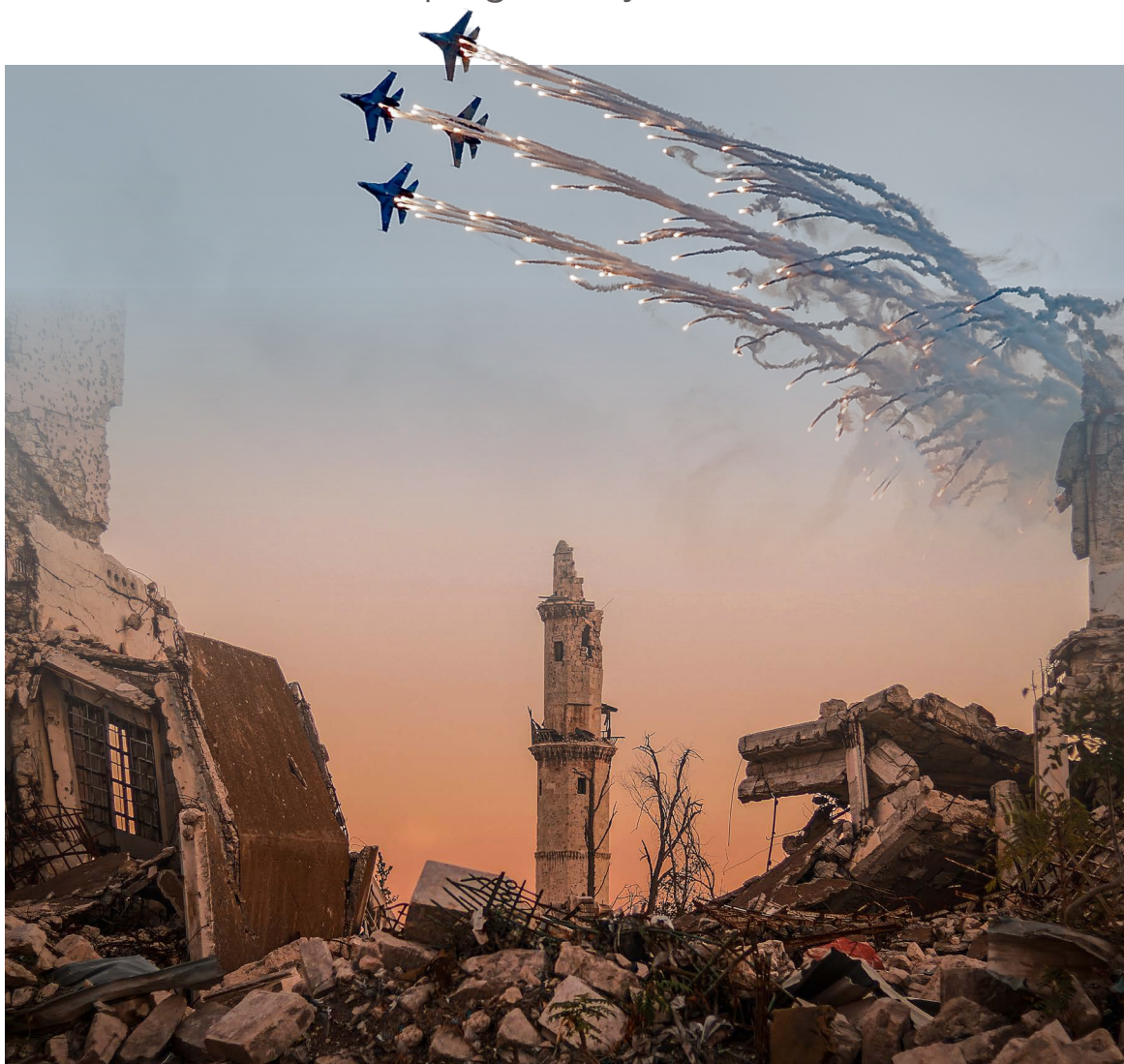


MICHAEL SIMPSON, ADAM R. GRISSOM, CHRISTOPHER A. MOUTON,
JOHN P. GODGES, RUSSELL HANSON

Road to Damascus

The Russian Air Campaign in Syria, 2015 to 2018



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About This Report

The U.S. Air Force asked the RAND Corporation to assess Russia's employment of airpower in Syria's civil war. This report reviews the chronology of Russian air operations in Syria, the strategic and operational blueprint of the campaign, the basing strategy and disposition of Russian Aerospace Forces, the effectiveness of the Russian air campaign, and its applicability to future campaigns beyond Syria. This report should be of interest to Air Force combatant commanders, planners, and logisticians. The research reported here was commissioned by USAFE-AFAFRICA A5 and conducted within the Strategy and Doctrine Program of RAND Project AIR FORCE as part of a fiscal year 2019 project, "Russian Airpower Beyond the Near Abroad." This research was completed in September 2019, before the February 2022 Russian invasion of Ukraine. It has not been subsequently revised.

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Summary

Issue

The introduction of Russian airpower in Syria has been widely cited as a turning point in the Syrian civil war. Few analyses have attempted to systematically evaluate the impact of Russian airpower on Syrian military operations, against both the Western-backed opposition groups and the Islamic State in Iraq and Syria (ISIS). This study provides a strategic analysis and performance assessment of the use of Russian airpower in Syria from September 2015 to March 2018. The findings will provide insights to U.S. Air Force, Joint Force, Coalition, expert community, policy, and academic audiences about the Russian Aerospace Force's (VKS's) strengths, weaknesses, and adaptations in Syria—its first modern expeditionary air war.¹

Approach

We developed a database that integrates operational histories, Russian airstrikes, and disposition of Russian aircraft. We also created a software tool that generates theater-wide visualizations of the geographic distribution of daily Russian airstrikes, territorial control, and known Russian bases. We used these resources to analyze the relative effectiveness of Russian airpower against the opposition and ISIS. Finally, we compared the application of airpower in Syria by Russia and the U.S. Coalition. To illustrate this blended style of analysis, Figure S.1 displays the VKS's strike patterns across five distinct phases in Russia's air campaign in Syria.

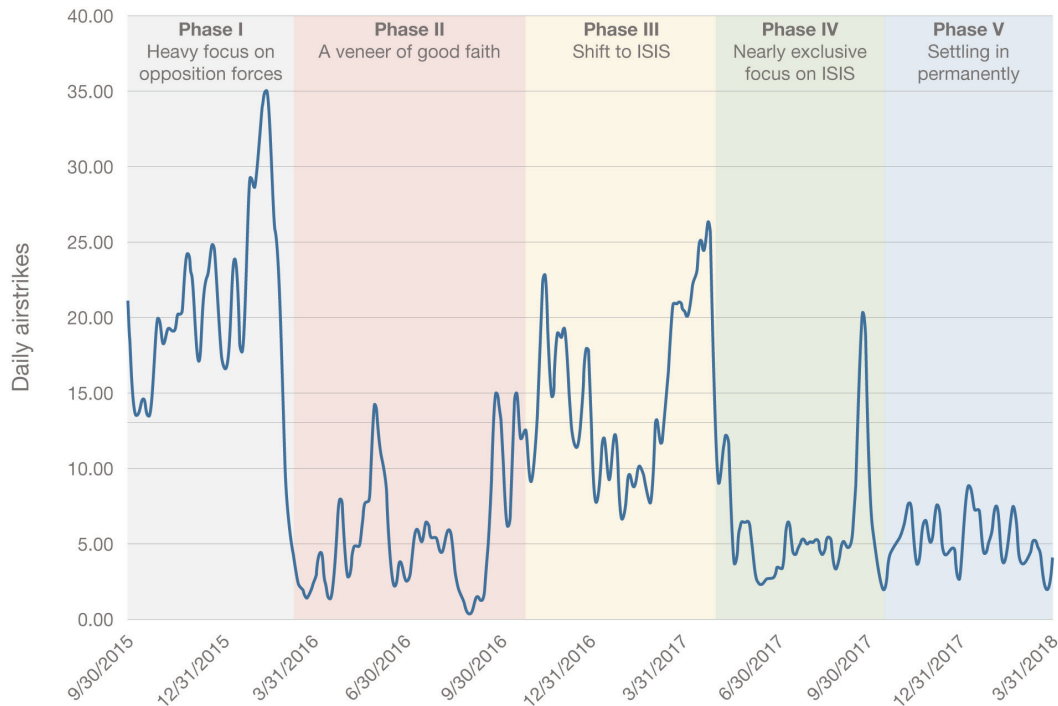
Conclusions

- Russian airpower played a decisive role in Syria. The Russian intervention ensured the survival of Syrian president Bashar al-Assad's regime, defeated his opposition, contributed to the rollback of ISIS, and secured Russia's position in the region.
- Russia's intervention was designed as a limited-liability expeditionary campaign, with a small theater footprint predicated on Russian aerospace and naval forces providing support to regime ground forces. Tactical effectiveness was mixed, but it was adequate to the mission and improved as the VKS adapted to the operational environment.
- To sustain Russia's expeditionary capability, the VKS experimented with a distributed basing model. Opening additional air bases enabled the VKS to relieve congestion at its main air base, scale up the deployed force, and operate more responsively. However, this model exhibited key gaps, including poor base protection and high attrition rates.
- The VKS's employment of airpower was significantly more effective in engagements against the opposition than in conflicts against ISIS.

¹ This research was completed in September 2019, before the February 2022 Russian invasion of Ukraine. It has not been subsequently revised.

- Despite making key adaptations in counter-ISIS operations—including joint operational planning, concepts of employment (CONEMP), forward basing, and advanced capabilities—Russian airpower was not uniquely powerful or decisive against ISIS. The U.S. Coalition conducted at least 50 percent more airstrikes, in aggregate, than did Russia in ISIS-controlled regions in north, central, and eastern Syria. Ultimately, Kurdish forces, supported by Coalition airpower, propelled the rollback of ISIS in northeastern Syria.

Figure S.1. The Russian Air Campaign in Syria, 2015 to 2018



Implications for Future Russian Air Campaigns

- It is unclear how effectively Russia might be able to export its expeditionary capability to other theaters. The geography in Syria was uniquely favorable for the VKS's reliance on rotary-wing operations, the conflict was low intensity, and Russian forces rarely encountered adversaries with advanced air-to-air or surface-to-air capabilities.
- The VKS's heavy reliance on distributed basing exhibited shortcomings that suggest a limited applicability to different operational contexts. It is unclear how well the VKS would perform, for example, if its basing options were limited.
- Russia refined CONEMP for enabler aircraft that it will likely apply to future conflicts. The VKS experimented with new capabilities in airborne intelligence, surveillance, and reconnaissance (ISR), early warning and control, command and control (C2), and command post roles. Russia has also invested in combat unmanned aerial vehicles with self-protection suites and the ability to conduct dual recon-strike missions.
- Russia's reluctance to invest in expensive precision-guided munitions, underdeveloped targeting and penetrating ISR capabilities, and lack of intertheater tanking could be liabilities in future campaigns with a larger area of operations, fewer regional basing options, or against a peer force that can deny Russia's less-capable legacy aircraft.

1. Introduction

Shortly before Russia's military intervention in the Syrian civil war in September 2015, the Syrian government controlled less than one-fifth of the country's territory and many Russian analysts believed that the regime's collapse was imminent. By the following December, the Syrian military had retaken Aleppo from the Western-backed opposition, with Russia's brutal air campaign having played a key supporting role. The introduction of Russian airpower in Syria has been widely cited as a turning point in the Syrian conflict. However, to our knowledge, no study has attempted to systematically assess the impact of Russian airpower on all major ground operations to which it was applied.¹

This study provides a strategic analysis and performance assessment of the use of Russian airpower in Syria from September 2015 to March 2018. It builds on the findings of a companion report,² which characterizes the underlying motivations that impelled Russia to intervene, by tracing Russia's strategic blueprint and operational priorities for the air campaign. Using an integrated, data-driven approach, the study then dissects the role that Russian airpower played at different stages of the Syrian conflict. It concludes by appraising the strengths, weaknesses, and adaptations of Russian airpower in Syria.

Our approach is multimethod, blending a qualitative evaluation of Russian air capabilities and operational outcomes with descriptive quantitative data. To this end, we developed an integrated database that weaves together operational histories, Russian airstrikes, and disposition of deployed Russian aircraft. We also created a software tool that generates theater-wide visualizations of the geographic distribution of daily Russian airstrikes, territorial control, and known Russian air and naval bases throughout the campaign.³

Study Scope

This study seeks to provide a strategic- and operational-level analysis about the application of Russian airpower in Syria—how it was employed, why it was used in the ways that it was, and

¹ This report is not, however, the first comprehensive analysis of Russia's intervention in Syria. See, for example, Robert E. Hamilton, Chris Miller, and Aaron Stein, eds., *Russia's War in Syria: Assessing Russian Military Capabilities and Lessons Learned*, Philadelphia: Foreign Policy Research Institute, 2020; Seth G. Jones, ed., *Moscow's War in Syria*, Washington, D.C.: Center for Strategic and International Studies, 2020; Michael Kofman and Matthew Rojansky, "What Kind of Victory for Russia in Syria?" *Military Review Online Exclusive*, January 2018; Anton Lavrov, *The Russian Air Campaign in Syria: A Preliminary Analysis*, Arlington, Va.: Report, Center for Naval Analyses, COP-2018-U-017903-Final, June 2018; and Ralph Shield, "Russian Airpower's Success in Syria: Assessing Evolution in Kinetic Counterinsurgency," *Journal of Slavic Military Studies*, Vol. 31, No. 2, 2018.

² Samuel Charap, Elina Treyger, and Edward Geist, *Understanding Russia's Intervention in Syria*, Santa Monica, Calif.: RAND Corporation, RR-3180-AF, 2019.

³ This research was completed in September 2019, before the February 2022 Russian invasion of Ukraine. It has not been subsequently revised.

what effects it had. We identify key issues that emerged from Russian air operations and chart their evolution over the course of the campaign to provide a set of insights for U.S. Air Force, Joint Force, Coalition, expert community, policy, and academic audiences about Russian aviation's approach to expeditionary warfare. These insights include lessons learned that could influence Russia's warfighting approach in future conflicts.

Our analysis partitions Russia's intervention into five phases that capture distinct shifts in Russian strategic priorities, force employment and basing patterns, and operational tempo.⁴ The first phase, beginning with the Russian Aerospace Force's (VKS's) initial deployment in September 2015, reflected a heavy focus on degrading Syrian rebel forces. In the second phase, beginning with the initial cessation of hostilities between government-backed and opposition forces in February–March 2016, the VKS significantly de-escalated its counteropposition air operations—a veneer of good faith that nevertheless culminated in the Syrian regime's brutal recapture of Aleppo with significant Russian air support.

In the third phase, following the regime's recapture of Aleppo in December 2016, the VKS shifted its focus to the Islamic State in Iraq and Syria (ISIS) from December 2016 through July 2017. This transition to a focus on ISIS intensified to a nearly exclusive focus on ISIS, the fourth operational phase, from July through December 2017. After achieving a “complete victory” over ISIS in central Syria and Deir al-Zour in December 2017, the VKS withdrew most of its aviation assets from counter-ISIS operations, focused on eliminating remaining pockets of opposition forces in Damascus and Idlib, and began to settle in permanently in the fifth and final phase analyzed in this report.⁵

The focus of this report is on Russian airpower; therefore, ground and maritime operations are not emphasized, except as part of the broader narrative or, in the case of naval air, to the extent that they contributed to Russian air operations. Since our data primarily measure Russian airstrike patterns, we concentrate our analysis on Russian air-to-ground operations. Other air activities such as intelligence, surveillance, and reconnaissance (ISR) and mobility, while clearly important in their own right, therefore, play only an ancillary role in our study. Finally, we use publicly available reporting on U.S. and Coalition air activities in Syria, under the umbrella of the Combined Joint Task Force—Operation Inherent Resolve (CJTF-OIR), to draw broad comparisons between Russian and U.S. airpower in Syria.

Data Collection and Methodology

Tracking Russian aircraft deployment and airstrike patterns over time with meaningful precision entails significant uncertainty in the best of circumstances. Data availability and

⁴ It is important to note that these phases do not align with the corresponding phases of the U.S.-led CJTF-OIR campaign in Syria, since the two reflected distinct strategic priorities and began at different points in time.

⁵ Vladimir Putin, quoted in Jack Stubbs, “Putin Declares ‘Complete Victory’ on Both Banks of Euphrates in Syria,” *Reuters*, December 6, 2017.

reliability challenges amplify this uncertainty. We employed a series of remedial approaches to correct for incomplete or unreliable data, taking care to document any remaining sources of uncertainty. In the following sections, we characterize the public data environment encapsulating Russian aircraft deployment and airstrike patterns, identify potential data gaps and inconsistencies, and describe the methods by which we sought to remediate data problems. The first section below focuses on aircraft deployment patterns; the second focuses on airstrike patterns.

Tracking Russian Aircraft Deployment Patterns

Documenting Russian VKS aircraft deployment patterns to the Syrian theater was a core task of this research effort. To accomplish this task, we used open-source reports (see details in the following section) to create a database—the RAND Time-Phased Russian Aircraft Deployed to Syria-Open Source (TRADS-OS) Database—that tracked deployed Russian aircraft across multiple analytic dimensions, including deployment date, aircraft type, estimated number of deployed aircraft per platform type, and base location.

Deployment Date

Our data set begins on September 1, 2015, which roughly coincides with the inception of Russia’s direct involvement in the Syria conflict,⁶ and extends through March 31, 2018, the last date for which aircraft strike data were available. Where possible, we obtained daily observations to facilitate a direct mapping to the daily strike data. For reasons we discuss below, it was not always possible to maintain this level of fidelity. In the event of missing observations, we estimated relevant aircraft information to provide a daily record of Russian aircraft deployments.

Aircraft Type

We limited our analysis of aircraft deployments to rotary-wing and combat fixed-wing platforms. However, it is important to note that the VKS has employed an array of other aircraft types during its Syrian air campaign. For example, the VKS has relied on several intra- and intertheater cargo and transport platforms to rotate personnel and equipment. The VKS employs a range of fixed-wing enabler aircraft, most notably the Il-20M *Coot-A*⁷ electronic signals intelligence (ELINT), Tu-214R multi-intelligence,⁸ A-50M/U *Mainstay* airborne early-warning and control (AEW&C), and An-30 *Clank* ISR platforms, and unmanned aerial vehicles (UAVs) such as the Orlan-10 and Forpost. Although we provide some high-level insights regarding the

⁶ This date corresponds to the arrival of the first Russian aircraft to the Syrian theater; however, Russian air operations did not begin until September 30, 2015.

