



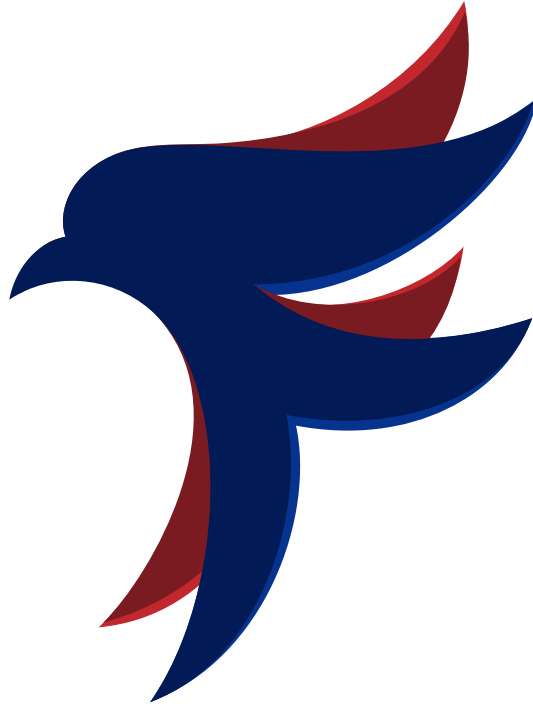
FOREIGN POLICY RESEARCH INSTITUTE

RUSSIA'S WAR IN SYRIA

# RUSSIAN AERIAL OPERATIONS

ANTON LAVROV





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This report is part of FPRI's edited volume *Russia's War in Syria: Assessing Russian Military Capabilities and Lessons Learned*, ISBN: 978-0-910191-00-5, available at:

<https://www.fpri.org/article/2020/09/about-the-book-russia-war-syria/>

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Editing: Thomas J. Shattuck

Design: Natalia Kopytnik

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September 2020



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# RUSSIAN AERIAL OPERATIONS

## ABOUT THE AUTHOR

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## INTRODUCTION

Before the start of the military intervention in Syria in 2015, even top Russian generals were uncertain what the result would be. Shortly before the start of the intervention, the Russian Aerospace Forces (RuAF) received hundreds of new airplanes and helicopters and new “smart” precision weapons. Almost all of them had never been tested in real combat. The pilots and commanders also did not have combat experience and were trained by textbooks filled with outdated concepts and tactics.

The five years of war in Syria have been the most intense period of transformation for the RuAF since the war in Afghanistan in the 1980s. The Russian military not only gained an unprecedented amount of experience, but also made substantial improvements in tactics and strategy.

## EVOLUTION OF THE RUSSIAN AIR GROUP IN SYRIA

The Russian Federation began its Syria intervention on September 30, 2015, with 32 combat jets at the Khmeimim Airbase. The RuAF deployed 12 Su-24M bombers, 12 Su-25SM attack aircraft, four advanced Su-34 bombers, and four Su-30SM fighters to the remodeled civilian airfield near the capital of Latakia province. The fighters and bombers were accompanied by four transport and 12 attack helicopters as well as a few transport and reconnaissance aircraft.

Subsequently, the composition of the Russian air group changed depending on the situation on the ground and the intensity of the fighting. After the shoot-down of a Russian Su-24 by Turkey in November 2015, Russian command increased the number of fighters. Since then, it has kept 8-10 modern jets at Khmeimim at any given time and used them for typical fighter missions, like combat air patrol. They are also often involved in strike missions.

During the most intense periods of fighting in March 2016 and November 2017, the number of Russian jets at Khmeimim reached 40-44. Despite several attempts to claim “mission accomplished” in Syria<sup>1</sup> and reduce numbers, on average, there were 25-30 combat airplanes in the country and up to a dozen auxiliary ones. To support the military operations, the RuAF deployed to Khmeimim a few light and medium transport planes, such as the An-32 and Il-76, and Il-20 and Tu-214 reconnaissance planes. One or two A-50 early warning and control aircraft were also present at times.

Over time, the composition of the group has changed to include more modern aircraft types. Su-24M bombers, used during the Cold War, were gradually replaced with newer Su-34s, about one hundred of which were acquired since 2009. Initially, the ratio of Su-24M to Su-34 was 12:4. By the end of 2017, it changed to 8:14.<sup>2</sup> In 2016, numerous old Su-25 attack planes were retired. A group of four simple and rugged Su-25 “Frogfoot” returned for several months in 2017 to operate from the forward T4 airbase, located in Syrian desert 60 kilometers west of Palmyra.<sup>3</sup> No other types of Russian aircraft, except helicopters, were permanently stationed outside of Khmeimim.

