A-50U AWACS plane, and, surprisingly, two prototypes of the newest fifth-generation fighter Su-57 (aka PAK FA or T-50).⁵⁶ The number of planes grew more than 30 percent in one day. Another attempt to reduce forces had failed.

Two days later, on February 24, government troops launched a massive assault on East Ghouta, held by the opposition and Islamists. With heavy Russian air support, this main stronghold of the opposition in the suburbs of the capital was forced to

⁵⁴ Russian Ministry of Defense briefing, Jan. 11, 2018, <http://syria.mil.ru/news/more.htm?id=12157872>.

⁵⁵ "Russia's failure at Sochi means more war for Syria in 2018," Middle East Eye, Feb. 7, 2018, <http://www.middleeasteye.net/columns/failure-and-futility-sochi-1028624332>

⁵⁶ Alleged PHOTO, VIDEO of Russian Su-57 Fifth Gen Jet in Syria Released on Twitter, Sputnik, Feb. 22, 2018, <https://sputniknews.com/middleeast/201802221061888802-su-57-footage-pak-fa-syria/>.

surrender in just a month.⁵⁷ Victory here became no less important than the capture of Aleppo and led to the capitulation of several other smaller pockets of resistance.

But the situation for the Assad government—and for Russia in Syria—again became heated and uncertain after the April 14 joint U.S., British, and French massed missile strike on Syrian government facilities after an alleged chemical attack.

Air force losses in Syria

For almost two and a half years, the Syrian campaign, with more than 34,000 aircraft sorties,⁵⁸ had few aviation losses. The vast majority of flights were carried out at altitudes that were inaccessible not only to small-caliber antiaircraft artillery but also to the few MANPADS possessed by opposition forces. At the same time, at least 15 Syrian planes and helicopters that had to attack from low altitudes were shot down by enemy fire from the ground.⁵⁹ Four of the six losses of Russian planes were due to accidents. Another plane was shot down by a Turkish fighter.

Helicopters suffered more significant losses. The onboard self-defense systems installed were not an ideal solution. Day flights had significantly greater risks. Helicopters that made an emergency landing due to damage or technical malfunctions were often destroyed by the enemy's antitank guided missiles (ATGMs), which are very numerous in the region. Table 1 describes the RuAF's aircraft losses in Syria.

⁵⁷ "Deal reached to surrender last rebel-held town in Eastern Ghouta," Al Jazeera, Apr. 8, 2018, <https://www.aljazeera.com/news/2018/04/deal-reached-surrender-rebel-held-town-eastern-ghouta-180408172342106.html>.

⁵⁸ "S. Shoigu annual report," Russian Ministry of Defense website, Dec. 22, 2017, https://function.mil.ru/news_page/country/more.htm?id=12155960.

⁵⁹ According to author's data.

Table 1. RuAF aircraft losses in Syria

Date	Type	No. of crew and passengers dead	Region	Circumstances
24.11.2015	Su-24M	2	Latakia	Downed by Turkish F-16
24.11.2015	Mi-8AMTSh	1	Latakia	Destroyed on ground by TOW ATGM
12.04.2016	Mi-28N	2	Homs	Crashed during night flight
14.05.2016	Mi-24/35M	0	T4 air base	Burned on ground after mortar attack
14.05.2016	Mi-24/35M	0	T4 air base	Burned on ground after mortar attack
14.05.2016	Mi-24/35M	0	T4 air base	Burned on ground after mortar attack
14.05.2016	Mi-24/35M	0	T4 air base	Burned on ground after mortar attack
09.07.2016	Mi-35M	2	Palmyra	Hit by ATGM in the air
01.08.2016	Mi-8AMTSh	5	Idlib	Hit from the ground
03.11.2016	Mi-35M	0	Palmyra	Forced landing, destroyed with ATGM on ground
13.11.2016	MiG-29KUB	0	Sea	Accident during landing on aircraft carrier
03.12.2016	Su-33	0	Sea	Accident during landing on aircraft carrier
06.10.2016	Mi-28N	0	Hama	Forced landing
10.10.2017	Su-24M	2	Khmeimim	Accident during take off
31.12.2017	Mi-35M	2	Hama	Forced landing
03.02.2018	Su-25SM	1	Idlib	Shot down by MANPAD
06.03.2018	An-31	39	Khmeimim	Accident during landing
03.05.2018	Su-30SM	2	Khmeimim	Accident during takeoff
07.05.2018	Ka-52	2	Euphrates	Shot down