⁷ Most Russian aircraft are represented by two distinct designators. The first, for example, Il-20M, corresponds to the manufacturer’s model—that is, Ilyushin-20M. The second, for example, *Coot-A*, is a unique North Atlantic Treaty Organization (NATO) designator for the model.

⁸ We are unaware of a specific NATO designator for the Tu-214R variant.

VKS's concepts of employment (CONEMP) and operational performance of enabler aircraft, we excluded these types of aircraft from our data analysis due to lack of sufficiently robust observational data. We also excluded aircraft that participated in the VKS's air campaign but were based outside of Syria. These primarily consisted of long-range bombers (e.g., Tu-160M/M2 *Blackjack* and Tu-95MS *Bear*) stationed at the Mozdok and Engels air bases located in southwestern Russia.

Table 1.1 displays the full range of deployed Russian aircraft included in our analysis.

Table 1.1. Russian Aircraft in Syria

Platform	Platform Type	First Delivery
Sukhoi Su-24M/M2 Fencer-D	Fixed-wing	1983/2000
Sukhoi Su-25SM/UB Frogfoot	Fixed-wing	1999
Sukhoi Su-27SM3 Flanker-B	Fixed-wing	2009
Sukhoi Su-30SM Flanker-H	Fixed-wing	2012
Sukhoi Su-33 Flanker-D	Fixed-wing	1991
Sukhoi Su-34 Fullback	Fixed-wing	2006
Sukhoi Su-35/S Flanker-E	Fixed-wing	2011
Sukhoi Su-57 Felon	Fixed-wing	2019
Mikoyan MiG-29K/SMT Fulcrum	Fixed-wing	1992/1998
Mil Mi-8AMTSh Hip	Rotary-wing	2010
Mil Mi-24P Hind	Rotary-wing	1982
Mil Mi-28N Havoc	Rotary-wing	2006
Mil Mi-35M Hind-F	Rotary-wing	2011
Kamov Ka-27/29/31 Helix	Rotary-wing	1981/1985
Kamov Ka-52 Hokum B	Rotary-wing	2011

NOTE: This list is limited to only combat fixed-wing and rotary-wing aircraft. See Chapter 3 for a list of VKS long-range strike and enabler aircraft employed in Syria.

Estimated Number of Deployed Aircraft per Platform Type

In the section on data sources later in this chapter, we used a combination of commercial satellite imagery, public reporting, open-source commentary, and social media accounts to impute the numbers of deployed aircraft per platform type on a given date. Figure 3.1 and Table 3.2 present RAND's estimates for the VKS's air order of battle (maximum on-station).

Base Location

In September 2015, Russian forces assumed control of most base operating functions at Hmeimim air base, located at Bassel al-Assad International Airport in the Latakia governorate.⁹

⁹ The U.S. military and public reporting alternately refer to Hmeimim air base (the local Arabic name, also transliterated as *Kmeimim* and *Humayyim*) as Latakia and Bassel al-Assad air base. We use these names interchangeably. See "The Latest: Russia Moves to Extend Lease of Syria Naval Base," *Associated Press*, December 26, 2017.

Since then, Russia has retained Hmeimim as the main operating base (MOB) for its deployed forces in Syria. Unclassified reporting has subsequently confirmed the existence of at least five additional airfields that the VKS has used to forward-stage both fixed- and rotary-wing aircraft for ongoing operations. A full list of known Russian air bases (as of March 2018), including location and observed aircraft types, is displayed in Table 1.2.

Table 1.2. Known Russian Air Bases in Syria

Russian Air Base Name	Location	Observed Aircraft Types
Hmeimim air base	Latakia governorate	Fixed-wing, rotary-wing
Hama military airport	Hama governorate	Rotary-wing
al-Shayrat air base	Homs governorate	Rotary-wing
Tiyas military air base ("T-4")	Homs governorate	Fixed-wing, rotary-wing
Kuweires Military Aviation Institute	Aleppo governorate	Rotary-wing
Deir al-Zour military air base	Deir al-Zour governorate	Fixed-wing, rotary-wing

NOTES: Some open-source reporting speculates that the VKS has used Jirah air base, located in the Aleppo governorate, as a forward base for rotary-wing aircraft. However, we were unable to confirm the veracity of this claim—and, to the contrary, it appears that the observers may have mistaken Kuweires air base for Jirah.

Note that this list does not include air bases outside of Syria that served some role in the Russian air campaign. For example, the VKS has frequently utilized long-range bombers stationed at Mozdok and Engels air bases in southwestern Russia to conduct in-theater strike missions. The VKS has also sporadically used Shahid Nojeh air base in Iran's Hamadan Province to conduct limited sorties and serve as a temporary transit hub from Russia. Finally, we tracked Russia's deployment of its *Admiral Kuznetsov* aircraft carrier to the Russian naval base at Tartus, Syria, from November 2016 through January 2017. During this period, the *Kuznetsov's* carrier air wing was heavily utilized in ongoing air operations.

Data Sources

Given our research objective of tracking Russian aircraft deployments, including daily movements and their relationships to strike patterns, we concluded that the ideal method for documenting the numbers, types, and locations of Russian aircraft in Syria would be daily or weekly geospatial intelligence (GEOINT) provided by publicly available satellite imagery. However, data availability and reliability challenges often limited the viability of this approach. Although many commercial providers of geospatial products such as Airbus, DigitalGlobe, and Stratfor have periodically generated satellite imagery of Russian air bases for public consumption, no single commercial firm has persistently tracked Russian activities in Syria at the desired level of daily, weekly, or even monthly fidelity. Even in aggregate, no commercially available geospatial products have been produced with enough consistency or frequency to suffice as the linchpin of our data efforts.

Satellite imagery of Russian air bases in Syria poses three additional constraints. First, imagery analysis is, at times, an art rather than a science, particularly when the diversity of sourcing is limited. We encountered multiple examples of commercial imagery analysis that potentially misidentified Russian aircraft or posited an air order of battle (AOB) that conflicted with other reliable public reporting. Second, we found that it was extremely rare for all active

Russian air bases in Syria to be verifiably covered on any given day, even if imagery was available for individual bases. This yielded a perpetually incomplete picture of the VKS's AOB across its network of basing locations and necessarily injected uncertainty into aircraft deployment patterns. Finally, satellite imagery captures only a slice of daily activity at an airfield. This activity is necessarily confined to a narrow time window and is also potentially constrained in geographic scope. An image may exclude aircraft that are actively engaged in daily air operations or are temporarily hidden from view (e.g., in shelters) but should logically be included in the base's AOB. This final pitfall was common in the imagery we reviewed as part of this research and inevitably led to inaccurate results unless reconciled.

In spite of the limitations of commercial GEOINT, we nonetheless found it to be the most rigorous, consistent, and verifiable source of information regarding Russia's aircraft deployments. We therefore compiled all publicly available satellite imagery of Russian air bases in Syria from September 2015 through March 2018.¹⁰ This compilation constituted the foundation of our aircraft tracking database. Next, we reviewed other open-source video and imagery documentation—often published on social media accounts, blogs, message boards, and Arabic news sites—depicting the Russian aviation presence in Syria.¹¹ We contend that such evidence offers a second-best source of intelligence about Russian deployment patterns, given the direct access it provides to the numbers and locations of aircraft. There are obvious risks to relying on amateur or uncorroborated evidence, not least of which is the possibility that the images could be fabricated or misleading. Nevertheless, we strove to limit our use of these open-source documents to only those that have been independently validated.

As a general rule of thumb, in the absence of verified satellite imagery on a given day, we required the presence of at least two concurring open sources to establish a concrete aircraft estimate. Even in the event of two or more concurring sources, the information may be apocryphal, based on a flawed interpretation of GEOINT, or may reflect temporary disruptions in a base's AOB from aircraft rotations or some other variation.

Tracking Russian Airstrikes

The essential empirical basis for understanding any air campaign is a reliable and detailed record of what operations the air arm in question conducted during the campaign. For an air-to-ground campaign like the Russian effort in Syria, this first and foremost means understanding where the VKS struck, when, and how often.

Unfortunately, Russia is a notoriously poor source of information on its operations. Not only does the Ministry of Defense (MoD) make very little systematic data available to the public, but

¹⁰ Commercial imagery sources included Stratfor, DigitalGlobe, Jane's, SIIS, and Airbus.

¹¹ Among the extensive open sources we consulted, some of the richest included the Twitter plane-spotting and conflict-monitoring accounts @obretix and @warsmonitoring, the Scramble plane-spotting message board, open-source intelligence blogger Matthew Aid, the *Within Syria* blog, and Syrian news source Zaman Al-Wasl.

it often traffics in falsehoods for strategic or institutional purposes. For example, the MoD repeatedly lied about the flight path of the Su-24 shot down by a Turkish F-16 in November 2015.¹² Moreover, an assortment of studies found government-published figures to be inflated and inconsistent. Czuperski et al. report that crowdsourced public analysis of Russian MoD strike videos and statements demonstrated that “the Ministry was providing false information about the targets and locations of the air strikes.”¹³ Published government airstrike figures have been repeatedly debunked as inaccurate or outright disinformation. For this reason, the occasional strike summaries released by the VKS are not an adequate basis for analysis.

Other potential sources proved no more satisfactory. Western media reporting on Russian operations in Syria often commented on the apparent scale and scope of airstrikes, but reports were too infrequent and geographically sparse to serve as a basis for operational analysis. Official Western government open-source reporting was similarly incomplete.

To overcome this lack of data, the project team searched for unconventional sources that might be sufficiently informative to support detailed analysis. We noted that social media reporting, both from private individuals and from local media outlets, frequently included near-real-time reporting of strike activity by Russian, Syrian, and/or Coalition aircraft. The team purchased a subscription to a database of Syrian social media reporting, maintained by IHS Janes as the Syria Conflict Monitor database, and analyzed the raw data for reports of Russian strike activity, finding more than two thousand georeferenced and time-stamped reports.

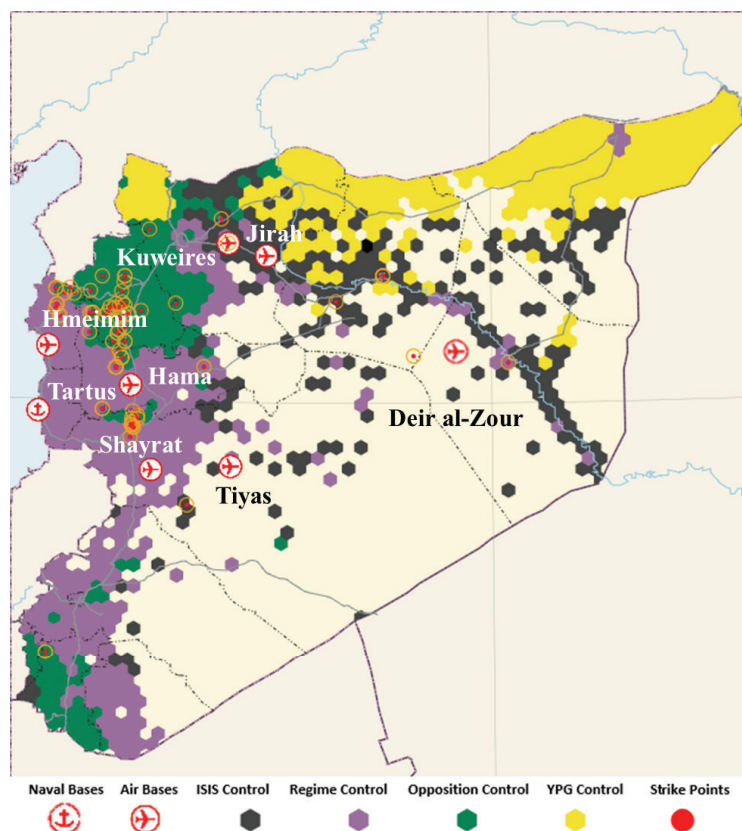
It is important to note that the Conflict Monitor database broadly classifies airstrikes as events in which Russian or Syrian aircraft are documented to have released munitions on identifiable targets. This means that an airstrike could consist of a single aircraft striking a single target, or it could represent multiple aircraft striking multiple targets. Therefore, our airstrike data do not describe all individual strikes delivered, weapons released, or targets destroyed by Russian aircraft. Although this clearly limits our ability to comprehensively assess Russia’s operational performance in Syria, the event-driven character of our airstrike data still allows us to track patterns in VKS air activities and key operational priorities underlying Russia’s air campaign. Our georeferenced data provide a conservative approach to tracking Russian airstrikes, the obvious benefit of which is that we do not rely on dubious government figures.

The team subsequently built a software visualization tool that allows analysts to view strike reports, territorial control data, and major ground operations by locality and day in order to easily understand how the pattern of Russian airstrikes related to ongoing ground operations and the shift in territorial control over time. Figure 1.1 depicts the visualization tool displaying the results for a given day, with social media reports of Russian strikes highlighted by red dots,

¹² Elizabeth Trudeau, Daily Press Briefing, U.S. Department of State, November 30, 2015.

¹³ Maksymilian Czuperski, John Herbst, Eliot Higgins, Frederic Hof, and Ben Nimmo, *Distract, Deceive, Destroy: Putin at War in Syria*, Washington, D.C.: Atlantic Council, April 2016, p. 10.

Figure 1.1. Snapshot of RAND Visualization Tool: Daily Russian Airstrikes, Territorial Control, and Russian Air and Naval Bases



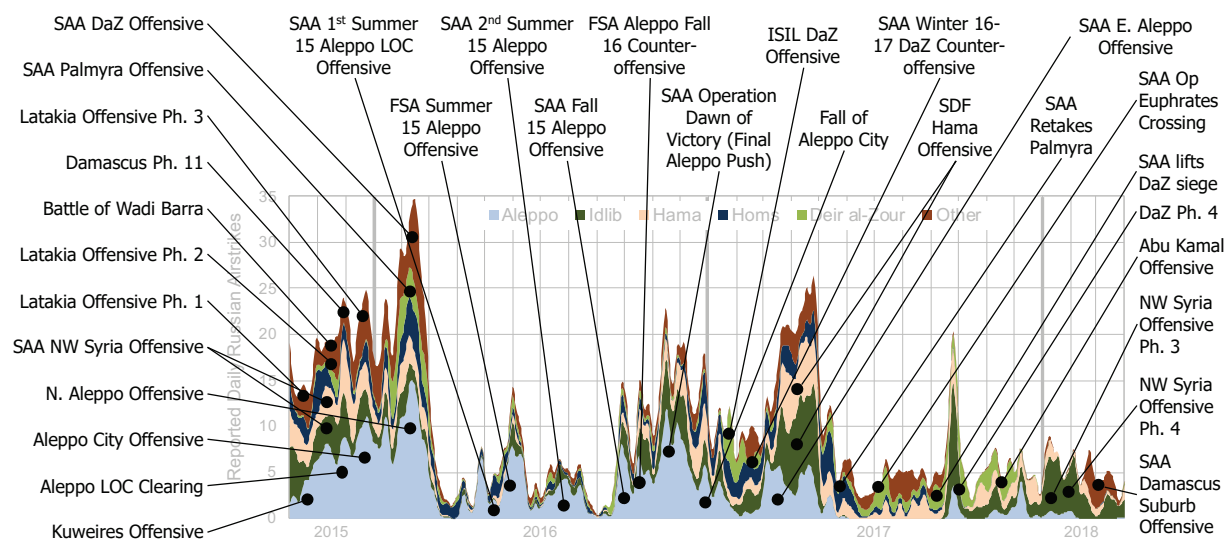
NOTES: ISIS = Islamic State of Iraq and Syria; YPG = Yekîneyên Parastina Gel (Kurdish People's Protection Units).

territorial control by color-coded hexagons, and Russian air and naval bases by red icon. The tool can be advanced or retreated in time manually or run as an automatic time lapse of the campaign.

Clearly, individual social media reports of Russian strike activity may be incorrect for a variety of reasons. Observers may mistake Syrian or Coalition aircraft for Russian types, particularly in poor lighting, or may simply report bad data by mistake or by intention. In order to ascertain whether enough errors existed in the data to prevent rigorous analysis, the team cross-referenced the social media reporting with mainstream Western media reports on the timing and location of major ground operations. We found that the bulk of reported Russian strike activity could be collocated in time and place with ground operations of the sort that generate requirements for Russian airstrikes. Figure 1.2 illustrates this relationship.

Further analysis by the team, partly codified in this report, indicated that social media reporting of Russian strike activity revealed patterns that could be profitably subjected to rigorous analysis. Thus, although the strike activity database developed by the project team undoubtedly includes a significant number of erroneous entries, subsequent analysis indicates that the overall empirical patterns are sufficiently valid and detailed for the purposes of

Figure 1.2. Cross-Referencing Russian Airstrikes with Syrian Ground Operations, 2015 to 2018



NOTES: DaZ = Deir al-Zour; FSA = Free Syria Army; ISIL = Islamic State of Iraq and the Levant; LOC = lines of communication; Ph = phase; Op = opposition; SAA = Syrian Arab Army; SDF = Syrian Democratic Forces; E = east; N = north; NW = northwest.

understanding the broad design of the Russian air campaign as well as its strengths, weaknesses, and overall effectiveness.

Comparing Russian and U.S. Coalition Airstrike Activities

Ideally, we would like to be able to compare Russian and U.S. Coalition airstrike activities to gauge both overall operational effects and the comparative intensity of Russian and U.S. airpower in ongoing operations. As we outline above, there is a wide discrepancy in the credibility of published Russian and Coalition airstrike figures. The Russian and U.S. militaries also employ different methods for counting airstrikes, compounding the challenge of comparability. In particular, Russian government strike releases tend to conflate airstrikes with targets engaged. As we discuss in Chapter 4, the latter is often exaggerated or is further conflated with weapons released. Therefore, official Russian airstrike data are not directly comparable to published CJTF-OIR strike reports.

To make a comparative analysis more tractable, we employed two distinct data sources that track Coalition airstrikes over time. First, our original data set uses georeferenced social media reporting to compile daily Coalition airstrikes in Syria. These airstrike figures use an event-driven aggregation method that is directly comparable to our data collection method for Russian airstrikes. The key limitation of this approach is that our daily Coalition airstrike data are aggregate figures—they are not broken out by geographic region. Even though we can use these data to draw top-line conclusions about Russian and Coalition airpower employment patterns,

this clearly inhibits our ability to analyze performance and outcomes in specific operational areas.