1 Partial aircraft withdrawal was officially ordered on 14 March 2016, 29 December 2016, and 11 December 2017.

2 According to satellite photos of Khmeimim.

3 “Russia deploys Su-25 attack aircraft at T-4 Airbase in Homs,” Al-Masdar Al-Arabi, 21 July 2017, <https://www.almasdarnews.com/article/russia-deploys-su-25-attack-aircraft-t-4-airbase-homs>.





(kremlin.ru)

By the end of major hostilities at the end of 2018, the number of jets was reduced to just 18—the lowest point of the entire campaign.<sup>4</sup> By then, Russia had built concrete shelters for military aircraft and helicopters to protect them from crude and improvised drones that the opposition had built and used to target Russian aircraft.<sup>5</sup> This development made it challenging to use open source satellite imagery to monitor the composition of the air group accurately. Even the second visit of Russia's most modern jet, the Su-57, for combat tests in 2019 went unnoticed by observers and became known after Russian Defense Minister Sergey Shoygu made a statement acknowledging their presence.<sup>6</sup> But it's unlikely that more than 30 jets were there in 2019-2020 at any given time because

this would exceed the shelter space built to protect the jets.

Several flight crews and technicians were stationed at the base for each aircraft. As a result, a single Su-24 could fly up to 6 sorties per day. This is more than typical for modern conflicts. Such a high tempo allowed a relatively small number of aircraft to make up to 88 attacks<sup>7</sup> and strike more than 200 targets per day. This helps Russia to have a significant impact on the ground situation in Syria with limited resources.

4 "Russian air group in Syria as of November 8," *Diana Mikhailova*, 25 November 2018, <https://diana-mihailova.livejournal.com/3026747.html/>

5 "Khmeimim 2.0: Large-scale renovation at Russia's airbase in Syria protects jets & allows deployment of even more," *RT*, 27 September 2019, <https://www.rt.com/news/469715-khmeimim-russia-airbase-syria-renovations/>.

6 "Su-57 tested new types of missiles and bombs in Syria," *TASS*, 24 December 2019, <https://tass.ru/armiya-i-opk/7413645>.

7 "Russian air force makes 88 sorties, hits 86 IS targets in Syria," *Reuters*, 13 October 2015, <https://www.reuters.com/article/us-mideast-crisis-syria-russia-sorties/russian-air-force-makes-88-sorties-hits-86-is-targets-in-syria-ifax-idUSKCN0S-71DY20151013>.

## FROM LATAKIA TO DAMASCUS: RUAF IMPACT ON THE GROUND SITUATION

The effectiveness of the Russian air group was not constant. It increased with experience gained in the first months and during the assault on Aleppo. In later operations around Damascus, in the Syrian desert, and in the province of Idlib, the effect was noticeably improved.

In the first months of the operation, the effect of Russian airstrikes on the course of combat operations was surprisingly low. The start of the bombing campaign did not radically change the situation on the ground. The October 2015 government offensive in the mountainous part of Latakia province had little success, even though ground forces there were supported by the full power of Russian aviation and helicopters, which conducted 70-80 strike sorties per day from an airbase just a hundred kilometers away.

At first, Russian airstrikes were distributed over a vast territory in several Syrian provinces against many opposition groups at the same time. This lack of concentration of efforts impeded progress. Even a strike with 26 ship-based cruise missiles on October 7, 2015 did not produce any noticeable military effect. As a political message, it was quite effective.<sup>8</sup> For the first time ever, Russia demonstrated the possibility of delivering sudden and precise strikes by its Navy. The range of missiles used in the strike allowed Russia to project power onto a significant part of Europe and the Middle East from the Black and Caspian Seas.

The Russian command's fear of losses at least partially explains the early ineffectiveness of Russian air operations in Syria. Russian aircraft operated exclusively from the heights of five km or more, inaccessible to Man-Portable Air Defense Systems (MANPADs) and rebels and terrorist groups' air defense assets. Before Syria, such scenarios on exercises were not common. Equipped with mostly unguided bombs, strikes from such heights proved not especially useful for close air support and tricky for striking small and sturdy targets.

## THE RUSSIAN COMMAND'S FEAR OF LOSSES AT LEAST PARTIALLY EXPLAINS THE EARLY INEFFECTIVENESS OF RUSSIAN AIR OPERATIONS IN SYRIA.

The first visible successes came in November 2015. In response to the Russian Metrojet Flight 9268 terror act by the Islamic State (ISIS), Russian command conducted a massive retaliation operation against ISIS targets in Syria. For the first time, strategic bombers flying from Russia took part. The heavy and powerful Tu-160 jets and Tu-95MS turboprops used long-range cruise missiles X-102 and X-555. The smaller and shorter-range Tu-22M3 attacked targets with unguided bombs.