Source: Compiled by author from news reports

In total, the Russian Air Force and Navy lost 23 crewmembers and 37 passengers. Most of the losses were due to the crash of a transport An-32 aircraft in March of this year. Seven planes and 12 helicopters were lost. Media reports that on New Year's Eve of 2017/2018 during the mortar bombardment of the air base, seven more planes were destroyed;⁶⁰ however, this information was never confirmed and is probably false.

⁶⁰ "Khmeimim under the fire," *Kommersant*, Jan. 3, 2018, <https://www.kommersant.ru/doc/3514249>.

Tactical aviation

During the two-year Syria campaign, from September 2015 to January 2018, the Russian military aviation and fleet aviation (without counting helicopters, or transport and reconnaissance aircraft) carried out more than 34,000 combat sorties in Syria—an average of 42 flights per day. (See Table 2.) At the moments of greatest efforts, the sorties exceeded 100 per day, but, on average, they did not exceed 70-80 assault missions per day—two to three flights per airplane or three to four sorties for operable aircraft.

Table 2. Total number of sorties

Date	Sorties	Average per day	Targets hit
03.10.2015	60	15	50
22.10.2015	934	41	819
29.10.2015	1,391	46	1,623
16.11.2015	2,289	48	4,111
14.12.2015	4,201	55	n/a
24.12.2015	5,240	61	n/a
22.02.2016	11,700	80	22,000
22.12.2016	18,800	42	71,000
26.04.2017	23,000	40	77,000
25.08.2017	28,000	40	90,000
22.09.2017	30,650	42	96,828
22.12.2017	34,000	42	n/a

Source: Compiled by author from news reports

Such high rates were achieved by the deployment of at least two crews per aircraft and significantly more technicians than the standard number used in Russia. In addition, in Syria, representatives of aircraft, weapon, and equipment manufacturers—which could conduct more-complex repairs, maintenance, and even small upgrades—were constantly deployed on the air base. In addition to qualified personnel, spare parts and service equipment were supplied by the plants. As a result, aviation equipment had higher than average serviceability, despite its intensive use.⁶¹ Of course, this experience cannot be applied to the everyday situation on Russian bases, but it is useful for expeditionary actions and in case of war.

Until the spring of 2017, Su-24Ms made up half of all combat sorties. Only in late 2017, at the time of ISIS's defeat, did newer types of aircraft come to the fore.

⁶¹ "The Syrian conflict gave good practice in organizing the servicing of Russian military equipment," Russian Ministry of Defense website, Oct. 31, 2017, <http://syria.mil.ru/news/more.htm?id=12149080>.

Initially, attack helicopters were represented only by the obsolete Mi-24P, which protected the bases and was rarely involved in combat operations. Helicopters began to play a more significant role after ISIS attacks in the desert areas of Syria, around Palmyra and Euphrates and Deir-ez-Zor, in 2016-2017. Mi-35Ms, Mi-28Ns, and Ka-52s were involved. The Ka-52s managed to test the latest Russian helicopter weapons in Syria—long-range guided missiles called Vikhr-Ms—under both daytime and nighttime conditions.

Strategic bombers

The possibility of escalating air strikes in Syria by using long-range bombers initially was provided for by the Russian commanders. The six Tu-22M3s were relocated to the Russian airfield in Mozdok and carried out training flights there.⁶² On public satellite imagery, these bombers can be detected there in October 2015, a month before the "retaliation campaign."