We used CJTF-OIR airstrike data compiled by Wasser et al. to create a more complete picture of the U.S. Coalition’s use of airpower in Syria.¹⁴ Fortunately, we operationalize Russian airstrikes in a manner that closely resembles the method employed in Wasser et al. The authors of that report note:

One strike is not necessarily the same magnitude as another. The CJTF-OIR definition of “strike” captures a cohesive effect, which can differ from strike to strike. It does not correspond to the number or type of aircraft, the number or type of munitions, the number of aimpoints, or the number of engagements to deliver the cumulative effect. . . . A CJTF-OIR strike may be a single aircraft delivering a single munition against one target or a number of aircraft delivering multiple munitions over several engagements for a cumulative effect.¹⁵

Although this is not a perfect analog for the event-driven character of our airstrike data, it is close enough to draw broad comparisons. Indeed, our data collection effort parallels Wasser et al. by treating airstrikes as a “cohesive effect” irrespective of the aircraft involved, munitions released, or targets engaged.¹⁶ When we compared our top-line Coalition airstrike figures with the official CJTF-OIR data compiled by Wasser et al., we observed that our data set systematically undercounted Coalition airstrikes by more than 2,600 from September 2015 through March 2018, or about 85 per month.

Given the systematic undercounting present in our data, we used a bounded estimation approach to facilitate a more consistent comparison with the official CJTF-OIR numbers. First, we set the conservative, event-based Conflict Monitor strike figures as a lower bound on actual airstrikes. We then assumed that missing Russian and Coalition airstrike data followed a uniform process (i.e., missingness varied systematically between the two), enabling us to scale Russian airstrikes to match the Wasser et al. Coalition airstrike distribution.¹⁷ This estimate serves as an upper bound on actual Russian airstrikes. Together, our estimation and bounding procedures facilitated a comparison—in rough orders of magnitude—between the intensity of Russian and Coalition airstrikes. This analysis comes with severe limitations, but it does enable us to draw some crude, high-level conclusions about the employment of airpower in Syria by the VKS and CJTF-OIR (which we outline in Chapter 4).

¹⁴ Becca Wasser, Stacie L. Pettyjohn, Jeffrey Martini, Alexandra T. Evans, Karl P. Mueller, Nathaniel Edenfield, Gabrielle Tarini, Ryan Haberman, and Jalen Zeman, *The Air War Against the Islamic State: The Role of Airpower in Operation Inherent Resolve*, Santa Monica, Calif.: RAND Corporation, RR-A388-1, 2021.

¹⁵ Wasser et al., 2021, pp. 326–327.

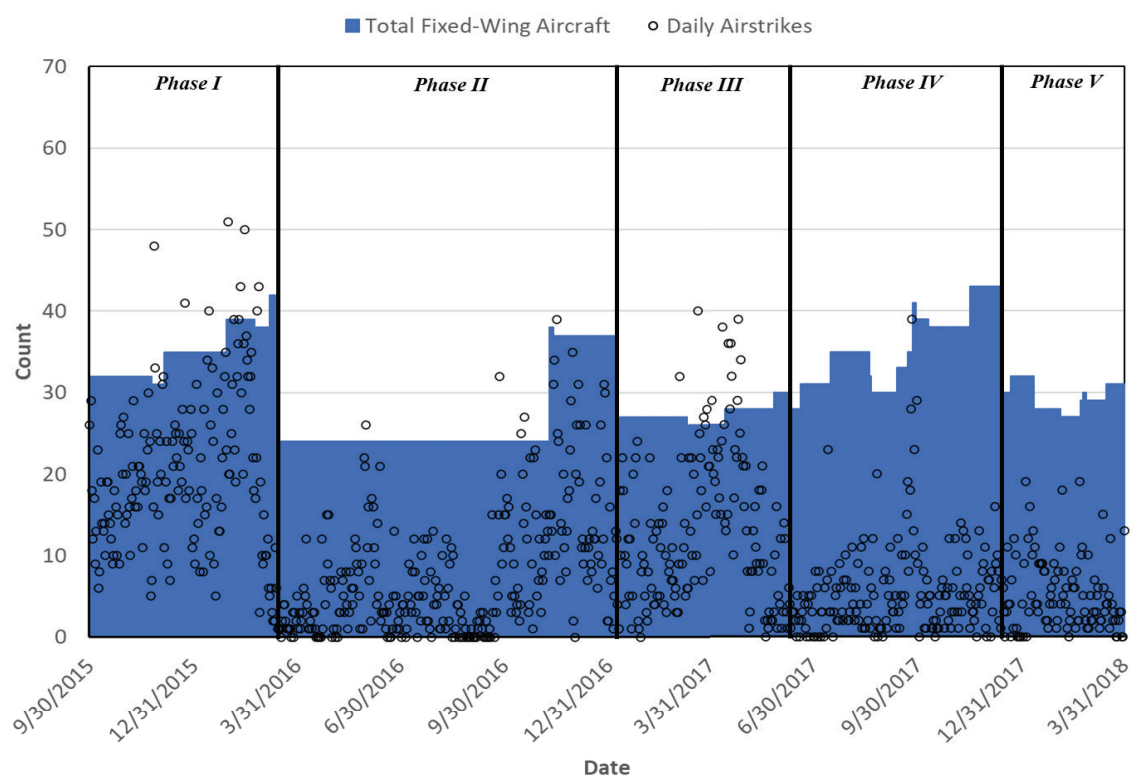
¹⁶ Wasser et al., 2021.

¹⁷ Wasser et al., 2021, pp. 326–327.

Analytical Approach and Intermediate Results

The integrated data collection process described in the previous section served as the foundation of our analysis. We constructed a history of Russia's air campaign that cross-references operational narratives with data on daily airstrikes, changes in territorial control, and numbers and locations of deployed aircraft. This approach enabled us to draw conclusions regarding the structure and execution of Russia's air campaign. For example, Figure 1.3 overlays daily Russian airstrike volumes atop our estimates of deployed Russian fixed-wing combat aircraft stationed at Hmeimim.

Figure 1.3. Daily Russian Airstrikes, Overlaid atop Deployed Fixed-Wing Combat Aircraft

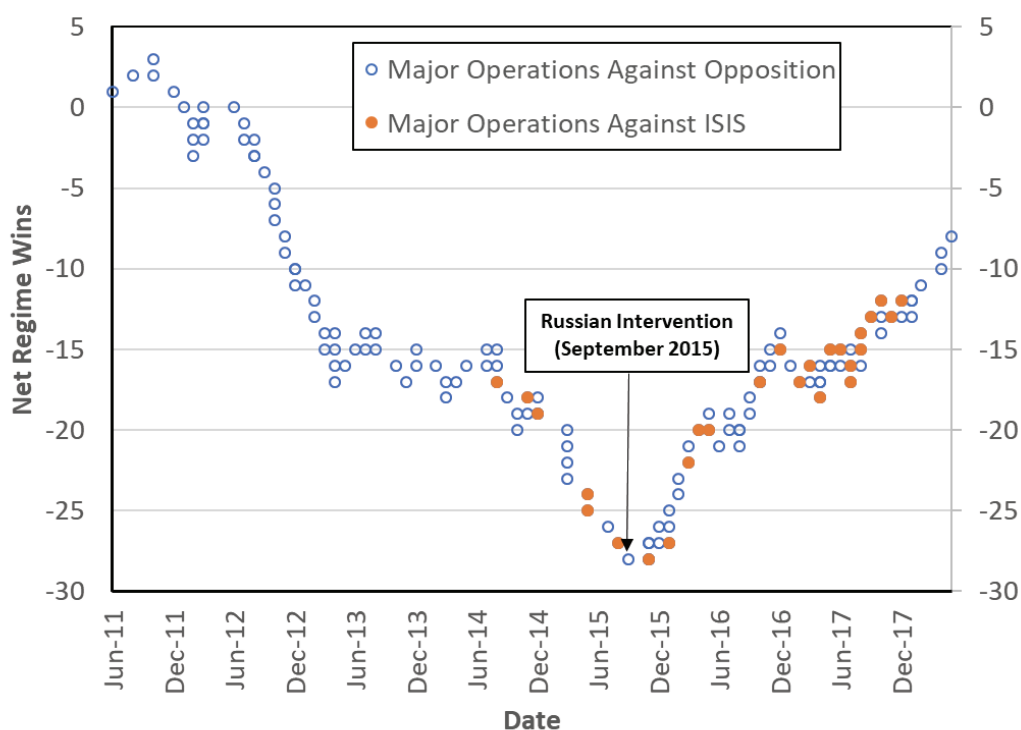


Several inferences may be drawn from this figure. First, strike patterns visually correspond to the five operational phases described above. Second, there is a strong correlation between aircraft rotations and the tempo of Russian airstrikes, with combat aircraft deployments ramping in parallel to major Russian air operations and receding thereafter. This relationship between aircraft rotations and operational tempo reflects a key development in Russian military concepts of operations (CONOPS), adopted by the Russian General Staff to optimize its expeditionary warfighting capability. Russian strategists devised a limited-liability military intervention that would obviate the need to commit overwhelming ground forces, limit conspicuous losses, and

avoid sunk costs. Russia’s lean approach embodied a small theater footprint, with Russian aerospace and naval forces providing support to allied Syrian, Iranian, and Shi’a militia ground forces. Maintaining this lean expeditionary capability thus required the VKS to periodically “deleverage” through at least three major force rotations.¹⁸

Our integrated approach also facilitated an assessment of the operational performance of Russian airpower. For example, we compared secondary accounts of major regime operations with an analysis of changes in territorial control to measure operational outcomes. Figure 1.4 presents our analysis of net wins by Syrian-allied forces in major operations from 2011 to 2018. We operationalize *net wins* as a cumulative measure of regime wins and losses in major operations since the conflict’s inception in 2011.

Figure 1.4. Net Wins by Syrian-Allied Forces in Major Operations, 2011 to 2018



As Figure 1.4 indicates, the Russian intervention was a clear inflection point in the Syrian military’s relative operational success. Combining this higher-level assessment of operational outcomes with georeferenced airstrike information, we can disentangle the relative effectiveness of Russian airpower against the Syrian opposition and ISIS, respectively. As we argue in the

¹⁸ Michael Kofman, “Syria and the Russian Armed Forces: An Evaluation of Moscow’s Military Strategy and Operational Performance,” in Robert E. Hamilton, Chris Miller, and Aaron Stein, eds., *Russia’s War in Syria: Assessing Russian Military Capabilities and Lessons Learned*, Philadelphia: Foreign Policy Research Institute, 2020, p. 51.

following chapters, the VKS's employment of airpower was, from the start of the campaign, significantly more effective in operations against the opposition than in operations against ISIS.

Organization of the Report

Chapter 2 tracks the chronology of Russian air operations in Syria from 2015 to 2018. Chapter 3 describes Russia's strategic and operational blueprint, basing strategy, and the disposition of VKS forces in Syria over that time. Chapter 4 assesses the strengths and weaknesses of Russian airpower in Syria. Chapter 5 offers concluding insights about the Russian intervention and its potential applicability beyond Syria.

2. Chronology of Russian Air Operations in Syria

Russia's Operational Priorities in Syria

In the four years following the inception of the Syrian civil war in early 2011, Russia assiduously refrained from directly participating in military operations. Mindful of the risks of escalation, the Russian government initially limited its engagement to providing arms, assistance, diplomatic backing, and other support to the Syrian regime. Although Russia's support was constrained prior to September 2015, this is not to suggest that it was insignificant. Indeed, the companion report to this study characterizes Russia's pre-2015 intervention in Syria as "medium-scale."¹ Moscow directed a "steady supply of materiel to Damascus" beginning in 2012, ramping up military assistance from "ammunition, small arms, and light weapons" in the early stages to "attack helicopters, unmanned aerial vehicles, air-defense systems, armored vehicles, radars, electronic warfare (EW) systems, and guided bombs."² In parallel,

Moscow consistently sought to undermine any justification for a Western military intervention to oust Assad. It vetoed resolutions authorizing action under Chapter VII of the UN Charter, which can be invoked to sanction the use of force, on three occasions—in October 2011 and again in February and July 2012. In June 2012, Russia successfully prevented any hint of regime change from appearing in the Geneva Communiqué, the peace plan for Syria that eventually was adopted as an UNSCR [United Nations Security Council Resolution].³

After a modicum of success in the autumn of 2014, Syrian government-aligned forces did not fare well in the early months of 2015. We analyzed operational outcomes in the Syrian conflict and found that the regime did not win a decisive victory in any of its nine major operations in 2015, from January through September. Advances by U.S.-backed opposition forces in both the northwest (Aleppo, Idlib) and southwest (Daraa, Damascus) resulted in two decisive losses for the regime: in Idlib and at the Battle of Bosra. ISIS gains in Homs and Deir al-Zour compounded the pressure on the Syrian government, which saw its geographic control dwindle to less than one-fifth of the country by early fall 2015.⁴ Figure 2.1 illustrates the distribution of geographic control among Syrian government, Kurdish (YPG), Syrian opposition (secular and Sunni Islamist rebel groups, Jabhat al-Nusra, etc.), and ISIS forces leading up to the Russian intervention in September 2015.

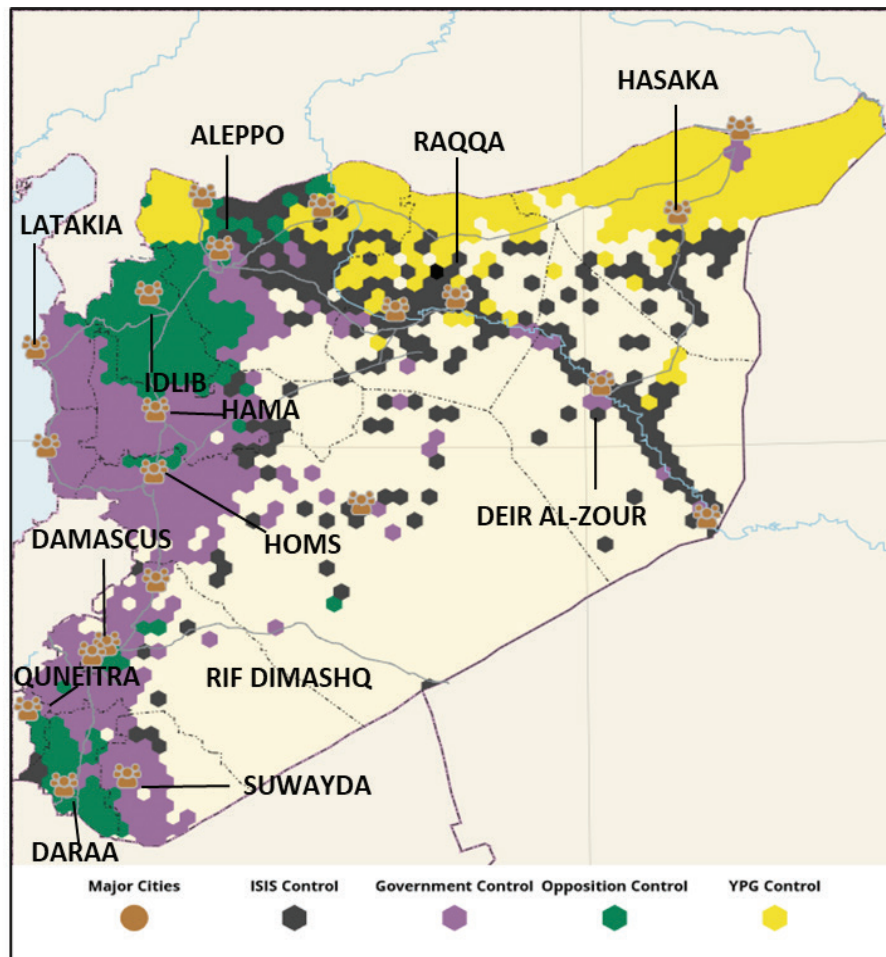
¹ Charap, Treyger, and Geist, 2019, pp. 13–14.

² Charap, Treyger, and Geist, 2019, p. 13.

³ Charap, Treyger, and Geist, 2019, p. 13.

⁴ Anna Maria Dyrer, "Two Years of Russian Military Operations in Syria: Results and Prospects," *Bulletin*, No. 103 (1043), Polish Institute of International Affairs, October 30, 2017, p. 1.

Figure 2.1. Map of Geographic Control in Syria, September 2015



NOTES: ISIS = Islamic State of Iraq and Syria. YPG = Yekîneyên Parastina Gel (Kurdish People's Protection Units).

By mid-2015, Syrian president Bashar al-Assad's military forces faced a key operational dilemma: at least two distinct sets of adversaries (the mélange of Syrian opposition forces and ISIS) had seized control of large swaths of territory spanning much of the country's geographic area. Both opposition and ISIS forces occupied sizable wedges of major Syrian cities, military installations, roadways and physical infrastructure, and natural resources. The opposition held pockets of territory surrounding the Syrian capital of Damascus, posing a direct threat to the Assad government. Meanwhile, ISIS had expropriated critical oil and gas assets in the northeast—a strategically important source of revenues for the Assad government.⁵ The dispersed posture of adversary forces and obstructed access to key roadways thus forced the regime to prioritize a limited set of immediate operational objectives.

⁵ See, for example, Quy-Toan Do, Jacob N. Shapiro, Christopher D. Elvidge, Mohamed Abdel-Jelil, Daniel P. Ahn, Kimberly Baugh, Jamie Hansen-Lewis, and Mikhail Zhizhin, *How Much Oil Is the Islamic State Group Producing? Evidence from Remote Sensing*, Policy Working Paper 8231, Washington, D.C.: World Bank, October 2017.

Although the regime's setbacks against ISIS were significant, ISIS strongholds tended to be geographically isolated from Damascus and Alawi enclaves in the northwest.⁶ From the Assad government's perspective, ISIS therefore posed no imminent threat to either the regime or its primary domestic constituency. Moreover, in the months prior to ISIS forces encircling Deir al-Zour and advancing on Palmyra (Tadmur), the regime had engaged ISIS in a stalemate of offensives and counteroffensives on two main fronts. By contrast, the Assad regime perceived opposition assaults on Alawi-majority regions in Hama and Latakia as a dire concern, since these communities constituted the key sources of the regime's domestic support.⁷ Syrian opposition forces thus posed severe operational risks to the regime on more fronts than did ISIS and, more importantly, constituted a more imminent threat to the regime's survival.