<sup>8</sup> "Putin's Navy Sends a Shot Across Obama's Bow," *Bloomberg*, 16 October 2015, <https://www.bloomberg.com/opinion/articles/2015-10-16/russian-cruise-missiles-in-caspian-send-a-message-to-u-s->.





Su-25s at Latakia (Wikimedia Commons/mil.ru)

For several days, Russia concentrated all efforts on ISIS. The RuAF carried out a series of attacks on large, soft, and stationary targets: oil production and refining facilities, as well as columns of thousands of oil carriers engaged in oil smuggling for terrorists. Such objectives were much more similar to standard training tasks. The total damage to oil infrastructure was significant even with high-altitude airstrikes. In parallel, the United States was also engaged in attacks on the same targets.<sup>9</sup> It is difficult to determine whose contribution was more substantial, but the economic base of ISIS in Syria was irrevocably destroyed.

This effort also coincided with Turkey's shootdown of the Su-24, which allegedly violated Turkey's sovereign airspace on November 24, 2015. Russian command reacted by bringing an S-400 long-range air defense system to Khmeimim and deploying several of its newest and most capable Su-35 fighter planes there. For a while, fighters

escorted bombers operating near the Turkish border. But in general, the incident did not have any meaningful impact on the subsequent Russian bombing campaign.

The list of targets attacked during the first month of the Russian campaign is indicative. According to the Russian Ministry of Defense (MoD), the air group performed 1,391 combat sorties engaging 1,623 targets, including 249 command and communication centers, 51 training camps, 35 car-bomb workshops, 131 ammunition depots, 371 strong points and fortified positions, and 786 field camps and bases from September 30, 2015 to October 30, 2015.<sup>10</sup> These are exclusively stationary targets, and most of them are non-frontline. Vehicles are noticeably absent from the target list.

After a brief period of concentration against ISIS, Russia returned to fighting against other Islamist and moderate opposition groups. The

<sup>9</sup> "U.S. Warplanes Strike ISIS Oil Trucks in Syria," *New York Times*, 16 November 2015, <https://www.nytimes.com/2015/11/17/world/middleeast/us-strikes-syria-oil.html>.

<sup>10</sup> *Briefing by Russian MOD*, 30 October 2015, [http://eng.mil.ru/en/news\\_page/country/more.htm?id=12062281](http://eng.mil.ru/en/news_page/country/more.htm?id=12062281).



culmination and turning point of the entire war was the months-long battle for Aleppo. Success in this urban battle in summer-autumn 2016 was achieved not by high technology, but by the massing of aviation and a relentless bombing campaign largely directed at Western-backed opposition groups in the city. After the fall of Aleppo, a change in Russian strategy became evident in 2017 when the RuAF focused on the fight against ISIS in the Syrian desert and around the Euphrates River.

## IMPROVEMENT IN RECONNAISSANCE CAPABILITIES AND ACCUMULATED OVERALL EXPERIENCE SINCE THE START OF OPERATIONS HAS ALLOWED RUSSIA TO ESTABLISH A MORE EFFECTIVE “KILL CHAIN” AND TO IMPROVE REACTION TIME FROM DETECTION TO TARGET DESTRUCTION.

Improvement in reconnaissance capabilities and accumulated overall experience since the start of operations has allowed Russia to establish a more effective “kill chain” and to improve reaction time from detection to target destruction. Also, desert conditions made it possible to send helicopters for free hunting

to established “kill zones” during day and night. The Ministry of Defense provided most of the rare video footage of the destruction of moving tanks and vehicles from these battles. The role of Russian aviation in the victory over ISIS south of the Euphrates was decisive.

In 2018, the battles for the suburbs of Damascus were supported by a much more experienced Russian Aerospace Forces. Using fewer planes and sorties than during the Aleppo battle, the RuAf significantly improved its effectiveness, lethality, and coordination with ground forces. The fight for these heavily fortified and well-defended cities went much faster than the fight for Aleppo.

Russia easily defeated the rare attempts by militants to mount counterattacks in 2018. An example is the Hayat Tahrir al-Sham (HTS) counterattack in Northern Hama on March 14 when the RuAF decimated entire armored battle teams. To do this, a force must have capability to quickly locate and destroy hostile mobile targets on a dynamically changing front line. This is a different and no less difficult task compared to urban warfare. Success against opposition strikes demonstrated that the close air support capabilities of the RuAF also had grown significantly compared to 2015-2016.