Strategic aviation carried out 66 cruise missile attacks. The new X-101s, which are more accurate than the modernized X-555s, were first used only on Tu-160s. Then they were used on Tu-95MS bombers, which carried them on an external hardpoint. In September 2017, Tu-95MS carried four X-101s for over 7,000 kilometers with one refueling in the air.⁶³

In 2016-2017, aircraft missile strikes were not massive; rather, individual aircraft fired from one to several missiles. Their application was rather experimental. The Russian Aerospace Forces tested their new weapons in real combat, identified and eliminated their shortcomings, and analyzed the results.

The extremely active use of long-range Tu-22M3 bombers was quite a surprise. These bombers cannot be refueled in the air, which limits their range. Also, they do not carry guided weapons. Nevertheless, most of the long-range aircraft missions were accomplished by this aircraft and not by the more powerful Tu-160 and Tu-95MS. This might have been because sorties by Tu-22M3s with unguided bombs were much cheaper.

Consequently, strategic aviation was recognized as successful during Syrian campaign. The production of the Tu-160 was resumed, and it will be the basis of

⁶² "Long Range Aviation Combat Routes," Red Star website, Dec. 24, 2015, <http://redstar.ru/index.php/advice/item/27143-boevye-marshruty-dalnej-aviatsii>.

⁶³ "Tu-95MS bombers struck with cruise missiles on targets of militants in Syria," Russian Ministry of Defense website, Sep. 26, 2017, <http://syria.mil.ru/news/more.htm?id=12143592>.

strategic forces for a long time. Modernization, with the service life extension of the Tu-22M3, was announced too.

Actions by naval aviation

The role of naval aviation in the Syrian campaign was greater than is commonly believed. Naval pilots were regularly rotated to Syria to gain experience. They flew both Su-24M bombers and Su-30SM fighters from land air bases. (The Su-24 that crashed during take-off on October 10, 2017, was from the 72nd Baltic Fleet air base.)⁶⁴ The fleet's air defense S-300 and Forpost heavy drones, with drone operators, were also used.

But the mission of the aircraft carrier *Admiral Kuznetsov* in 2016 was most important for the Russian Navy. Never before had Russia's carrier-based aviation been used in real combat; therefore, both military and political leaders paid close attention to the aircraft carrier's campaign. It was a chance to demonstrate the usefulness and necessity of aircraft carriers for Russia.

Sorties from the aircraft carrier took place from November 15, 2016, to January 5, 2017. The air group consisted of 10 Su-33 fighters, five MiG-29K/KUBs and about 20 helicopters (Ka-27s, Ka-29s, and Ka-52s).

The air group carried out 420 sorties, including 117 night sorties. Helicopters made about 700 sorties to support the aircraft operation, mainly for search-and-rescue missions.⁶⁵ According to NATO, only 154 sorties were made from the aircraft carrier.⁶⁶ Two fighters were lost in accidents during carrier landings—a catastrophic performance compared to the operations of Aerospace Forces in Syria. Due to problems with the landing system and the low bomb load, the entire *Admiral Kuznetsov* air group was moved to Khmeimim air base and conducted the majority of

⁶⁴ "Crew of Su-24 crashed in Syria were pilots of the Baltic Fleet," Interfax, Oct. 10, 2017, <http://www.interfax.ru/world/582618>.

⁶⁵ "The Ministry of Defense announced 420 sorties of aviation from Admiral Kuznetsov in Syria," RBC, Jan. 6, 2017, <https://www.rbc.ru/rbcfreenews/586f5fee9a794767744bf7b9>.

⁶⁶ "Russia steps up military presence in Syria, despite Putin promise," Fox News, Jan. 11, 2017, <http://www.foxnews.com/world/2017/01/11/russia-steps-up-military-presence-in-syria-despite-putin-promise.html>.

combat sorties from the ground.⁶⁷ The Su-33s used only unguided weapons during 360 of their strike missions.