Meanwhile, the Kremlin watched the events unfold in Syria with a growing sense of alarm.⁸ ISIS's capture of Palmyra in May 2015 was a symbolic turning point for Russia's perception of the conditions on the ground. Then, in July, Turkey granted the "U.S.-led anti-ISIS coalition" access to its air bases, a decision that was swiftly denounced by Iran as an infringement of Syrian state "sovereignty."⁹ Some observers have concluded that Russia's decision to intervene crystallized in the wake of multiple visits to Moscow in July by the commander of Iran's Quds Force, Maj Gen Qassem Soleimani.¹⁰ Russia appears to have been receptive to such concerns given the proximity of its Tartus naval facility, one of the only military facilities it still possessed outside of the Russian near-abroad, to the encroaching rebel forces in Latakia. The prospect of a U.S.-led "safe zone" near Tartus likely contributed to the Russian calculus vis-à-vis military intervention.¹¹

The decision to intervene in September 2015 had thus been incubating for at least two months. Nevertheless, developments in northwest Syria during the late spring and early summer ultimately made the decision to intervene all but inevitable. The success of Islamist groups such as Jaysh al-Fatah and Jabhat al-Nusra across the northwest enabled Syrian rebel forces to seize nearly full control of the Idlib governorate by August 2015. As Charap et al. document, Russian foreign

⁶ Hugo Spaulding, Christopher Kozak, Christopher Harmer, Daniel Urchick, Jessica Lewis McFate, Jennifer Cafarella, Harleen Gambhir, and Kimberly Kagan, *Russian Deployment to Syria: Putin's Middle East Game Changer*, Washington, D.C.: Institute for the Study of War, September 17, 2015, p. 1.

⁷ Spaulding et al., 2015, p. 1.

⁸ For an assessment of contemporaneous Russian thinking and the factors underlying Russia's decision to intervene in Syria, see, for example, Charap, Treyger, and Geist, 2019.

⁹ Spaulding et al., 2015, p. 2.

¹⁰ Laila Bassam and Tom Perry, "How Iranian General Plotted Out Syrian Assault in Moscow," *Reuters*, October 6, 2015.

¹¹ Russia had considered Tartus little more than a "minor resupply point" with "little military significance" since the fall of the Soviet Union but that it acquired increasing significance as a core foundation of Russia's aspirations to develop an expeditionary force following its initial deployment in Ukraine. Indeed, losing access to Tartus would mean the loss of a critical naval resupply and logistics hub in the eastern Mediterranean, a prospect that Russia deemed unacceptable. See Kofman and Rojansky, 2018, p. 4.

policy experts “consistently emphasized that the Russian leadership believed the regime would have fallen . . . in months, if not weeks, had Russia not intervened.”¹² Russian decisionmakers shared the Assad government’s dire assessment of the regime’s prospects amid the opposition’s dual fronts in the northwest and southwest. From the regime’s perspective, Russian military action was nothing short of a survival imperative. In turn, Russian decisionmakers reasoned that intervening in Syria would enable Russia to forestall the Syrian regime’s imminent collapse, preventing a series of negative security outcomes and providing Russia with leverage to potentially coerce a negotiated settlement with the West.

Charap et al. reviewed contemporaneous Russian government statements, U.S. government reports, and conducted interviews with Russian foreign policy experts to compile a list of primary Russian objectives and secondary considerations. They identified three broad sets of factors underlying Russia’s decision to intervene: primary political-strategic, secondary political-strategic, and military.¹³ Table 2.1 displays each of these factors, broken out by particular objectives or other considerations.

Table 2.1. Factors Underlying Russia’s Intervention in Syria

Primary Political-Strategic Factors	Secondary Political-Strategic Factors	Military Factors
• Adverse military outcome imminent • Security implications • Exhaustion of diplomatic and other means	• Geopolitical benefits • Cover of international legitimacy • Significant, but not existential risks	• Uncontested airspace • Air base and port access • Friendly ground forces • Peer rival presence • History of defense cooperation • Significant on-the-ground intelligence sources • Maritime ease of access

SOURCE: Charap, Treyger, and Geist, 2019.

The Kremlin believed that an adverse military outcome would have “disastrous consequences for regional and global stability,” conjuring images of Russia’s “own struggle with Chechen separatism and the Soviet Union’s war against the mujahedeen in Afghanistan.”¹⁴ Moscow was further concerned with preventing the return to Russia of opposition and ISIS fighters who had originally hailed from former Soviet states.¹⁵ Perhaps most importantly, Russia viewed U.S.-backed

¹² Charap, Treyger, and Geist, 2019, p. 4.

¹³ See the project team’s companion publication on Russia’s motivations for intervening in Syria: Charap, Treyger, and Geist, 2019.

¹⁴ Charap, Treyger, and Geist, 2019, p. 4.

¹⁵ See James Sladden, Becca Wasser, Ben Connable, and Sarah Grand-Clement, *Russian Strategy in the Middle East*, Santa Monica, Calif.: RAND Corporation, PE-236-RC, 2017, pp. 3–5; and Spaulding et al., 2015, pp. 1–2.

regime change as a threat to its national security. Therefore, Russia viewed preserving the Assad regime not only as a vital symbolic objective for Russia but as a linchpin of Russian national security. Other key driving forces behind Russia's decision to intervene included restricting U.S. freedom of action in Syria and preempting the sort of Western "adventurism" it had perceived in Iraq, Libya, and Ukraine. Finally, the international community's efforts to find a diplomatic resolution to the Syrian conflict had stalled by 2015. After the Western-backed Syrian National Coalition boycotted Russia's two rounds of government-opposition talks in early 2015, Russian government officials "came to believe that diplomacy had been tried and had failed to deliver."¹⁶

Countering ISIS was, in contrast, only a subsidiary objective in Russia's decision to intervene in Syria. ISIS posed neither an immediate threat to regime survival nor a direct security risk to the Russian homeland.¹⁷ However, ISIS factored into Russian strategic and operational planning in five key ways. First, Russia was able to parlay the West's counter-ISIS agenda to frame its intervention as equally legitimate to the Coalition's efforts. Russian officials then used this justification for its attacks on all forces opposed to Assad, providing at least the pretense of legitimacy to all Russian operations in Syria—whether against ISIS or not.¹⁸

Second, even if ISIS posed a lesser threat to the government's survival than did the various opposition groups, ISIS forces had nevertheless besieged major Syrian cities and strained Syrian military resources. A Russian military presence directed against ISIS enabled the Syrian Arab Army (SAA) to more efficiently target its resources and effects elsewhere (i.e., protecting Alawi-majority enclaves and degrading the U.S.-backed opposition in the northwest).

Third, containing both opposition and ISIS forces was, in Russia's view, vital to preventing the return of foreign fighters who had hailed from former Soviet states.¹⁹ Fourth, some analysts have argued that Russia considered Deir al-Zour, which had been under heavy assault by ISIS for more than a year, a valuable long-term strategic priority due to its proximity to Syria's oil and mineral wealth.²⁰ Fifth and finally, Russia's counter-ISIS area of operations abutted U.S.-led Coalition air operations, which offered the potential for Russia's military to intimately study NATO's capabilities and tactics, techniques, and procedures (TTPs).

¹⁶ Charap, Treyger, and Geist, 2019, pp. 6–7.

¹⁷ Russia did view the spread of ISIS as a security threat to the Russian homeland but only as a by-product of the potential collapse of the Assad regime.

¹⁸ There is evidence that the Kremlin did not consider these objectives to be in conflict; rather, Russian doctrine treated all Islamist-aligned rebel groups in Syria, including those backed by the West, as terrorist organizations. See below.

¹⁹ See Sladden et al., 2017, pp. 3–5; and Spaulding et al., 2015, pp. 1–2.

²⁰ See, for example, Anton Lavrov, "Russian Aerial Operations in the Syrian War," in Robert E. Hamilton, Chris Miller, and Aaron Stein, eds., *Russia's War in Syria: Assessing Russian Military Capabilities and Lessons Learned*, Philadelphia: Foreign Policy Research Institute, 2020; and Timothy Thomas, *Russian Combat Capabilities for 2020: Three Developments to Track*, MITRE, No. MTR190740, December 2019.

However, closer to the root cause of the intervention, the Syrian opposition's ever-tightening control over northwest Syria directly raised the regime's odds of complete collapse. Following its decision to intervene, Russia heavily concentrated its airpower in areas controlled by U.S.-backed opposition forces. Russia's CONOPS eschewed precision targeting for indiscriminate bombing, often delivered to civilian populations and urban areas. Russia's initial employment of airpower thus reflected the urgency with which it sought to stave off defeat for its Syrian government allies and, secondarily, a theory of coercive bargaining that was designed to compel political negotiations with the West.

Timeline of Russia's Air Campaign

In late July 2015, open-source GEOINT observers geolocated Russian Spetsnaz special forces troops being "discreetly deployed" to Syria, ostensibly as military advisers to the SAA.²¹ Satellite imagery captured a steady stream of Spetsnaz forces flowing into Syria throughout August, culminating in the first confirmed arrival at Tartus of a Russian Alligator-class landing ship tanker transporting BTR-82A armored personnel carriers.²²

Then, on August 26, the Russian and Syrian governments signed a formal leasing agreement that effectively transferred control of the Hmeimim air base, located at Bassel al-Assad airport in Latakia Province, to the VKS for at least twelve months.²³ Satellite imagery captured the arrival of Russian engineering units, prefabricated housing, and portable air traffic control towers to Hmeimim over the next two weeks, signaling a concerted effort by the VKS to extend the airfield's aprons, construct additional runway space, and upgrade the shelters for a sizable contingent of fixed- and rotary-wing aircraft.²⁴

Throughout late August, the VKS incrementally deployed aviation assets to Hmeimim through a combination of air and sea transport. The deployed Russian air wing included two fixed-wing attack squadrons and one fighter-bomber squadron. The VKS supplemented its fixed-wing force with three helicopter detachments, each composed of four Mi-24P *Hind-F* attack helicopters and one Mi-8AMTSh *Hip* transport helicopters.

A series of Russian airstrikes on September 30, 2015, irrevocably transformed Russia's participation in the Syrian civil war into a direct military intervention. Following strikes in Homs and Hama Provinces, Russian aircraft targeted rebel groups in the provinces of Latakia, Idlib, and Aleppo, and ISIS forces in the provinces of Raqqa and Deir al-Zour, over the next

²¹ Sarah Fainberg, "Russian Spetsnaz, Contractors and Volunteers in the Syrian Conflict," *Russie.Nei.Visions*, No. 105, Ifri, Translated by Frances Thomas, December 2017, pp. 5–6, 12.

²² Spaulding et al., 2015, p. 2.

²³ Michael Birnbaum, "The Secret Pact Between Russia and Syria That Gives Moscow Carte Blanche," *Washington Post*, January 15, 2016.

²⁴ Lavrov, 2018, p. 1; John Tirpak, "Russian Roulette," *Air Force Magazine*, December 2015, p. 43.

several days, in what Russian observers came to describe as Operation Vozmezdie (“Retribution”).

Table 2.2 provides the chronology of major counteropposition and counter-ISIS operations in which the VKS played at least a supporting role. The VKS supported 31 major counteropposition operations, versus 18 counter-ISIS operations, during the time frame covered in this analysis (September 2015 through March 2018). The counteropposition operations spanned 31 months; the counter-ISIS operation spanned 25 months. The former covered 70 overlapping months (or “operation months”), the latter, 37. All shaded rows in Table 2.2 represent major counter-ISIS operations, while all unshaded rows represent major counteropposition operations.

Table 2.2. Major Russian-Supported Operations, 2015 to 2018

Major Operation Name	Initiator	Governorate	Dates
Phase I (September 2015 to March 2016): Heavy Focus on Opposition Forces			
Battle of Aleppo (Kuweires Offensive)	Regime/Russia	Aleppo	September–November 2015
Latakia Offensive	Regime/Russia	Latakia	October–November 2015
Northwest Syria Offensive	Regime/Russia	Hama	October–November 2015
Battle of Aleppo (SAA Offensive)	Regime/Russia	Aleppo	October–December 2015
Aleppo Governorate Offensive	Regime/Russia	Aleppo	October–December 2015
Battle of Deir al-Zour	ISIS	Deir al-Zour	November 2015
Latakia Offensive	Regime/Russia	Latakia	December 2015–January 2016
Battle of Deir al-Zour	ISIS	Deir al-Zour	January 2016
Battle of Aleppo (SAA N. Aleppo)	Regime/Russia	Aleppo	February 2016
Latakia Offensive	Regime/Russia	Latakia	February–March 2016
Phase II (March to December 2016): A Veneer of Good Faith			
Battle of Palmyra	Regime/Russia	Homs	March 2016
Battle of Deir al-Zour	Regime/Russia	Deir al-Zour	March–May 2016
Battle of Aleppo (Opposition S. Aleppo)	Opposition	Aleppo	April–June 2016
Battle of Aleppo (SAA Offensive)	Regime/Russia	Aleppo	June–July 2016
Battle of Aleppo (Opposition Counteroffensive)	Opposition	Aleppo	July–August 2016
Battle of Yarmouk	Opposition	Latakia	June–August 2016
Battle of Aleppo (SAA Offensive)	Regime/Russia	Aleppo	August–September 2016
Latakia Offensive	Regime/Russia	Latakia	September 2016
Battle of Aleppo (Fall SAA Offensive)	Regime/Russia	Aleppo	September–October 2016
Battle of Aleppo (Opposition Counteroffensive)	Opposition	Aleppo	October–November 2016
Operation Dawn of Victory	Regime/Russia	Aleppo	November–December 2016

Major Operation Name	Initiator	Governorate	Dates
Phase III (December 2016 to July 2017): Shift to ISIS			
Battle of Palmyra	ISIS	Homs	December 2016
Battle of Deir al-Zour	ISIS	Deir al-Zour	January–February 2017
Battle of Palmyra	Regime/Russia	Homs	January–March 2017
Daraa Offensive	Opposition	Daraa	February–March 2017
Battle of Deir al-Zour	Regime/Russia	Deir al-Zour	March–April 2017
Hama Offensive	Opposition	Hama	March–April 2017
Syrian Desert Campaign	Opposition	Suwayda	March–April 2017
Eastern Homs Offensive	Regime/Russia	Homs	March–May 2017
Daraa Offensive	Opposition	Daraa	April–May 2017
Central Syria Campaign	Regime/Russia	Raqqa	May–June 2017
Syrian Desert Campaign	Regime/Russia	Homs	May–July 2017
Syrian Desert Campaign	Regime/Russia	Suwayda	May–July 2017
Battle of Deir al-Zour	Regime/Russia	Deir al-Zour	June–July 2017
Daraa Counterattack	Regime/Russia	Daraa	June–July 2017
Phase IV (July to December 2017): Nearly Exclusive Focus on ISIS			
Jobar Offensive	Regime/Russia	Rif Dimashq	June–August 2017
Central Syria Campaign	Regime/Russia	Raqqa	July–August 2017
Central Syria Campaign	Regime/Russia	Hama/Homs	August 2017
Battle of Deir al-Zour	Regime/Russia	Deir al-Zour	August–September 2017
Euphrates Crossing Offensive	Regime/Russia	Deir al-Zour	September–October 2017
Hama Offensive	Opposition	Hama	September–October 2017
Battle of Deir al-Zour	Regime/Russia	Deir al-Zour	September–November 2017
Northwest Syria Campaign	Regime/Russia	Hama	October 2017
Abu Kamal Offensive	Regime/Russia	Deir al-Zour	October–December 2017
Northwest Syria Campaign	Regime/Russia	Aleppo	November–December 2017
Battle of Harasta	Opposition	Rif Dimashq	November 2017–January 2018
Phase V (December 2017 to March 2018): Settling in Permanently			
Northwest Syria Campaign	Regime/Russia	Idlib	December 2017–January 2018
Rif Dimashq Offensive	Regime/Russia	Rif Dimashq	February–April 2018

NOTE: Shaded rows represent major counter-ISIS operations; unshaded rows represent major counteropposition operations.

Five Phases of Russia's Air Campaign in Syria

Russia's campaign in Syria can be partitioned into five phases that capture distinct shifts in Russian strategic priorities, force employment and basing patterns, and operational tempo. The first phase, beginning with the VKS's initial deployment in September 2015, reflected a heavy

focus on degrading Syrian rebel forces. Counter-ISIS operations were sporadic and typically involved long-range bombers stationed at bases in Russia.

In the second phase, beginning with an initial cessation of hostilities negotiated between a group of world powers (including the United States and Russia) in February 2016, the VKS significantly de-escalated its counteropposition air operations. This gesture reflected a genuine desire by Russian leaders to reach a favorable political settlement with the West. When the VKS maintained a steady-state theater force presence and continued to provide air support to the SAA's assault of Aleppo, despite intimations to the contrary, it became clear that Russia's veneer of good faith was designed to maximize military leverage for subsequent negotiations with the West. Following the collapse of bilateral negotiations between the United States and Russia in September 2016, however, the SAA completed its brutal recapture of Aleppo with significant Russian air support. This crippling blow to the opposition highlighted the broad success of Russia's initial strategic objectives—preventing the collapse of the Assad regime, countering U.S. influence in the Syrian conflict, and establishing a successful expeditionary warfare capability—and signaled the onset of a new phase in Russia's campaign.

In the third phase, following the regime's recapture of Aleppo in December 2016, the VKS shifted its focus to ISIS. The resurgence of ISIS throughout the winter of 2016–2017 directly threatened Russia's newly developed expeditionary basing and logistics infrastructure. The VKS limited its participation in the regime's counteropposition operations to defensive air support, enabling it to concentrate its airpower on clearing ISIS out of Homs Province to prepare for a major assault on Deir al-Zour.

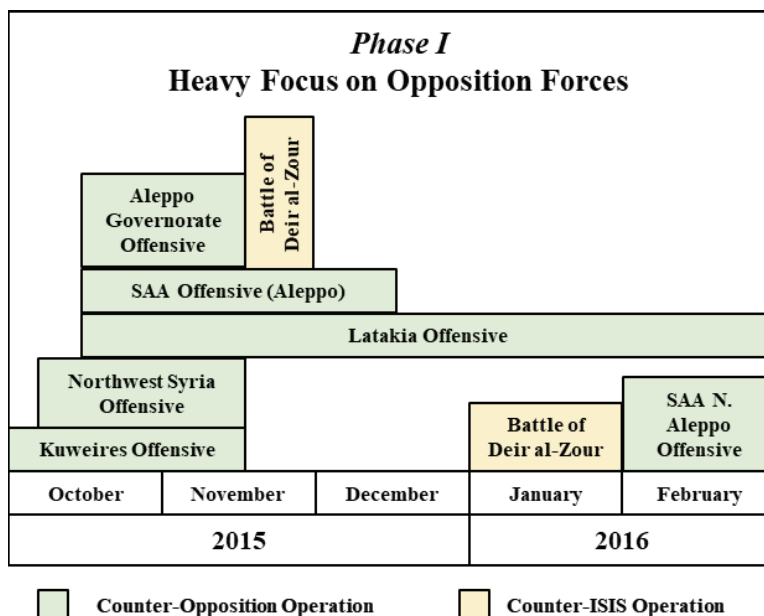
This transition to a nearly exclusive focus on ISIS constituted the fourth operational phase, from July through December 2017. After achieving a “complete victory” over ISIS in central Syria and Deir al-Zour in December 2017, the VKS withdrew most of its aviation assets from counter-ISIS operations, focused on eliminating remaining pockets of opposition forces in Damascus and Idlib, and began to settle in permanently in the fifth and final phase analyzed in this report.²⁵

The following sections explore each of the five major Russian operational phases in greater detail, combining data on Russian airstrikes with force deployment patterns to illustrate the evolution of Russian strategic objectives in Syria. Figures 2.2, 2.4, 2.6, 2.8, and 2.10 provide timelines for the individual phases of Russia's air campaign in Syria.