Even Turkey's provision of MANPADS to militants in Idlib Province in 2020 did not change the overall picture. Turkish-backed fighters managed to stop the operations of Syria's helicopters completely. They also fired missiles at Russian planes. But MANPADS were ineffective against aircraft flying at high altitudes. Russian aviation did not suffer any losses and was able to deliver a sufficient level of attrition to the militants, thwarting their counterattacks.

During the battle for Idlib, the Turkish Air Force's F-16s shot down three Syrian Su-24 bombers, but they did not attack Russian jets. Without direct intervention of a peer opponent, the RuAF became the most crucial factor that impeded the attempt of the opposition's revenge on the ground and saved regime forces from the defeat.

## PRECISION PROBLEM

By the beginning of the Syrian operation, the RuAF had a limited inventory of guided weapons, especially modern high-precision weapons. There are no official numbers from the MoD, but judging by photos, videos, and reports from the initial period, the most common weapons were dumb high-explosive bombs weighing 500 and 250 kilograms.

To compensate for the insufficient accuracy of dumb bombs, the use of cluster and incendiary munitions, such as AO-2.5RTM, ShOAB-0.5M, PTAB-1M, and SPBE, was common.<sup>11</sup> The precision weapon of choice in the first few months became KAB-500S satellite-guided bombs.<sup>12</sup>

Even old Su-24M and Su-25SM aircraft were modernized variants with advanced digital sights developed by the Gefest company and equipped with accurate satellite navigation systems. In theory, this technology allows the use of unguided bombs with near smart-weapons precision.<sup>13</sup> But this system had

never been tested in combat before and took months to master.

The typical attack scenario with the new sight mirrored the following pattern. The Russian forward air controller with the Strelets reconnaissance, command, control, and communications complex determined the exact satellite coordinates of the stationary target at the front line. Target information was sent through an automated communication system to the attack aircraft patrolling in the air.<sup>14</sup> The coordinates of the target could also be obtained from reconnaissance drones or loaded before the flight from the target database on Khmeimim. Once the aircraft received the coordinates, the process was highly automated and took only a few minutes. The navigation and sight systems calculated the approach to the target and, at the precisely determined moment, dropped one bomb. The result of the hit was studied by a drone or visually by the forward air controller. If necessary, the aircraft turned around and attacked again. Another approach to the target took 5-10 minutes. Sometimes, up to four approaches on one target were made. According to MoD statistics, in most sorties, more than one target was attacked (or, per MoD, "destroyed"), three on average.<sup>15</sup> These numbers allow us to estimate that one, less often two, bomb(s) was spent on most objects. Such a sequence was typical for simple Su-25SM3 attack aircraft and advanced Su-35 fighters.

11 Marks Czuperski, Faysal Itani, Ben Nimmo, Eliot Higgins, Emma Beals, "Breaking Aleppo," *Atlantic Council*, 2017, <https://www.publications.atlanticcouncil.org/breakingaleppo/cluster-munitions/>.

12 Michael Kofman. "Russia's Arsenal in Syria: What Do We Know?," *War On The Rocks*, 18 October 2015, <https://warontherocks.com/2015/10/russias-arsenal-in-syria-what-do-we-know/>.

13 "Russia's advanced technology helps use unguided munitions as precision bombs," *TASS*, 25 August 2017, <https://tass.com/defense/962079>.

14 Roger McDermott. "Russia's Network-Centric Warfare Capability: Tried and Tested in Syria," *Eurasia Daily Monitor*, vol. 15, issue 154, 30 October 2018, <https://jamestown.org/program/russias-network-centric-warfare-capability-tried-and-tested-in-syria/>.

15 "Russian Aerospace Forces during the operation in Syria destroyed 122 thousand objects of terrorists," Russian Ministry of Defense, 22 October 2018, [https://function.mil.ru/news\\_page/country/more.htm?id=12200595@egNews](https://function.mil.ru/news_page/country/more.htm?id=12200595@egNews)



Russian paratroopers (mil.ru)/Facebook)

In 2019-2020, the Russian Aerospace Forces were still using a lot of unguided bombs. Even on videos published by the Ministry of Defense and loyal media, misses of 15-30 meters from a stationary object are not uncommon. With 500 kg high-explosive bombs, this is still enough to destroy most soft targets.<sup>16</sup>

Accuracy with dumb bombs nonetheless noticeably increased. Countless videos show that in recent operations the RuAF were able to reliably hit with unguided bombs a single house in an urban environment or a weaponized pick-up truck hiding in a shelter. The Russian Ministry of Defense's newspaper claimed even examples of direct hits by the Su-35 fighters from a height of five kilometers on standing tanks.<sup>17</sup>

At the same time, to hit high-priority targets, Russian command often uses guided bombs. This is especially true for attacks on underground bunkers and similar hard targets. Use of short- and medium-range missiles was limited and not promoted as much as the long-range sea- and air-based cruise missiles.