The *Admiral Kuznetsov* campaign was thus a complete failure. Its first combat deployment demonstrated the lack of operational availability of both equipment and personnel. Deck aviation radically lacked capabilities when compared to ground-based aviation, and failed to produce a noticeable effect on the battlefield.

Air defense

Originally, Russian bases in Syria did not have serious air defense protection. Only short-range Pantsir-C1s (SA-22 Greyhounds) were deployed. Initially, additional protection was provided by “Moscow” missile cruisers with the sea version of the S-300 (SA-N-6) complex.

The situation changed drastically after the Russian Su-24 was shot down in October 2015. In Khmeimim and Masyaf the S-400 battalion was deployed. In October 2016, the Tartus defense base was strengthened with S-300V4s (SA-23s).⁶⁸

There have been no known long-range surface-to-air missile (SAM) engagements in Syria. The Russian command initially made it clear that they were there only to protect Russian bases and troops. This was later confirmed. The Russian air defense did not react to the U.S. attack with cruise missiles at the Shayrat air base on April 7, 2017, or to repeated attacks by the Israeli Air Force on the Hezbollah and government targets.

During recent U.S. and coalition missile strikes against some Syrian chemical facilities, Russian air defense systems were up and running, but did not engage targets.⁶⁹ A few hours later, before the official Pentagon statement, the Russian military correctly disclosed a precise number of cruise missile used, demonstrating good situational awareness by Russian air defense systems.

⁶⁷ “Satellite images highlight potential problems for Russia's lone aircraft carrier, the Admiral Kuznetsov,” *National Post*, Dec. 1, 2016, <http://nationalpost.com/news/world/satellite-images-highlight-potential-problems-for-russias-lone-aircraft-carrier-the-admiral-kuznetsov>

⁶⁸ “Russia deploys advanced anti-missile system to Syria for first time, US officials say,” Oct. 4, 2016, <http://www.foxnews.com/world/2016/10/04/russia-deploys-advanced-anti-missile-system-to-syria-for-first-time-us-officials-say.html>.

⁶⁹ Who learned more from the strikes in Syria — America or Russia?, *Defense News*, Apr. 21, 2018, <https://www.defensenews.com/pentagon/2018/04/20/who-learned-more-from-the-strikes-in-syria-america-or-russia/>.

All known engagements of air targets were made by Pantsir-S short-range air defense systems. These systems protected Russian bases from small drones and rocket attack. By the end of 2017, they claimed to have shot down 16 drones and 53 rockets.⁷⁰ On January 5, 2018, during an unmanned attack by a swarm of small bomber drones, this air defense system shot down 7 of the 13 targets. The rest were defeated by EW. Subsequent attacks with smaller numbers of drones were also averted.

Conclusion

The Russian Aerospace Forces entered the Syrian war with new equipment, but with almost no real combat experience. A prolonged conflict, the end of which is still not visible, has become the most enlightening lesson for them since the Soviet war in Afghanistan (1979-1989). The Russian military tried all its new capabilities and weapons, including its fifth-generation fighter. Thanks to quick rotation of personnel, 80 percent of tactical aviation crews, as well as 95 percent of army aviation helicopter crews, flew 100-120 combat sorties in Syria.⁷¹

During the conflict, Russian troops demonstrated their ability to adapt and learn from their experience. Thanks to this, the combat effectiveness of a small Russian contingent is growing and has allowed government forces to attain success on the ground.

Undoubtedly, the experience gained in the conflict will be further analyzed and studied. This experience will be used for shaping the Russian Aerospace Forces for the foreseeable future.

⁷⁰ "S.Shoiigu annual report," Russian Ministry of Defense website, Dec. 22, 2017, https://function.mil.ru/news_page/country/more.htm?id=12155960.

⁷¹ "More than 48 thousand Russian military received combat experience in Syria," RIA Novosti, Dec. 22, 2017, <https://ria.ru/syria/20171222/1511541630.html>.

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