²⁵ Putin quoted in Stubbs, 2017.

Phase One (September 2015 to March 2016): Heavy Focus on Opposition Forces

Figure 2.2. Phase One Timeline, by Month and Major Operation



From the outset of the intervention, Russian officials justified the country’s escalation of military force by citing counter-ISIS considerations. Russian Defense Ministry spokesman Maj Gen Igor Konashenkov characterized the initial barrage of airstrikes on September 30, 2015, as “pinpoint strikes against ground targets of the IS terrorist group.”²⁶ The counter-ISIS narrative pervaded the Russian government’s public statements in the earliest stages of its air campaign. It is clear, in retrospect, that Russian president Vladimir Putin’s address to the United Nations on September 28, 2015, proposing an international coalition to counter ISIS and “other terrorist” organizations in Syria, was a trial balloon for Russia’s counter-ISIS justification to intervene in the Syrian conflict.²⁷

Some Western observers have claimed that the Kremlin’s counter-ISIS rationale was ultimately belied by the geographic distribution of observed Russian airstrikes and by the Russian government’s own evolving rhetoric.²⁸ U.S. State Department figures and independent

²⁶ Reported in Czuperski et al., 2016, p. 10.

²⁷ Reported in Czuperski et al., 2016, p. 10. It is worth noting that Putin also called for nonintervention in his 2015 speech to the United Nations (UN). Importantly, he presented nonintervention in such a way as to promote the stability of existing regimes, which became part of Russia’s imprimatur for intervention. We are grateful to Becca Wasser for pointing this out. See Sladden et al., 2017.

²⁸ For example, Czuperski et al. (2016) argue that Putin invoked ISIS to deceive the international community and distract from Russia’s real target: U.S.-backed Syrian opposition groups. See also Azmi Bishara, *Russian Intervention in Syria: Geostrategy Is Paramount*, Al Dhaayen, Qatar: Arab Center for Research & Policy Studies, November 2015, pp. 8–11; and Brian Glyn Williams and Robert Souza, “The Consequences of Russia’s ‘Counterterrorism’ Campaign in Syria,” *CTC Sentinel*, Vol. 9, No. 11 (November/December 2016), pp. 23–24.

estimates indeed suggest that over 90 percent of Russian airstrikes in the first week of the campaign, and about 80 percent in the first month, targeted groups other than ISIS.²⁹ As it became clear that the initial strikes had disproportionately targeted areas held by Western-backed Syrian rebel groups, and not by ISIS, official Russian justifications for its use of military force began to conflate ISIS with other “terrorist” organizations operating in Syria. Over time, Russian officials came to publicly define all organizations fighting against the Syrian government—including ISIS, Islamist cells such as Jabhat al-Nusra, and secular rebel groups such as the Free Syrian Army—as terrorists.

Still other analysts of Russian military doctrine have countered that to claim Russia’s initial counter-ISIS justifications were deceptive is to misread Russian strategic thinking. Borshchevskaya observes that Russia’s approach to counterterrorism operations in Syria—the belief that “anyone who is armed and opposes Assad is a terrorist”—was consistent with the Kremlin’s “historic definition of terrorism and approach to it.”³⁰ The very notion of a “moderate” Syrian opposition, Russian analysts have contended, is a misnomer, since many Western-backed rebel groups have overt ties to Jabhat al-Nusra and other Islamist organizations.³¹ The companion report to this one argues:

Since preserving the regime (what Putin calls “Syrian statehood”) was a necessary precondition for any effective counterterrorism strategy, attacking those groups that were threatening the regime’s survival was the most urgent priority. Therefore, the initial focus of the bombing on the non-ISIS opposition does not necessarily undermine the case that Moscow genuinely feared the terrorist threat stemming from the Assad regime’s collapse.³²

According to this view, the Assad regime’s survival was critical to Russia’s counterterrorism strategy. Russian strategists believed that maintaining the Syrian government was essential to both conducting the ground campaign and holding territory. Therefore, Russian operational plans prioritized those groups that posed the most significant threat to the regime.

The VKS’s force employment and strike patterns early in its Syria campaign were thus important indicators of Russia’s strategic and operational priorities. More than three-quarters of observed Russian airstrikes in the first months targeted opposition-held areas. Likewise, VKS operational planning prioritized counteropposition operations for most of its deployed combat

²⁹ For further reading on independent estimates of the distribution of Russian airstrikes, see Czuperski et al., 2016, p. 12; and Lavrov, 2018, p. 2.

³⁰ Anna Borshchevskaya, “The Russian Way of War in Syria: Threat Perception and Approaches to Counterterrorism,” in Robert E. Hamilton, Chris Miller, and Aaron Stein, eds., *Russia’s War in Syria: Assessing Russian Military Capabilities and Lessons Learned*, Philadelphia: Foreign Policy Research Institute, 2020, p. 23. See also Yossef Bodansky, “The Evolution of Russian, Syrian, and Iranian Actions Against the Jihadist Movement and Turkish-U.S. Responses,” *ISPSW Strategy Series: Focus on Defense and International Security*, Issue No. 394, Institute for Strategic, Political, Security and Economic Consultancy, January 2016, p. 2.

³¹ Charap, Treyger, and Geist, 2019, p. 5.

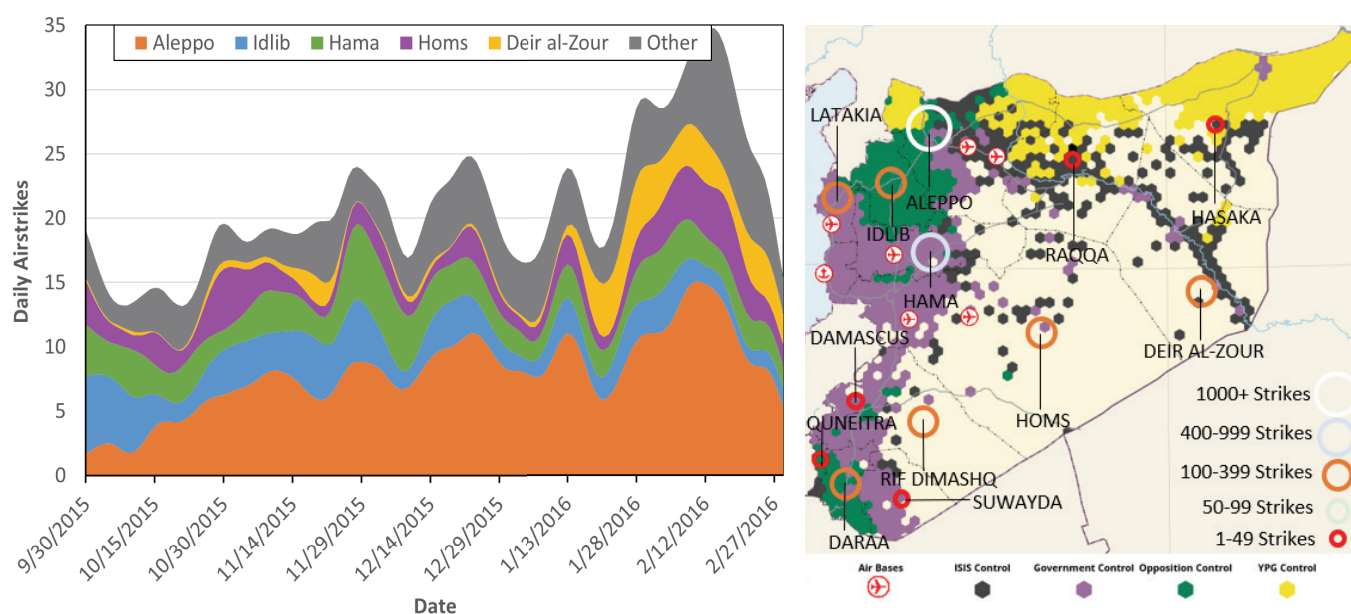
³² Charap, Treyger, and Geist, 2019, p. 5.

aircraft. Initial combat air operations had two primary objectives: to “restore ground lines of communication and main roads linking infrastructure” and to “create a buffer space around the Russian base of operations” in Latakia.³³ As analyst Michael Kofman observed, these patterns reflected the Russian military’s operational imperatives at the outset: to “change the momentum on the battlefield, halt the advance against Assad’s forces, and bolster the morale of regime units and affiliated militias by providing them with combat air power.”³⁴

By contrast, Russia’s reluctance to dedicate theater assets to counter-ISIS operations early in the campaign reflected both the lower strategic priority that Russia placed on ISIS and the logistical challenges that counter-ISIS operations posed, at that time, to government-allied forces in Syria. ISIS controlled large stretches of the Homs and Deir al-Zour highways by 2015, which impeded Russian and SAA supply lines from Hmeimim. Moreover, Syrian air bases had not yet been improved to host VKS detachments. Finally, Russia struggled to generate adequate ISR over ISIS-controlled areas to support major air operations.

Figure 2.3 displays the geographic distribution of daily Russian airstrikes, broken out by Syrian governorate. Initial VKS airstrikes were heavily clustered in Aleppo, Idlib, Hama, Homs, and Latakia (“Other”)—regions populated principally with opposition forces—but counter-ISIS air operations in Raqqa (“Other”) and Deir al-Zour are likewise modestly discernible.

Figure 2.3. Daily Russian Airstrikes, by Syrian Governorate, September 2015 to March 2016



NOTE: “Other” includes Latakia, Raqqa, Hasaka, Damascus, Quneitra, Rif Dimashq, Suwayda, and Daraa.

³³ Kofman, 2020, pp. 49, 51.

³⁴ Kofman, 2020, p. 49.

In October and early November, the VKS employed a combination of strike aircraft (Su-24s, Su-25s, and Su-34s) to deliver air-to-ground effects to primarily opposition targets in Latakia, Aleppo, and Hama Provinces, as well as ISIS targets in Raqqa and Homs Provinces. Most counteropposition operations fell within the combat radii of deployed Russian fighter-bomber squadrons stationed at Hmeimim (see Chapter 3). The air campaign's early workhorse in counteropposition strike missions was the older Su-24M variant. Some observers have argued that the VKS's early employment of older-model aircraft bespoke its primary operational aims—namely to degrade the Syrian opposition in northwest Syria by inflicting indiscriminate damage in order to stanch the opposition's momentum and restrict its transport and supply lines in Latakia and Hama.³⁵ Many strike operations early in the campaign involved preplanned, static targets, often in urban areas.³⁶ Most published estimates suggest that over 80 percent of ordnance delivered in the first months of Russian air operations was unguided, with Su-24s and Su-25s typically dropping free-falling “dumb bombs” with minimal target identification.³⁷

Meanwhile, Russia's limited focus on ISIS early in the campaign aimed to relieve SAA-occupied military bases that had been besieged by ISIS. Deir al-Zour, soon to become a focus of Russian air efforts, was not only a target for its strategically important oil infrastructure; Syrian forces stationed at the Deir al-Zour air base absorbed a three-month ISIS onslaught beginning in September 2015. Concurrently, SAA and Shi'a militia ground forces near Aleppo, supported by Russian airpower, initiated an offensive against ISIS, which had encircled the Kuweires air base.³⁸ Throughout October and November, the VKS also kept a squadron of Su-25 strike aircraft and a helicopter unit on alert status at Hmeimim to generate close air support (CAS) for counter-ISIS operations in Hama and Homs.

The first distinct shift in the VKS's employment of airpower began in November 2015, following two watershed events. First, President Putin declared on November 16 that ISIS had been responsible for the Metrojet Flight 9268 crash in Egypt two weeks earlier, and he signaled the need to intensify Russian air operations in Syria as part of a “retaliation campaign.”³⁹ Consequently, the VKS stationed two dozen long-range bombers, as well as an additional squadron of Su-34s and Su-27s, at the Mozdok and Engels air bases in southwestern Russia,

³⁵ For example, Genevieve Casagrande and Kathleen Weinberger, *Putin's Real Syria Agenda*, Washington, D.C.: Critical Threats Project, Institute for the Study of War, March 2017, p. 2; Kofman and Rojansky, 2018, p. 15; and Shield, 2018, p. 235.

³⁶ Daniel Trombly, “Russia's Military Role in Syria,” *USNI News*, November 13, 2015; Gary Wetzel, “Russia's Involvement in Syria Proves That It's Far Behind the Western World,” *FoxtrotAlpha*, May 5, 2017.

³⁷ The Su-24s typically employed 500 kg FAB-500M-62 high-explosive bombs, while Su-25s typically employed 250 kg OFAB-250-270 high-explosive fragmenting bombs and cluster bombs. See Tom Cooper, “Here's the Key to Understanding the Russian Air Force's Actions in Syria,” *War Is Boring*, June 6, 2016; Robert Lee, “Russia's Military Operation in Syria,” *Armed Forces*, Moscow Defense Brief No. 2, 2017, p. 11; and Shield, 2018, p. 217.

³⁸ Seth G. Jones, “Russia's Battlefield Success in Syria: Will It Be a Pyrrhic Victory?” *CTC Sentinel*, October 2019, p. 5.

³⁹ Lavrov, 2018, p. 6.

more than doubling the intertheater strike force “able to target positions in Syria.”⁴⁰ Throughout the next year, the VKS relied on the long-range bombers (Tu-160s, Tu-95MSMs, and Tu-22M3s), often in concert with cruise-missile strikes from Russian destroyers stationed in the Mediterranean, to target the remote ISIS forces in Deir al-Zour and Raqqa. The VKS targeted “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.”⁴¹ Russia carried out its retaliatory assault of ISIS oil infrastructure in Deir al-Zour in parallel to the CJTF-OIR’s own strike campaign (dubbed Operation Tidal Wave II) against ISIS’s oil resource base, which began in October 2015 and lasted two full years.⁴²

The common narrative, propagated by Russian government officials and treated as credible by most Western observers, is that the VKS doubled its daily sortie rate immediately following the Metrojet crash. Soon after Putin’s announcement, daily combat sorties reportedly peaked at more than 100 (by some estimates, as high as 143 in November 2015).⁴³ However, we are dubious of the veracity of this narrative. First, most publicly released Russian sortie and targeting figures are highly suspect for reasons we outline in Chapter 4. Although the VKS’s transfer of long-range aviation forces to Mozdok following the Metrojet crash is well documented, we find little evidence in our data of a sustained Russian punishment campaign against ISIS in Deir al-Zour (see Figure 2.3).

Total Russian airstrikes in Syria steadily rose from October 2015 through February 2016; however, Figure 2.3 clearly demonstrates that Russian airstrikes did not spike in Deir al-Zour until January 2016. Therefore, the ramp-up in air activities beginning in late fall 2015 was likely uncorrelated with the Metrojet episode. It is far more plausible, in contrast, that the increase in Russian air activities was principally driven by counteropposition operations in Aleppo. Indeed, Figure 2.3 conspicuously displays the VKS’s assault on Aleppo, leading into the cessation of hostilities in February 2016. This suggests that either the punishment campaign against ISIS was delayed or that the Russian government’s initial narrative regarding its planned counter-ISIS campaign in Deir al-Zour was primarily a rhetorical tool to mask its true intentions in Aleppo.

The second watershed event occurred on November 24, when a Turkish F-16 jet shot down a Russian Su-24 in Turkish airspace.⁴⁴ In response, the VKS launched two Mi-8AMTSh-V transport helicopters, along with a single Mi-24P attack helicopter providing top cover, in a combat search

⁴⁰ Genevieve Casagrande, *Russian Airstrikes in Syria: September 30, 2015–September 19, 2016*, Washington, D.C.: Critical Threats Project, Institute for the Study of War, undated, p. 50. The specific long-range bombers employed included between 12 and 14 Tu-22M3 long-range bombers based at Mozdok and a half-dozen each of Tu-95MS and Tu-160 strategic bombers based at Engels.

⁴¹ Lavrov, 2020, pp. 93–94.

⁴² For a comprehensive account of Operation Tidal Wave II, see Wasser et al., 2021.

⁴³ Lavrov, 2018, pp. 5–7.

⁴⁴ Trudeau, 2015.

and rescue (CSAR) mission to rescue the downed two-man crew.⁴⁵ Because the deployed Mi-24 attack helicopters were only daylight-capable, the mission occurred in “broad daylight,” and all three helicopters were targeted by ground fire in insurgent territory. Both Mi-8s were damaged in the operation, and one subsequently crashed.

This event starkly highlighted the limitations of the Mi-24P in the Syrian theater: In addition to being daylight-only, the older helicopter model does not possess a modernized self-protection capability to counter surface-to-air threats.⁴⁶ Russian attack helicopters began to perform CAS in counter-ISIS operations in Hama and Homs in October, along with providing an air assault role in Syrian ground operations to counter the opposition’s use of tube-launched, optically tracked, wire-guided (TOW) missiles against Syrian tanks.⁴⁷ The VKS was therefore compelled to supplement its deployed rotary-wing force with newer, more-capable models to support the growing importance of attack helicopters in Russian CONOPS. In early December, Russia deployed a unit of Mi-35M attack helicopters, an upgraded variant of the Mi-24 that is day/night-capable, possesses an electro-optical turret featuring “a modern FLIR/TV system for targeting,” and “at least one” was equipped with the Vitebsk integrated self-protection suite.⁴⁸

Russia’s deployment of newer rotary-wing platforms to minimize operational risks in counter-ISIS missions coincided with its increasing willingness to experiment with basing configurations. Beginning in early November 2015, the VKS stationed one helicopter detachment each, composed of four Mi-24/35 attack helicopters and one Mi-8, at the al-Shayrat and Tiya (“T-4”) air bases in the Homs governorate to support the Syrian regime’s ground operations along the Homs-Hama highway. This move was emblematic of the hub-and-spokes basing model, described in Chapter 3, that the VKS increasingly used to execute its counter-ISIS operations.