In the late stages of the operation, a pattern in the distribution of weapons developed. The old Su-24 and Su-25 use almost exclusively unguided bombs. Newer Su-34 bombers specialized in the use of precision weapons. Modern Su-35 fighters also often use guided bombs and missiles.

One noticeable sign that the accuracy increased was the decline in the use of cluster and incendiary munitions by Russian aviation in 2019-2020. For the Idlib campaign, non-

<sup>16</sup> For example video "Airstrike against building at Alteh village," Russian Ministry of Defense, 24 August 2019, <http://siria.mil.ru/war-on-terror/video/view.htm?id=9964>.

<sup>17</sup> "Impossible piloting over the Euphrates," *Red Star*, 12 January 2018, <http://redstar.ru/nevozmozhnyj-pilotazh-nad-evfratom/>.



governmental organizations did not report a single case of their use.<sup>18</sup> By the standards of the Russian Air Forces during the wars in Chechnya (1994-2001) or Georgia (2008), such a performance is a great achievement. But this is clearly not enough to put Russian among the world's elite modern air forces.

The Russian Aerospace Force's biggest problem is its inability to hit moving targets. Even after more than four years of experience, the level of success here is very modest. This limitation dramatically reduces its capability to prevent the movement of small enemy groups. While it is able to decimate large groups of enemy forces as it did against the HTS counterattack in March 2018, the RuAF still had problems stopping smaller counterattacks by militant armored groups in 2020.

This problem comes mostly from a lack of effective ammunition. According to traditional Russian doctrine, the elimination of armored and combat vehicles is the task of helicopters and Su-25 attack aircraft. But given the widespread presence of MANPADS in Idlib, the daytime use of helicopters is too dangerous. The Su-25 also operated mainly as a level bomber from a higher altitude, instead of the low-altitude attacks for which it was designed. Missile threats for aircraft in future conflicts will only increase, so we can expect that the task to defeat moving targets will be ultimately delegated to the new generation of Russian strike drones—one of many new weapons tried in Syria.

## SYRIA AS A TESTING GROUND

The list of weapons tested in Syria is vast. According to official figures, 359 types were used in real combat for the first time.<sup>19</sup> This number includes not only the latest models, but also fairly old Soviet equipment, such as the strategic bombers Tu-160 and Tu-95MS. Most of these weapons have been developed more recently.

Russian command sent to Syria not only systems already in service, but also those undergoing test and evaluation. Performance results from Syria have become an important criterion for making procurement decisions, so defense industry enterprises were interested in such trials. They sent their prototypes to the battleground with teams of engineers and technicians. These personnel actively interacted with the military and made changes and corrections on the spot.

Even the newest and secret Su-57, still under state trials, was sent to Syria. In February 2018, the arrival of two Su-57 at Khmeimim was spotted and filmed. Dissatisfied with the violation of secrecy, the Russian Ministry of Defense quickly withdrew these fighters from the country. Nevertheless, they managed to complete about ten flights and use weapons, specially developed for this aircraft, against real targets. In 2019, Su-57s went to Syria for the second time.

The Navy tested Kalibr missiles as well as several types of new warships, including cruise missile-armed diesel submarines, corvettes, and frigates. But most valuable was the first-ever trial of Admiral Kuznetsov aircraft carrier with new MiG-29K and the maritime

18 "The Syrian Regime Repeatedly Uses Cluster Munitions Against Residential Neighborhoods in and Around Idlib Governorate, Constituting War Crimes," Syrian Network for Human Rights, 27 February 2020, <http://sn4hr.org/blog/2020/02/27/54699/>.

19 "Russia tested 43 more new weapons in Syria," *RIA Novosti*, 24 December 2019, <https://ria.ru/20191224/1562776515.html>.



version of the Ka-52K helicopters as well as modernized Su-33s with improved digital sights. After losing one of the MiG-29KUB and Su-33 fighters in landing incidents, all other planes were transferred from the carrier to Khmeimim and made most of the sorties from the ground.<sup>20</sup> For carrier-based aviation, this obviously was a complete failure. The Kuznetsov was recalled home faster than anticipated and put on lengthy repairs.

A significant innovation for helicopters was the use of modernized Vikhr-M (AT-16 Scallion) missiles by the Ka-52 attack helicopter. For the first time, Russian Army Aviation developed the ability to reliably hit targets day and night from a distance of up to 8 kilometers. This is a significant improvement over the old missiles with a range of 5-6 km at the very best.