The Turkish shootdown of the Russian Su-24 thus fundamentally altered the VKS’s CONOPS and basing posture for core air-to-ground missions in Syria (e.g., CAS, CSAR). However, the episode further transformed Russia’s prosecution of air-to-air and surface-to-air missions. In addition to raising questions about Russian pilot inexperience (a major concern for the VKS throughout the early campaign; see Chapter 4), the encounter with the Turkish F-16 offered a stark reminder of the congested nature of Syrian airspace and the risks of escalation.⁴⁹ Prior to Russia’s air campaign in Syria, the VKS had a mixed record conducting joint operations, securing air superiority, and providing effective air-to-ground integration. This had led Russian military strategists and operational planners to identify uncontested airspace as an operational

⁴⁵ Wetzel, 2017.

⁴⁶ Wetzel, 2017.

⁴⁷ Williams and Souza, 2016, p. 24.

⁴⁸ Wetzel, 2017.

⁴⁹ See, for example, Hamilton, Miller, and Stein, 2020, p. 4; Jones, 2020, p. 57; and Wasser et al., 2021, p. 260.

precondition.⁵⁰ Minimizing operational risks, high rates of attrition, and the probability of escalation were therefore key components in Russia's early strategic planning.

However, the encounter with the Turkish F-16 highlighted deficiencies in Russian capabilities and operational execution. As Hamilton et al. observe, the episode "rais[ed] tensions between Moscow and Ankara to levels not seen since the Cold War."⁵¹ This prompted the VKS to take several key actions, including tasking deployed Su-30 fighters exclusively with ensuring air superiority and providing air-to-air escort on all strike sorties.⁵² Russia also doubled the number of Su-34s stationed at Hmeimim, to eight, in early December 2015 and, for the first time, deployed four Su-35S air-to-air fighters the following month to supplement the existing force. Finally, Russia stood up S-300 and S-400 surface-to-air missile systems in Syria in late November to protect its main air base at Hmeimim and to deter Turkey and the United States from establishing a no-fly zone.⁵³ Formulating clear deconfliction mechanisms and minimizing the risk of escalation also became increasingly urgent priorities for Russian military and political leaders, as evidenced by Russia's role in UN-led peace talks and bilateral discussions with their U.S. counterparts (see Chapter 4).

From December 2015 through February 2016, Russian intratheater air assets were primarily employed in support of the SAA's offensive across the northwest, which targeted opposition forces in Hama, Latakia, and Aleppo. VKS assets available for counter-ISIS operations were limited to the long-range bombers stationed at Mozdok and Engels in southwestern Russia, which conducted several air-to-ground sorties to slow the ISIS siege of Deir al-Zour, and rotating attack helicopter units at Shayrat and Tiya, which provided CSAR for VKS pilots and CAS to Syrian ground forces, respectively, in Homs Province.

During the fall of 2015, VKS aircraft averaged between 40 and 80 daily combat sorties.⁵⁴ According to published Russian figures, daily combat sorties spiked to between 100 and 130 by February, generating a crescendo of Russian and Syrian airstrikes that targeted opposition forces in Aleppo.⁵⁵ By some estimates, Russian combat sorties totaled over 6,000 during the first phase of the air campaign; however, as we discuss in Chapter 4, there are reasons to doubt these figures.⁵⁶ Following the unanimous adoption of the UN Security Council's Resolution 2254, which called for an immediate cease-fire and a political settlement to the Syrian conflict, a group of world powers negotiated an initial cease-fire in Munich that culminated in the United States

⁵⁰ Charap, Treyger, and Geist, 2019, p. 19.

⁵¹ Hamilton, Miller, and Stein, 2020, p. 4.

⁵² Daniel Brown, "These Are the 11 Types of Russian Military Jets and Planes Known to Be Stationed in Syria," *Business Insider*, February 26, 2018.

⁵³ Jonathan Marcus, "Russian S-400 Syria Missile Deployment Sends Robust Signal," *BBC*, December 1, 2015.

⁵⁴ Kofman (2020) and Lavrov (2020) present slightly different sortie averages for October 2015.

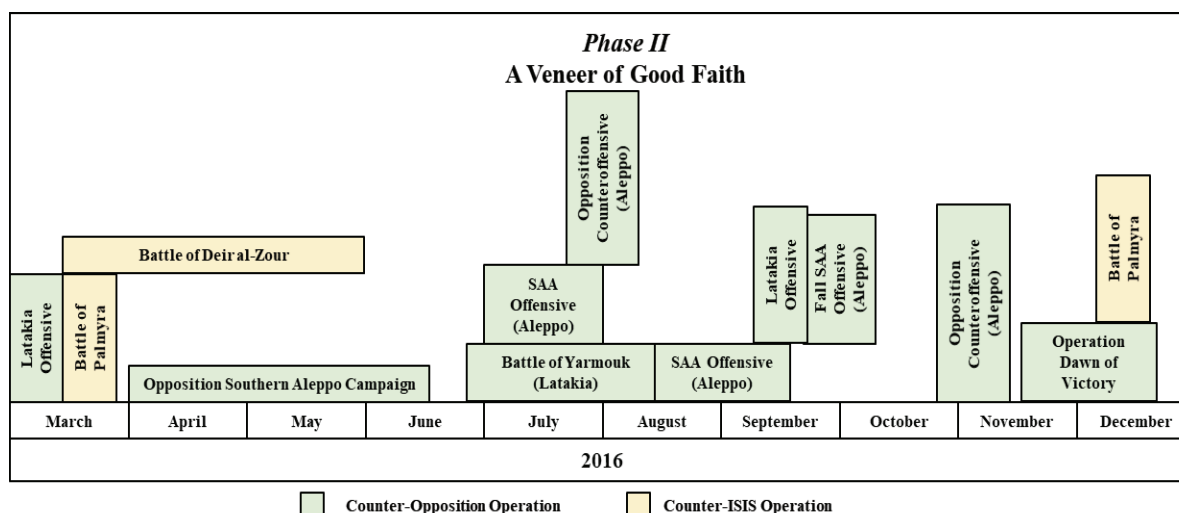
⁵⁵ Kofman, 2020, p. 53.

⁵⁶ Douglas Barrie and Howard Gethin, *Russian Weapons in the Syrian Conflict*, Book Review, NATO Defense College Russian Studies, May 2018, p. 4.

and Russia announcing a preliminary cessation of hostilities in mid-February.⁵⁷ Shortly thereafter, UN-led peace talks resumed in Geneva. Russian airstrikes rapidly declined in opposition-controlled regions—a trend clearly visible in Figure 2.4. However, the VKS maintained a stable tempo of counter-ISIS operations in Deir al-Zour and Homs during early spring 2016.

Phase Two (March to December 2016): A Veneer of Good Faith

Figure 2.4. Phase Two Timeline, by Month and Major Operation



The escalating tempo of indiscriminate Russian bombing in opposition-held areas through February 2016 was followed by a fragile cessation of hostilities that lasted for about half a year. While Russia attenuated the volume and tempo of its airstrikes to opposition-controlled areas in response, Russian airstrikes to Aleppo nevertheless persisted, at a lower rate, through September. Indeed, the VKS fully halted airstrikes to Aleppo during only a single two-week period in late March (see Figure 2.5). Russia's significant reduction in airstrikes during spring 2016 was thus circumscribed by the VKS's ongoing assault of Aleppo—particularly targeting al-Nusra, which Russia considered exempt from the cessation of hostilities as a designated terrorist organization.⁵⁸ This result accorded with Russia's strategic goals of degrading the opposition and securing the Assad regime. Projecting a veneer of good faith while surreptitiously continuing to target the opposition was therefore central to Moscow's strategy in the second phase.

Following the initial cessation of hostilities in February, President Putin announced on March 14, 2016, that Russia would be withdrawing its deployed forces from Syria.⁵⁹ By this

⁵⁷ David E. Sanger, "U.S. and Russia Announce Plan for Humanitarian Aid and a Cease-Fire in Syria," *New York Times*, February 11, 2016.

⁵⁸ Casagrande, undated.

⁵⁹ Neil MacFarquhar and Anne Barnard, "Putin Orders Start of Syria Withdrawal, Saying Goals Are Achieved," *New York Times*, March 14, 2016.

point, the total number of Russian fixed-wing combat aircraft stationed at Hmeimim had risen to 42, greater than at nearly any other point in the campaign. Many observers have speculated about Russia's intentions underlying this announcement.⁶⁰ Putin presented the force drawdown to the international community as a gesture of his commitment to diplomacy and his desire to reach a negotiated settlement. The latter aim did, indeed, reflect a genuine Russian political objective; removing nearly half the fixed-wing inventory from Hmeimim was, therefore, a clear overture to the West amid the ongoing cessation of hostilities.

However, the gesture itself was mostly empty—at most, it was a post hoc justification with the potential to redound indirect political benefits to Russia. Putin's public declaration aside, Russia imposed only a partial withdrawal of deployed fixed-wing aircraft, with the entire Su-25 squadron and four Su-34s rotating back on March 15. The rotating fixed-wing aircraft were replaced with two advanced attack helicopter units, such that the VKS AOB actually *increased* following Putin's announcement.

Following its removal from the theater, the Su-25 would be absent from Syria for nearly a year. In its place, Russia deployed its two most-capable attack helicopters, the Ka-52 *Hokum-B* and Mi-28N *Havoc*, in detachments of four helicopters each, to fulfill the primary CAS role. Although diplomacy was Russia's official justification for the force rotation, the change was more likely driven by operational considerations. It was the first of at least three major VKS force rotations (the other two occurring in 2017), reflecting a belief by the Russian General Staff in the need to cyclically “deleverage” its presence in Syria.⁶¹ Russian military officials' recognition, in particular, of the Su-25's operational limitations portended a shift in the VKS's operational approach.⁶² Indeed, the superior performance of the Mi-35M, coupled with the emerging need for CAS platforms more suitable to the ongoing counter-ISIS offensive in Palmyra, ultimately drove the deployment of the Ka-52s and Mi-28s. Like the Mi-35M, both platforms are night-capable, both are equipped with modernized targeting systems,⁶³ both are capable of “self-generated” precision CAS, and the Ka-52 carries the Vitebsk integrated self-protection suite.⁶⁴ Moreover, the desert terrain and dearth of man-portable air defense systems

⁶⁰ See, for example, Casagrande, undated; Czuperski et al., 2016; Kofman, 2020; and Lavrov, 2018.

⁶¹ Kofman, 2020, p. 51.

⁶² Michael Kofman argues that Russia's force rotation in March was a response to “the Syrian and Iranian desire to drive towards Aleppo versus the Russian preference to push towards Dayr al-Zawr,” which forced the VKS to rely on an “economy of force” approach. This is a plausible explanation; however, the advanced attack helicopters that replaced the withdrawn Su-25 aircraft in theater were primarily employed in a CAS role in Russia's counter-ISIS operations in Palmyra and eastern Syria. It seems more likely, therefore, that the rotation was intended as an operational upgrade rather than an acknowledgment of Russia's and Syria's different strategic priorities.

⁶³ The *Havoc* is equipped with the OPS-28 Tor FLIR/TV targeting turret, the *Hokum-B* with a “nose-mounted” FH01 Myech-1U radar, FLIR/TV system, and “laser targeting and designation.” See Wetzel, 2017.

⁶⁴ Wetzel, 2017.

(MANPADS) among ISIS forces made the conditions ideal for operational testing of relatively new systems.⁶⁵

In addition to the diversity of new Russian helicopters that were deployed in spring 2016, the VKS likewise displayed a willingness to experiment with rotary-wing basing locations and various configurations of forward-based helicopter units. Two CAS detachments rotated between al-Shayrat and Tiyas throughout early 2016, followed by a detachment each of Mi-24/35s, Ka-52s, and Mi-28s in March. Throughout its Syrian campaign, Russian rotary-wing basing trends evolved in parallel with the regime's counter-ISIS focus. The cessation of hostilities between the Syrian regime and opposition thus enabled the VKS to conduct operational testing of newer rotary-wing capabilities, TTPs, and force deployment patterns in counter-ISIS operations.

The bulk of Russian operational activities during spring 2016 concentrated on recapturing Palmyra from ISIS. On March 27, the SAA finally pushed ISIS out of the city for the first time in nearly a year.⁶⁶ The VKS maintained a forward rotary-wing posture in Homs throughout the spring and summer, even after a ground attack by ISIS forces on Tiyas air base destroyed multiple Russian helicopters.⁶⁷ Despite the cessation of hostilities, VKS forces continued to strike opposition-controlled areas in Aleppo from April through September and provided sporadic coverage to the SAA's ongoing Latakia offensive. Combat sorties to Aleppo approached 2015 levels, and long-range bombers separately conducted several strike missions from southwest Russia throughout the summer.

After roughly six months of stopgap cease-fires between pro-government and rebel groups and fleeting talks between U.S. and Russian diplomats, it became clear to Russia and the Syrian regime that the United States was unwilling to forgo its demand that Assad step down. Preserving Assad's tenuous hold on the Syrian presidency was a critical Russian precondition to deeper bilateral negotiations with the West. Indeed, the Kremlin viewed the prospect of Assad stepping down as a serious threat to Russian national security. As Charap et al. note, Assad's downfall "was understood to mean both a victory for the forces of transnational terrorism (and thus an increased terrorist threat to Russia) and a legitimization of Western-backed regime change, which also represented a threat to Russia's national security."⁶⁸

Although U.S. president Barack Obama had, in December 2015, publicly backed off his previous insistence on an immediate regime change, Russian negotiators were increasingly convinced that the United States would not countenance Assad in office indefinitely.⁶⁹ Therefore, the SAA resumed its protracted drive, in September 2016, to push the remaining opposition

⁶⁵ Lavrov, 2018, p. 12.

⁶⁶ Hwaida Said and Kareem Fahim, "Syrian Troops Said to Recapture Historic Palmyra from ISIS," *New York Times*, March 27, 2016.

⁶⁷ Patrick Wintour, "Syrian Airbase Used by Russia Damaged in Isis Attack—Report," *The Guardian*, May 24, 2016.

⁶⁸ Charap, Treyger, and Geist, 2019, p. 4.

⁶⁹ Teresa Welsh, "Obama Backs Off Demand for Assad to Step Down," *U.S. News and World Report*, December 18, 2015.

forces out of Aleppo. The collapse of bilateral negotiations led Russia to drop any pretense of restraint and to intensify air operations in support of the SAA's Aleppo offensive. To this end, Russia deployed the *Admiral Kuznetsov* aircraft carrier to the Syrian theater to augment the Aleppo campaign and relieve congestion problems at Hmeimim.

The participation by the *Kuznetsov*'s carrier air wing in Syrian operations, starting on November 16, 2016, marked the first combat experience for carrier-based aircraft in Russian naval history. The carrier air wing, composed of about 14 fixed-wing aircraft and a half-dozen helicopters, conducted more than 400 sorties, only one-third of which were carrier based.⁷⁰ The consensus among most observers is that the actual operational impact of Russian naval aviation was minimal, if not outright disastrous. Lavrov contends, for example, that the fate of Aleppo was "already sealed" prior to the arrival of the *Kuznetsov* in theater and that the carrier air wing generated negligible numbers of sorties relative to fixed-wing aircraft based at Hmeimim. The *Kuznetsov* lost two fixed-wing aircraft in its short deployment due to equipment failures.⁷¹ The Russian Navy's inability to effectively project airpower forced most of the carrier's air wing to conduct combat air missions from Hmeimim, compounding the very congestion problems Russia had sought to alleviate.

Although the operational performance of Russian naval aviation was ultimately disastrous, the decision to deploy the *Kuznetsov* reflected both the Russian military's desire to project sea-based airpower and the VKS's adaptation to congestion problems at Hmeimim. Moreover, Russian air support was vital to the SAA's recapture of Aleppo in late December. Jones describes the VKS's relatively effective air-to-ground integration in Aleppo:

Dubbed "Operation Dawn of Victory," Russia conducted intelligence collection from human sources, signals intelligence, and satellite imagery throughout 2016. Moscow then used intelligence derived from those assets and platforms to identify targets and orchestrate an extensive bombing campaign in and around the city to weaken rebel positions. In August 2016 alone, Russian aircraft flew an average of 70 sorties per day against targets in Aleppo, using aircraft like Tu-22M3s and Su-34s. . . . In addition to air and naval strikes, the Russians supported ground forces with Orlan unmanned aerial vehicles, electronic warfare capabilities, forward air controllers, and soldiers from the 120th Russian Guards Artillery Regiment. By December 2016, ground forces had effectively encircled and crushed rebel groups operating in the city.⁷²

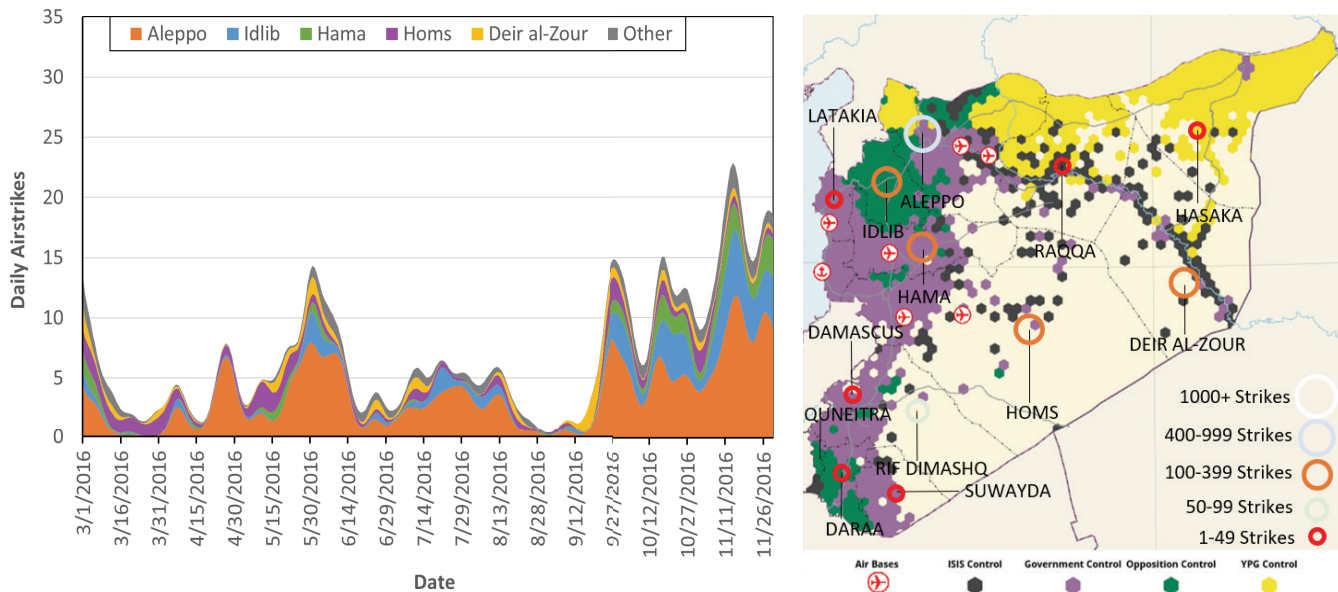
Russian airstrike patterns during the last half of 2016 largely mirrored the intermittent peace talks, intensifying in September as the regime resumed its assault of Aleppo and initiated other offensives in Latakia, Idlib, and Rif Dimashq. These trends are evident in Figure 2.5.

⁷⁰ Lavrov, 2018, p. 24. After the takeoff crashes, the *Kuznetsov* stationed most of its air wing at Hmeimim for the remainder of their deployment. Also note that our AOB for the *Kuznetsov* differs somewhat from Lavrov's estimates.

⁷¹ David Filipov and Andrew Roth, "Russian Jets Keep Crashing, and It May Be an Aircraft Carrier's Fault," *Washington Post*, December 5, 2016.

⁷² Jones, 2019, pp. 4–5.

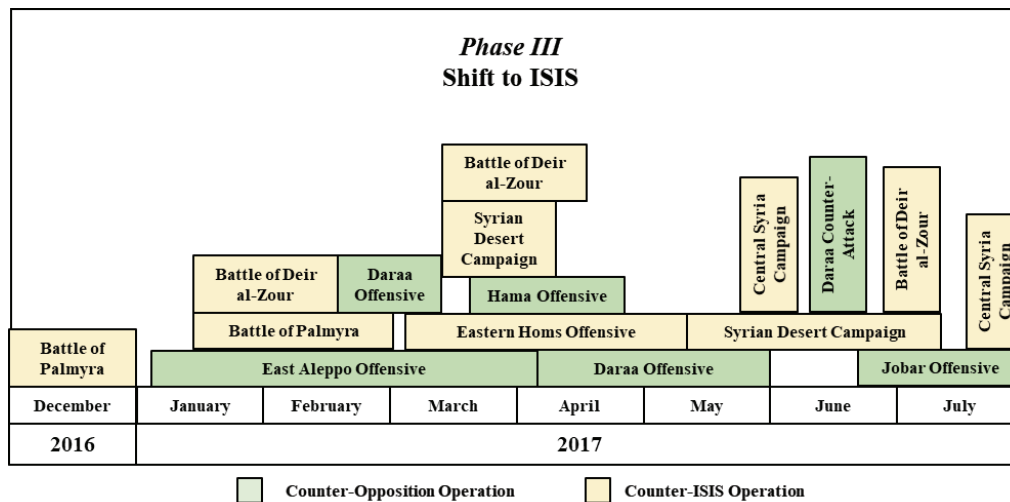
Figure 2.5. Daily Russian Airstrikes, by Syrian Governorate, March to December 2016



NOTE: "Other" includes Latakia, Raqqa, Hasaka, Damascus, Quneitra, Rif Dimashq, Suwayda, and Daraa.

Phase Three (December 2016 to July 2017): Shift to ISIS

Figure 2.6. Phase Three Timeline, by Month and Major Operation



The regime's recapture of Aleppo in late December 2016 and subsequent negotiated cease-fire with the U.S.-backed opposition coincided with dual ISIS counteroffensives in Homs and Deir al-Zour in December 2016 and January 2017. Less than a year after reclaiming Palmyra from ISIS, the Syrian government once again lost control of the city.⁷³ ISIS forces also pushed toward other strategic locations in Homs, notably Tiyaas air base, an essential VKS forward operating base. The resurgence of ISIS thus directly threatened Russia's expeditionary basing infrastructure. With Russia's principal strategic objectives of marginalizing the U.S.-backed opposition and securing the Assad government having been largely achieved, ISIS finally emerged as Russia's key operational focus.

This shift in focus also reflected a degree of mission creep. Russian strategic priorities had evolved from saving the Assad regime and supplanting U.S. geopolitical influence to protecting the VKS's expeditionary infrastructure, experimenting with new capabilities and operational concepts, and observing NATO TTPs in counter-ISIS operations. The VKS freed most intratheater fixed-wing combat aircraft from a dedicated offensive role, and for much of the rest of the campaign, Russian combat aircraft were used primarily in defensive operations or allocated on a dynamic basis in response to emerging needs.

The decisive SAA victory in Aleppo allowed the VKS to reallocate fixed-wing sorties to strike and CAS missions in Homs. Spring 2017 was the first time that the VKS dedicated a preponderance of its deployed aviation forces to counter-ISIS operations. For nearly two months, a majority of the airstrikes—generated by a combination of fixed-wing fighter-bombers out of Hmeimim, long-range bombers from Mozdok, and forward-stationed attack helicopters at al-Shayrat—targeted ISIS locations in Homs and Deir al-Zour (see the right tail of Figure 2.7).

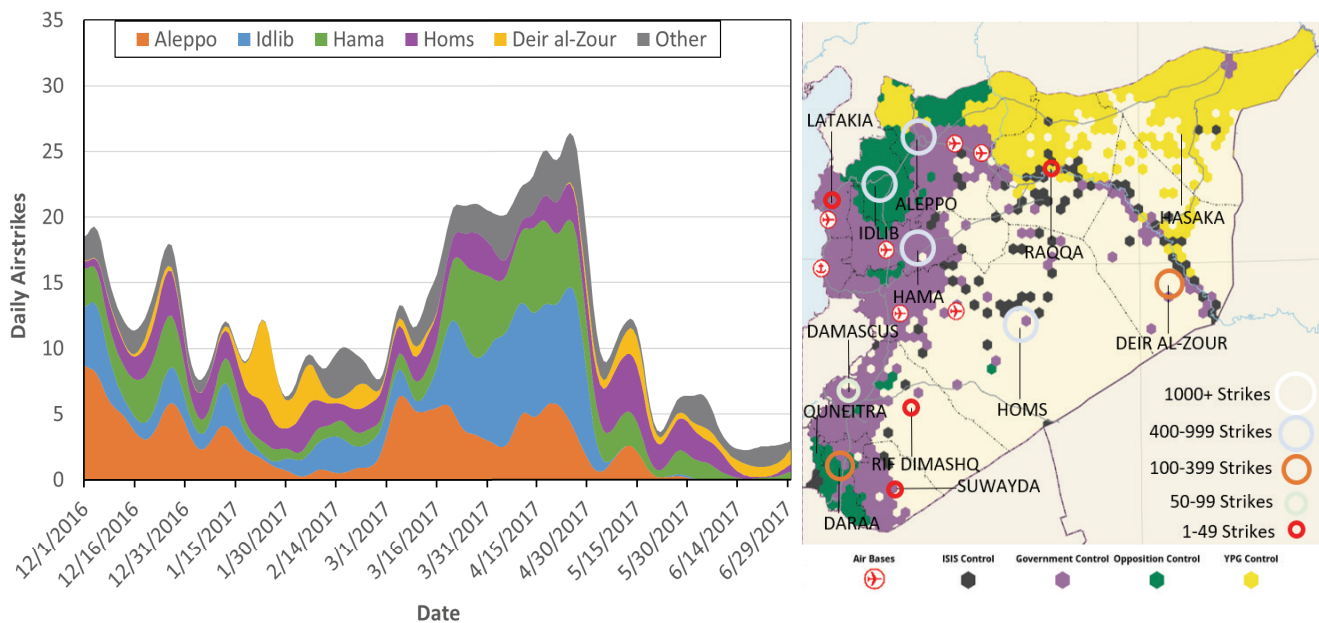
Russia had viewed Deir al-Zour as a long-term strategic priority from the start; loosely affiliated Russian private military companies, likely hired to secure Syrian oil and mineral resources for their Russian and Syrian benefactors, had been active there since at least 2012, and the Russian military chafed at ongoing U.S. operations near the Euphrates.⁷⁴ Moreover, ISIS had blockaded two Syrian military garrisons in the city for more than a year. Following a renewed offensive in Deir al-Zour by ISIS in December 2016, Russian long-range bombers conducted “more than 30 sorties on large targets” in the first weeks of January 2017.⁷⁵ Through the end of

⁷³ Maria Abi-Habib and Noam Raydan, “Islamic State Retakes Ancient City of Palmyra,” *Wall Street Journal*, December 11, 2016.

⁷⁴ Thomas reports the existence of “a contract on extracting oil from Syrian territory between Syrian authorities and the Russian firm EuroPolis.” Likewise, the Wagner Group private military company was reportedly originally hired “to protect [Syrian] oil extraction facilities, which some believe Assad had promised to transfer to Russian investors” (Thomas, 2019, p. 21). See also Candace Rondeaux, “Decoding the Wagner Group: Analyzing the Role of Private Military Security Contractors in Russian Proxy Warfare,” *New America*, November 2019.

⁷⁵ Jones, 2019, pp. 4–5.

Figure 2.7. Daily Russian Airstrikes, by Syrian Governorate, December 2016 to July 2017



NOTE: "Other" includes Latakia, Raqqah, Hasaka, Damascus, Quneitra, Rif Dimashq, Suwayda, and Daraa.

January, six Tu-22M3 bombers conducted daily sorties from southwestern Russia.⁷⁶ The tempo of Russian airstrikes in Deir al-Zour helped SAA forces entrenched at the air base weather the ISIS offensive as the Syrian ground campaign progressed through eastern Syria.

The VKS's air support in the SAA's final siege of Palmyra and surrounding areas in spring 2017 (evident in the Homs Province wedge in Figure 2.7) also proved vital. Government-allied forces decisively secured much of the Homs governorate, including Palmyra in March, while imposing considerable losses on ISIS forces. The VKS allocated most of its Su-25s, along with a majority of its attack helicopter units, to providing CAS for the SAA's eastern Homs offensive in spring and summer 2017. As the SAA pushed east through Homs, the regime began planning a major operation, based out of Homs, to break the ISIS siege of Deir al-Zour. Russian engineers completed runway improvements at Tiyas air base at around this time, an important achievement that allowed the VKS to finally experiment with staging fixed-wing aircraft at forward operating locations.⁷⁷

Beyond the opportunity this created for the VKS to test new operational concepts, the ability to base fixed-wing aircraft at Tiyas altered joint operational planning for the SAA's impending offensives in Deir al-Zour, Raqqah, and eastern Homs. Prior to this time, Deir al-Zour had posed a

⁷⁶ Lavrov, 2018, pp. 15–16.

⁷⁷ Lavrov (2018, p. 15) suggests that half a squadron of Su-25SM aircraft may have been present at T-4 since at least December 2016, though we were unable to verify this claim.

conundrum for VKS air operations. The VKS was reluctant to task Su-25 aircraft stationed at Hmeimim with CAS missions to Deir al-Zour, likely due to a combination of concerns about distance, aircrew quality, and aircraft performance. Deir al-Zour was also at the extreme edge of the combat radii of Russia's attack helicopters, even from forward operating locations such as Tiya. Russian air operations in Deir al-Zour had thus previously been limited to strike sorties from Mozdok and Engels and occasional support from forward-based helicopter units.⁷⁸ However, Tiya was only about 150 nautical miles (nm) from Deir al-Zour, meaning that the SAA could now rely on persistent Su-25 coverage as Syrian ground forces pushed from Homs into Deir al-Zour.

By dedicating nearly half a squadron of Su-25 aircraft to the Deir al-Zour operation, the VKS was able to reallocate its remaining fixed-wing assets to support defensive air operations in countering renewed opposition advances from Hama and Damascus. The opposition's Hama offensive in spring 2017, led by the Islamist group Tahrir al-Sham and the Free Syrian Army, aimed to roll back SAA advances in Hama and Idlib.⁷⁹ In response, the VKS executed its highest volume of airstrikes in over a year. Russia's level of engagement in the defensive operation proved to be a deciding factor for the regime, which secured a major victory.⁸⁰ In May, Russian air support also enabled the SAA to recapture the city of Homs, the one-time "capital of the rebellion."⁸¹

Heading into the summer, Russia provided preplanned air support to new regime offensives against opposition forces in East Aleppo, Damascus, Daraa, Idlib, and Suwayda. In May, however, a fourth round of peace talks in Astana, Kazakhstan, yielded a memorandum of agreement between Russia, Iran, and Turkey to abide by four de-escalation zones in Syria: Idlib, northern Homs, East Ghouta, and southern Syria along the Syria-Jordan border.⁸² The de-escalation agreement was then followed by a cease-fire in southern Syria in July.⁸³ As a result, Russia scaled back its airstrikes in these areas beginning in May.

⁷⁸ Su-24 and Su-34 strike aircraft operating from Hmeimim could range Deir al-Zour easily, but the VKS appears to have been reluctant to employ them in support of SAA in this region. See Chapter 4 for a discussion.

⁷⁹ Angus McDowall and Tom Perry, "Syrian Rebels Press Major Assault Near Hama," *Reuters*, March 22, 2017.

⁸⁰ Leith Aboufadel, "Russian Airstrikes Illuminate the Night Sky over Idlib," *Al-Masdar Al-'Arabi News*, April 16, 2017.

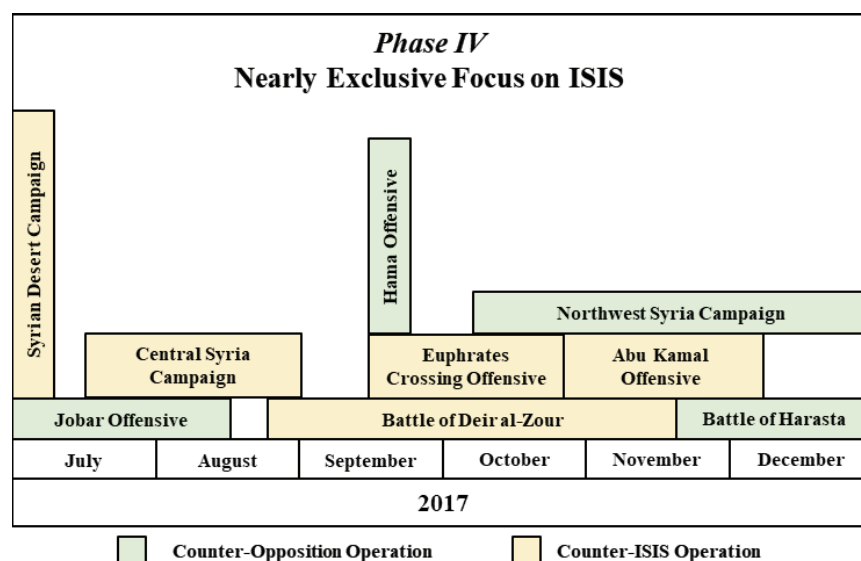
⁸¹ Jones, 2019, p. 4.

⁸² Emma Beals, "De-Escalation and Astana," Atlantic Council, Blog Post, September 15, 2017.

⁸³ Jeff Mason and Denis Dyomkin, "Partial Ceasefire Deal Reached in Syria, in Trump's First Peace Effort," *Reuters*, July 7, 2017.

Phase Four (July to December 2017): Nearly Exclusive Focus on ISIS

Figure 2.8. Phase Four Timeline, by Month and Major Operation

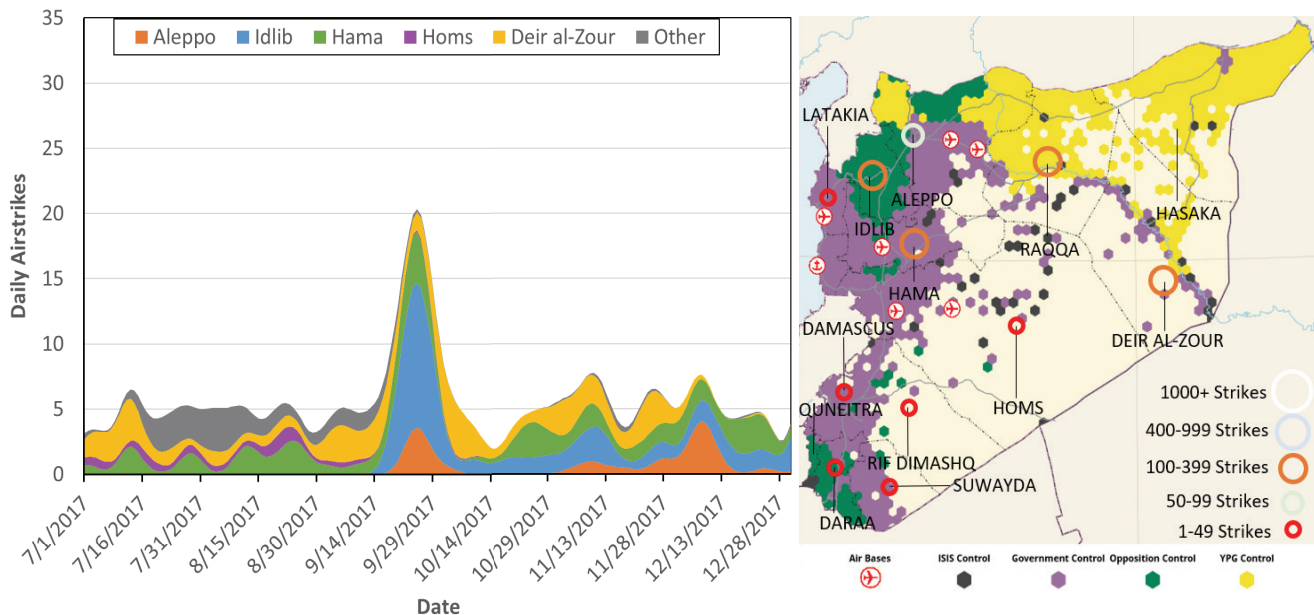


During late summer and early fall 2017, Syrian government-allied forces advanced on ISIS positions on two fronts: the central Syrian campaign in Raqqa, Hama, and Homs, and the Deir al-Zour offensive. From July through late September, nearly all Russian airstrikes targeted ISIS-held locations, as shown in Figure 2.9 (“Other” includes Raqqa). The advance into ISIS territories occurred amid a push by the United States and Jordan for de-escalation in southern Syria. Russian counteropposition air operations slowed to a trickle by August. However, this trend was punctuated by a sharp increase in Russian airstrikes in September, responding to incursions by Jabhat al-Nusra (with the tacit support of Turkey) against Russian security forces observing the Idlib de-escalation zone.⁸⁴

The introduction of the Su-25 in a CAS role in Deir al-Zour, complementing the forward-stationed attack helicopter units, provided an important advantage for Syrian ground forces against ISIS. Whereas the performance record of the Su-25 in Syria had been mixed during its initial deployment, the VKS made several improvements in operational planning and TTPs to enhance the aircraft’s effectiveness in a CAS role. Most importantly, the VKS had significantly improved joint operations planning, airborne command and control (C2), ISR, and air-to-ground communications with SAA ground forces. The VKS also deployed an upgraded variant of the platform—the Su-25SM3—that featured enhanced avionics, communications, navigation and attack precision, and weapons suites. The Su-25 thus proved to be much more effective in the

⁸⁴ Charles Lister, “Turkey’s Idlib Incursion and the HTS Question: Understanding the Long Game in Syria,” *War on the Rocks*, October 31, 2017.