In 2019, Russia tested in Syria its first MALE-class strike drone Orion-analog of the MQ-1

Predator, weighing 1.2 tons.<sup>21</sup> But the absence of unmanned combat aerial vehicles *en masse* is the most apparent capabilities gap for Russian Aerospace Forces. The contrast was especially evident in comparison to the successful operations of numerous Turkish attack drones in February-March 2020.

The situation with reconnaissance drones is better. The RuAf and Navy employed several MALE-class Forpost drones (licensed IAI Searcher II) and dozens of light ones. Up to 70 UAV were used daily, and they accumulated more than 25,000 flight hours in first three years of operation.<sup>22</sup> In Syria, through extensive experience, very tight interaction was established between planes and drones. UAVs find targets, determine their coordinates, and monitor the results of airstrikes.

20 "Kuznetsov transits through English channel," *Armada International*, 31 January 2017, <https://armadainternational.com/2017/01/kuznetsov-transits-through-english-channel/>.

21 "New types of missiles and bombs tested on the Su-57 in Syria," *TASS*, 24 December 2019, <https://tass.ru/armiya-i-opk/7413645>.

22 "Military operation of the Russian Armed Forces in the Syrian Arab Republic – in numbers," Russian Ministry of Defense, 22 August 2018, <https://www.youtube.com/watch?v=viCiwbJG5Pk>.

The use of drones also became a staple for the Ground Forces. The Russian Army has extensively used drones for artillery fire adjustment and reconnaissance. Since 2017, it has tested light drones with laser designators. They illuminate targets for the laser-guided artillery shell Krasnopol.<sup>23</sup> All modern modifications of larger UAVs, such as Forpost-R, will have similar and more powerful lasers, which will allow drones to direct heavy laser-guided munitions, such as the KAB-1500L aviation bombs, from great distances.

Russian media reported that in 2019 elements of the future S-500 air defense complex were transferred to Khmeimim. Launchers or missiles were not tested, but radars and control equipment did get tested.<sup>24</sup>

## AIR DEFENSE EXPERIENCE

Surprisingly, the amount of experience gained in Syria for Russian air defense is second only to aviation. Initially, Russian command did not expect serious air threats to its bases. Early in the campaign, Russia deployed to Khmeimim only short-to-medium range air defense systems with a reach of 20-40 kilometers. The military believed that several Pantsir missile systems (SA-22 Greyhound) would be enough to shoot down the small drones and unguided missiles used by militants.

The conflict with Turkey over the downed Su-24M bomber in 2015 forced Russia to

strengthen its air defense. By order of Vladimir Putin, a partial battalion of the newest long-range S-400 complex was swiftly deployed to Khmeimim Airbase in November 2015. Later, an S-300 battalion was added to protect the naval base in Tartus, eventually replaced by a second S-400 battalion. Long-range air defense systems have yet to fire a missile; shorter-range systems have done all the work.

In early 2018, Russian bases faced an entirely new threat. Ten light homemade drones with bomblets attacked the Khmeimim base. Three more tried to strike the Tartus base. A combination of electronic warfare systems and Pantsir air defense systems successfully repelled the attack.<sup>25</sup> In subsequent years, drone raids became a regular and constant threat, as did long-range bombardments with unguided missiles.

The Ministry of Defense had to create a multilayered air defense system to ensure the complete security of the bases. The short-range SAM Tor-M2 (SA-15 Gauntlet) was added to the air defense systems. According to some Russian reports, they were more successful in the fight against small drones than the Pantsir.<sup>26</sup>

The Ministry of Defense claimed that more than a hundred small enemy drones were shot down in two years. Initially, air defense systems had problems detecting targets with such a low radar signature and slow speed. According to the developer of air defense systems, they managed to cope with these challenges.<sup>27</sup>

23 "Innovative UAV Technology Helps Syrian Army Offensive in Idlib," *Aviation International News*, 27 February 2020, <https://www.ainonline.com/aviation-news/defense/2020-02-27/innovative-uav-technology-helps-syrian-army-offensive-idlib>.

24 "Prometheus ask for fire: S-500 systems tested in Syria," *Izvestia*, 02 October 2020, <https://iz.ru/927353/aleksei-ramm-aleksei-kozachenko-bogdan-stepovoi/prometei-prosiat-ognia-sistemy-s-500-ispytali-v-sirii>.

25 Briefing by the Head of the Russian General Staff's Office for UAV Development, Russian Ministry of Defense, 11 January 2018, <https://syria.mil.ru/en/index/syria/news/more.htm?id=12157872>.

26 "Tor-M2 "or Pantsir-C1?," *Gosnovosti*, 28 June 2018, [https://www.gosnews.ru/article/oboronka/tor\\_m2\\_ili\\_zrpk\\_pantsir\\_s1\\_](https://www.gosnews.ru/article/oboronka/tor_m2_ili_zrpk_pantsir_s1_).

27 "Interview with the chief designer of the Pantsir," *TASS*, 29 January 2020, <https://tass.ru/interviews/7623815>.



Date	Type	Killed	Aircraft	Notes
24 October 2015	Su-24M	1	plane	shot down by Turkish F-16
24 October 2015	Mi-8	0	helicopter	Hit by TOW-2 while on the ground
12 April 2016	Mi-28N	2	helicopter	piloting error in night flight
08 June 2016	MI-35M	2	helicopter	shot down by ATGM while in-flight
01 August 2016	Mi-8	5	helicopter	shot down
03 November 2016	Mi-35M	0	helicopter	hit by ATGM while on the ground
13 November 2016	MiG-29K	0	plane	accident on landing
03 December 2016	Su-33	0	plane	piloting error during landing
06 October 2017	Mi-28N	0	helicopter	technical problem
10 October 2017	Su-24M	2	plane	accident during take-off
31 December 2017	Mi-24	2	helicopter	technical problem
03 February 2018	Su-25SM	1	plane	shoot down by MANPAD
06 March 2018	An-32	39	plane	accident during landing
03 May 2018	Su-30SM	2	plane	accident during take-off
07 May 2018	Ka-52	2	helicopter	piloting error
17 September 2018	IL-20	15	plane	shoot down by Syrian air defense

The Turkish operation, dubbed Spring Shield, in 2020 provided a significantly greater challenge. For ten days, Russian air defense observed the highly successful actions of medium Turkish strike drones and their duels with the Syrian Buk-M2 and Pantsir systems, which were largely ineffective against them at the outset, but scored kills towards the end of the brief flare up.

Russia collected a substantial amount of information from observing numerous Israeli, American, and Turkish air strikes. These lessons will make it possible to modernize Russian air defense equipment and adapt its tactics to modern realities.

## LOSSES

In almost five years of combat operations, Russia has lost eight aircraft and eight helicopters. Seventy-three people on board lost their lives in those incidents. Only one airplane was shot down by enemy fire. Others were lost due incidents and technical problems. By contrast, most helicopters were hit by the enemy.

Most casualties occurred from two incidents. In March 2018, an An-32 plane transporting Russian military personnel from Aleppo crashed while landing on Khmeimim, killing all 39 men on board. The reason for the second-largest incident was “friendly fire” by an S-200 as Syrian air defenses were

responding to an Israeli air raid on September 17, 2018. Syrian air defenders misidentified a Russian reconnaissance aircraft and shot it down. The only combat loss of a combat jet occurred when an Su-25 used old tactics and attacked a ground target from low altitude with unguided rockets.<sup>28</sup> The most substantial losses were suffered by helicopters. Russia learned that their use during daytime is excessively risky. The RuAf adjusted tactics and reduced their use until modernized models arrive.

## FOR RUSSIA, ITS SYRIA OPERATION IS ITS MOST PROLONGED AND INTENSE AIR CAMPAIGN SINCE THE WAR IN AFGHANISTAN (1979-1989).

## LESSONS LEARNED

For Russia, its Syria operation is its most prolonged and intense air campaign since the war in Afghanistan (1979-1989). In their first four years in Syria, Russian combat jets conducted more than 45,000 sorties<sup>29</sup> (most of them on strike missions), and reconnaissance drones completed over 25,000 sorties. The experience gain for the RuAf has been unprecedented.

RuAf command, military scientific institutes, and combat training centers immediately began to study lessons from the operation. Based on their analysis, recommendations were developed, and tactical changes were introduced into combat training. The RuAf, then, tested the new tactics in battle. Russia has demonstrated the ability to flexibly change its approach depending on the situation. This involved both the general strategy of the operation as well as the weapons and military equipment used in the field.<sup>30</sup>

To maximize gains in experience, rotation of the staff at Khmeimim Airbase was significant. Pilots and staff officers serve in Syria in short shifts for two to three months. Some of them have made several rotations. At the beginning of 2019, the Russian Ministry of Defense reported that more than 68,000 military personnel had gained combat experience in Syria. By 2020, 90% of all RuAf aviation crews and 56% of air defense personnel were in Syria at least once. Some pilots made more than 200 combat sorties.<sup>31</sup> Strategic aviation was less involved, but more than half of the crews nonetheless conducted at least one airstrike.

The prolonged air operation made it possible to test all types of aircraft and aviation munitions. The Russian Ministry of Defense does not like to acknowledge problems publicly, but its actions speak for themselves. Modernization programs were announced for

28 "Lost vigilance. All about the death of the Russian Su-25 in Syria," *Radio Svoboda*, 05 February 2018, <https://www.svoboda.org/a/29019535.html>.

29 "Hmeimim airbase: stability factor," *Army Standard*, 02 October 2019, <https://armystandard.ru/news/t/2019930173-buqOl.html>.

30 Michael Kofman and Matt Rojansky, "What Kind of Victory for Russia in Syria?," *Military Review*, 24 January 2018, <https://www.armyupress.army.mil/Journals/Military-Review/Online-Exclusive/2018-OLE/Russia-in-Syria/fbclid/IwAR1C-c627O8fGTeq7SI0so6RpY405CeYQGURdxJJw4JcJZZ5wMPfeuhE585Y/>.

31 Sergey Shoigu address to the Parliament, 25 March 2020, [https://function.mil.ru/news\\_page/country/more.htm?id=12283769](https://function.mil.ru/news_page/country/more.htm?id=12283769).



11 planes and helicopters.<sup>32</sup> The most common point was an increase in combat capabilities and lethality: the integration of new precision weapons, better sights, and navigation systems. The Ministry of Defense ordered improvements even for new equipment, just recently adopted to service, such as Su-34 bombers or Mi-28N helicopters. Especially pressing was the combat helicopter problem. The effectiveness of the newest Mi-28N and Ka-52 in live-fire battles was not satisfactory, especially in night conditions.<sup>33</sup> These models were supposed to be the best helicopters available.

The Russian Ministry of Defense initiated a program to modernize the Mi-28N. The aircraft received new engines, sight, optics,

radar, and longer-range weapons. Moreover, Ataka (AT-9 Spiral-2) basic missiles with a range of 5 km, Khrizantema-VM missiles (AT-15 Springer), with a range of 10 km, and the newest «Izdelie 305»<sup>34</sup> with the range of 15-20 km were also integrated.

In 2019, an upgraded prototype of the new Mi-28NM was sent for battle testing in Syria. Immediately after trials, the MoD signed a contract to purchase 98 units.<sup>35</sup> A similar modernization program is underway for the Ka-52. A deal for about one hundred modernized Ka-52M is expected in 2020.

After waves of raids by small drones, training to repel such attacks on air and naval bases has become a regular exercise all over

32 "Russian aerospace forces evaluate the experience of the Syrian military campaign," *Interfax*, 28 October 2018, <https://www.interfax.ru/russia/635353>.

33 "Bondarev spoke about the "failed" Mi-28 electronics," *RIA Novosti*, 30 November 2017, <https://ria.ru/20171130/1509918854.html>.

34 Code name for the "Light multipurpose guided missile" currently in development.

35 "The Ministry of Defense signed a contract for 98 Mi-28NM helicopters," *TASS*, 27 June 2019, <https://tass.ru/armiya-i-opk/6601643>.



Russia.<sup>36</sup> On the modern battlefield, this problem is becoming more and more relevant for all the militaries of the world. Intercepting cheap primitive drones and unguided rockets with anti-aircraft missiles proved not to be cost-effective. Therefore, after the first years of combat duty in Syria, research and design of a completely new specialized version of the Pantsir-S began. It will be much lighter, cheaper, and have a shorter range, but will have more ammunition and a better fire rate against such targets.

In the competition between the Navy and RuAF as instruments of projection of force, the Aerospace Forces gained a definite advantage. The result was the initiation of a large-scale modernization of all three types of strategic bombers: Tu-22M3M, Tu-95MSM, and Tu-160M. Serial production of the upgraded Tu-160 has resumed. The development of the future strategic bomber PAK DA gained new momentum. For all strategic aircraft, new precision medium- and long-range missiles, including hypersonic ones, are being developed and integrated.

By sending several dozen aircraft and a few thousand military personnel to Syria, Russia managed to turn the tide of the civil war. The financial and material price (as well as the price in life) of this experience for Russia was bearable, and the experience gained has been substantial. The benefits of the operation clearly outweighed the cost.

Nevertheless, this experience is somewhat limited. The campaign was more of a counterinsurgency operation than a modern conventional war with a peer or near-peer opponent. The RuAF gained no knowledge in air-to-air combat or fighting against sophisticated air defenses. This can be only partially offset by observations of the actions of the air forces of other countries, including the fifth-generation aircraft of the United

States and Israel and the latest drones. Today's RuAF are much more effective and deadlier than in 2015, but even with all the recent improvements, the RuAF are still technologically behind in several key military technologies.



36 "About 20 'attacks' of drones of various modifications were repelled by military service personnel as part of the combat readiness check," *Interfax*, 13 February 2020, <http://www.interfax-russia.ru/FarEast/print.asp?id=1104471&sec=1671&type=news>.

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