Figure 2.9. Daily Russian Airstrikes, by Syrian Governorate, July to December 2017



NOTE: “Other” includes Latakia, Raqqa, Hasaka, Damascus, Quneitra, Rif Dimashq, Suwayda, and Daraa.

dual offensives in mid-2017, both in terms of dynamic targeting and minimizing operational risks, than it had been in previous counter-ISIS operations.⁸⁵ Still, according to some estimates, day- and night-capable attack helicopters conducted over two-thirds of Russian CAS sorties during the final Deir al-Zour campaign.⁸⁶

Long-range strike operations, from both Russian bombers stationed at Mozdok and sea-launched cruise missiles fired from Russian destroyers in the eastern Mediterranean, also contributed to the SAA’s eventual victory at Deir al-Zour. In the final month of the operation, Russian sea-based cruise missiles provided precision effects, targeted by Russian UAVs and forward ground controllers in Deir al-Zour, whereas six Mozdok-based Tu-22M3 bombers dropped unguided bombs on stationary ISIS targets.⁸⁷ The VKS supplemented its long-range strike missions to Deir al-Zour with combat sorties out of Hmeimim. According to Lavrov, the combat sorties in August and September constituted the “most intensive period since the beginning of the campaign,” with each aircraft conducting three to four daily sorties.⁸⁸

⁸⁵ Hamilton, Miller, and Stein, 2020, p. 150.

⁸⁶ Lavrov, 2018, p. 18.

⁸⁷ Lavrov, 2018, p. 18.

⁸⁸ Lavrov, 2018, pp. 16–17.

In September, Syrian government-allied forces broke the siege of Deir al-Zour that had begun three years earlier when ISIS encircled the city.⁸⁹ Deployed Russian forces further aided SAA efforts to clear Hama and Homs of residual ISIS enclaves. The SAA reached the Euphrates River in late September and Russian forces established a bridgehead. By November, the SAA had reestablished full control of Deir al-Zour.⁹⁰

Russia's Euphrates bridgehead was a crucible in several respects. The Euphrates River had been central to ISIS's self-proclaimed caliphate, both symbolically and as a logistical network between the organization's territories in Iraq and Syria. The Euphrates crossing offensive thus represented an important milestone in the rollback of the caliphate's geographic control and quasi-state apparatus. But Russia and the United States had also established the Euphrates as a formal deconfliction line in 2015: Syrian-allied forces conducted counter-ISIS operations to the west of the river, while CJTF-OIR and its allies (Kurdish YPG and Syrian Democratic Forces [SDF]) fought ISIS to the east.⁹¹

For the United States, the need for a deconfliction mechanism was tied to the presence of CJTF-OIR forces at al-Tanf military base in eastern Homs.⁹² Likewise, U.S. counter-ISIS operations east of the Euphrates in Raqqa and Deir al-Zour often overlapped with Syrian and Russian operations. The United States was eager, therefore, to establish a deconfliction communications channel to avoid accidents and miscalculations with regime-allied forces and create a buffer around the CJTF-OIR presence at al-Tanf.⁹³ For Russia, the deconfliction agreement offered the dual benefits of lowering the risk of military escalation with the West and enabling informal collaboration with CJTF-OIR on counter-ISIS operations.⁹⁴

The deconfliction agreement was heavily tested throughout summer and fall 2017. Russian and Syrian ground forces "began advertising their desire for control over territory east of the Euphrates, which undermined the deconfliction agreement and created new risks."⁹⁵ After a Syrian Su-22 airstrike targeted an area controlled by the SDF, a U.S. F-18 shot down the Su-22.

⁸⁹ Liz Sly, "A Boost for Assad as the Syrian Army Makes Gains Against ISIS in Eastern Syria," *Washington Post*, September 5, 2017.

⁹⁰ Jones, 2020, p. 37.

⁹¹ For a comprehensive historical account of the Russian-U.S. deconfliction efforts, see Robert E. Hamilton, "Russian and American De-Confliction Efforts in Syria: What's the Endgame in the Civil War?" *Russian Foreign Policy Papers*, Foreign Policy Research Institute, April 2018.

⁹² Wasser et al., 2021, p. 1.

⁹³ Wasser et al., 2021, p. 1.

⁹⁴ Some Western analysts have speculated that Russia's eagerness to establish informal mechanisms for sharing intelligence and targeting information was driven by its objective of gaining international legitimacy. See, for example, Kofman and Rojansky, 2018; and Andrew S. Weiss and Nicole Ng, *Collision Avoidance: The Lessons of U.S. and Russian Operations in Syria*, Washington, D.C.: Carnegie Endowment for International Peace, March 2019.

⁹⁵ Weiss and Ng, 2019.

The Kremlin responded by voiding its memorandum of understanding with the United States and increasingly pushed for the creation of “zones of exclusive operations east of the Euphrates.”⁹⁶

Then in September 2017, Russian aircraft sortied east of the Euphrates and struck known SDF positions, prompting the U.S. military to make several attempts to contact Moscow on the deconfliction hotline. Western analysts generally consider Russia’s September incursion across the deconfliction line to have been the result of a “pressure campaign” to expand Russia’s zone of operations, though some acknowledge the possibility that it was either a tactical error or an attempt to test U.S. resolve.⁹⁷ Following the episode, U.S. and Russian representatives met face-to-face in mid-September and ultimately agreed to “extend the de-confliction line on the Euphrates River from Dayr-az-Zawr south to Abu Kamal, on the Syria-Iraq border.”⁹⁸

The tenuous U.S.-Russia deconfliction agreement was tested several times over the next few months. For example, Russian and Syrian aircraft sortied across the deconfliction line “on average six to eight times per day, or roughly 10 percent of all flight activity.”⁹⁹ This increased the opportunity for miscalculation, including a near-collision between a Russian Su-25 and a Coalition F-22.¹⁰⁰ However, Russia’s operational priorities, which often conflicted with the West’s, also included nominal collaboration. For example, the VKS provided air support in December 2017 to the U.S.-backed YPG in its efforts to eradicate remaining pockets of ISIS east of the Euphrates.¹⁰¹ Ongoing U.S.-Russian deconfliction talks throughout fall 2017 further de-escalated tensions along the Euphrates.

With much of eastern Syria now occupied by the regime, the VKS rotated multiple Su-25s to Deir al-Zour air base and an attack helicopter detachment from Tiyaş to Kuweires air base, near Aleppo, to assist SAA operations in Raqqā. These rotations reflected the VKS’s increasing comfort with employing flexible basing postures to optimize the effectiveness of Russian air operations.

Concurrently, the Syrian opposition, led by Tahrir al-Sham (formerly al-Nusra Front), was engaged in a counteroffensive against SAA ground forces in Hama. Early battlefield successes by opposition forces were quickly reversed in April, with the regime emerging the clear victor. The surge of Russian airstrikes in the Idlib de-escalation zone in September, however, prompted Tahrir al-Sham to resume its Hama offensive. The SAA used Russian air support to stem the opposition’s push, but the outcome was inconclusive based on changes in territorial control. The Hama conflict continued in a stalemate through the end of 2017, with modest Russian air cover in Hama and Idlib.

⁹⁶ Weiss and Ng, 2019.

⁹⁷ For the first explanation, see Hamilton, 2018, and Weiss and Ng, 2019; for the latter two, see Kofman, 2020.

⁹⁸ Hamilton, 2018, p. 9.

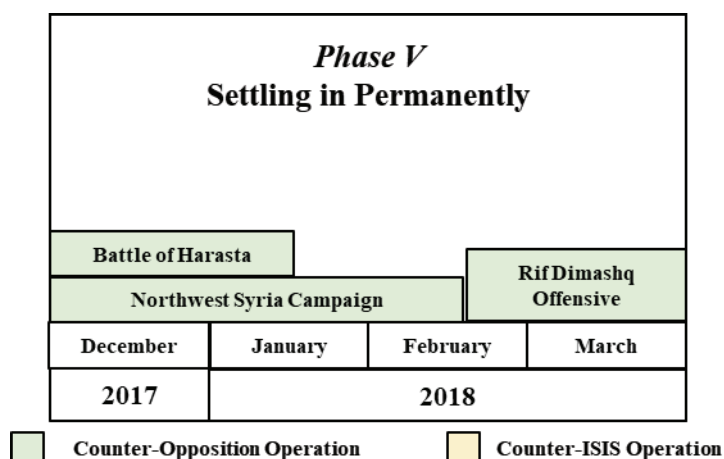
⁹⁹ Weiss and Ng, 2019.

¹⁰⁰ Ryan Browne, “US F-22s Intercept Russian Jets over Syria, Fire Warning Flares,” *CNN*, December 15, 2017.

¹⁰¹ Gonul Tol, “Why Is Turkey Silent on Russia’s Cooperation with the Syrian Kurds?” *War on the Rocks*, December 19, 2017.

Phase Five (December 2017 to March 2018): Settling in Permanently

Figure 2.10. Phase Five Timeline, by Month and Major Operation



President Putin stated in December 2017 that the Syrian regime had achieved a “complete victory” over ISIS on “both banks of the Euphrates river in Syria.”¹⁰² On a visit to Hmeimim air base on December 11, Putin announced another partial withdrawal of Russian troops from Syria. Shortly thereafter, the VKS removed about one-third of its fixed-wing assets from the theater. Nevertheless, from December 2017 through March 2018, the AOB remained consistent with steady-state force levels throughout the campaign. Far from diminishing its presence in Syria after Putin’s announcement, the VKS ensconced a permanent presence at Hmeimim (and the Tartus naval facility) on a 49-year lease and deployed new capabilities—notably, the Su-57—for technology demonstrations and operational testing.¹⁰³

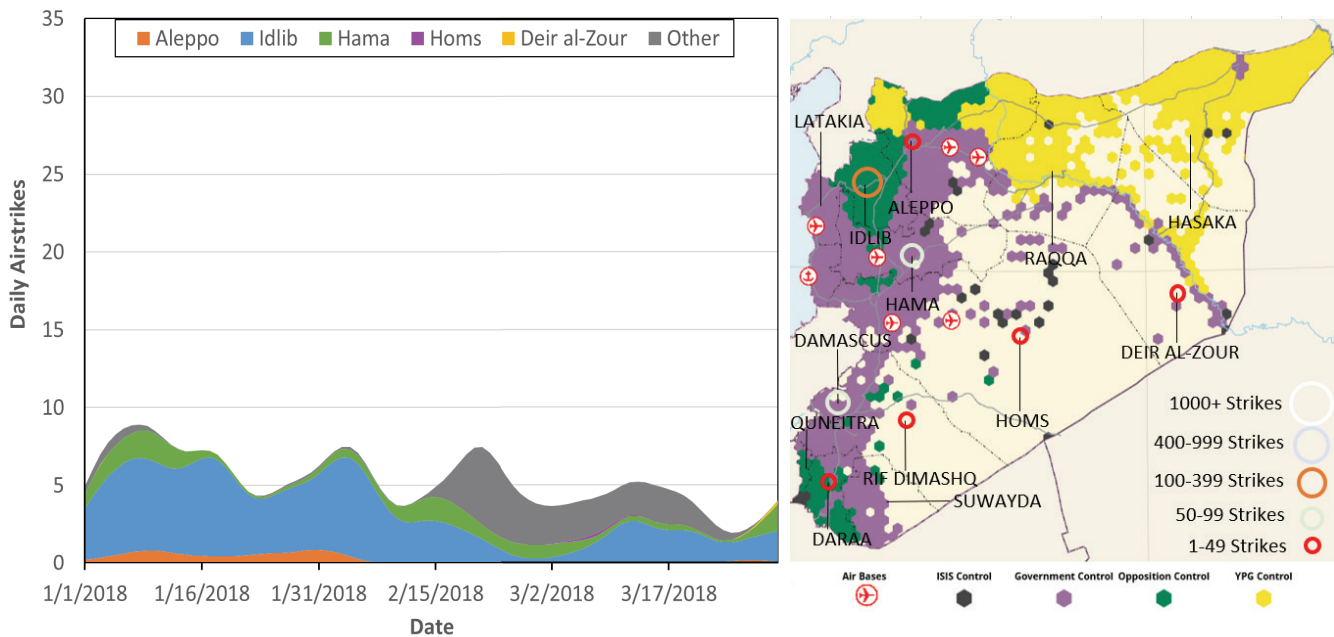
The central Syria campaign and Deir al-Zour offensive in 2017 marked the VKS’s last significant involvement (during the period considered in this report) in counter-ISIS air operations. Between then and March 2018, there was a conspicuous reduction in long-range bomber sorties out of Mozdok and Engels air bases, and Russian airstrikes primarily targeted remaining pockets of opposition forces in Damascus (“Other” in Figure 2.11) and Idlib.

In early 2018, the VKS dedicated nearly all of its remaining fixed-wing air assets to offensive CAS and air-to-ground sorties in support of the SAA’s dual offensives against the remaining pockets of opposition forces: the northwest Syria campaign in Idlib, and the Rif Dimashq offensive in Damascus, East Ghouta, and Hama. By this point in the campaign, the VKS had established a robust network of forward operating bases across Syria, including in the south. The

¹⁰² Stubbs, 2017.

¹⁰³ Samuel Osborne, “Russia to Stay in Syria for Another Half a Century as Putin Signs Air Base Deal with Assad Regime,” *The Independent*, July 27, 2017.

Figure 2.11. Daily Russian Airstrikes, by Syrian Governorate, December 2017 to March 2018



NOTE: "Other" includes Latakia, Raqqa, Hasaka, Damascus, Quneitra, Rif Dimashq, Suwayda, and Daraa.

VKS split its fixed-wing force between Hmeimim, which generated sorties in Hama and Idlib, and forward locations in southern Syria, which provided dedicated CAS to SAA ground troops in Rif Dimashq. The regime's spring offensives proved devastating to the opposition, which decisively lost all five major operations.

Although Russia's role in counter-ISIS operations diminished significantly in 2018, a key exception occurred on February 7 when "around 400 Russian Wagner group mercenaries armed with tanks and artillery crossed the deconfliction line and assaulted an SDF outpost in Khasam."¹⁰⁴ The Russian private military contractors' target appears to have been a Conoco gas plant adjacent to the SDF headquarters—reportedly as part of a broader effort to secure Syrian oil and gas infrastructure on behalf of Syrian and Russian investors.¹⁰⁵ It remains unclear whether the Wagner Group forces acted independently or with tacit Kremlin consent; however, when the United States used the deconfliction hotline to alert Moscow, Russian military leaders in Syria denied knowledge of the operation.¹⁰⁶

Beyond the Wagner Group's violation of the deconfliction agreement, the incident directly threatened CJTF-OIR advisers who were collocated with SDF forces at the Khasam outpost.

¹⁰⁴ Wasser et al., 2021, p. 75.

¹⁰⁵ Rondeaux, 2019.

¹⁰⁶ Wasser et al., 2021, p. 75.

After Russia's initial denial of responsibility on the deconfliction hotline, Coalition aircraft provided "protective overwatch, defensive counter-air, and ISR support."¹⁰⁷ U.S. air support then "release[d] multiple precision fire munitions and conduct[ed] strafing runs against the advancing aggressor force, stopping their advance and destroying multiple artillery pieces and tanks."¹⁰⁸ SDF forces, supported by heavy Coalition airstrikes, ultimately repelled the Wagner Group's attack, resulting in over 200 deaths of Russian private military contractors.

Conclusion

Russia's air campaign in Syria has been complex and oft-changing, but broad patterns are discernible. The volume of Russian airstrikes was heaviest in late 2015, as Moscow sought to halt a series of opposition offensives that posed an existential threat to the Assad regime. The high tempo of initial air operations, coupled with the VKS's practice of indiscriminately targeting opposition forces and civilians in northwest Syria, revealed Russia's core strategic objective: degrading the U.S.-backed Syrian opposition to save the Syrian regime, a by-product of which was to enhance bargaining leverage with the West. Russian airpower was effectively employed in the regime's northwest Syria campaign and then wielded before an international audience at Aleppo.

Although counter-ISIS operations were originally of only secondary importance, Russia's posture adaptations enabled the VKS to deliver a modest tempo of counter-ISIS intertheater strike sorties to Deir al-Zour and on-demand CAS in Hama and Homs. Ultimately, Russia's experimentation with force structure and capabilities enabled it to shift from an inefficient allocation of resources, producing mixed results (particularly in counter-ISIS operations), to a concept of operations that prioritized adaptable postures, targeting and precision fires, and persistent air coverage that could be scaled to the regime's operational needs.

¹⁰⁷ Wasser et al., 2021, p. 75.

¹⁰⁸ Wasser et al., 2021, p. 75.

3. Russia's Operational Blueprint, Basing Strategy, and Disposition of Forces in Syria

Before we assess the strengths and weaknesses of Russian airpower in Syria, it is important to contextualize how Russia's strategic and operational blueprint for the air campaign shaped the deployment patterns of Russian aerospace forces to Syria, the types of forces the VKS employed, and Russia's experimentation with different concepts for employment and basing postures. To this end, the next three sections break down Russia's strategic and operational blueprint in Syria; deployment patterns and CONEMP for VKS fixed-wing, rotary-wing, long-range strike, and enabler aircraft; and the disposition of theater aviation forces.

Russia's Strategic and Operational Blueprint

Two decades of observing Western warfighting innovations, beginning with the first Gulf War, fundamentally altered Russian military doctrine and operational art. Russian strategic planners, under the direction of General Valery Gerasimov, Russian chief of the General Staff since 2012, contemplated ways to counter the "indirect and asymmetric Western military methods in the late 1990s and early 2000s."¹ General Gerasimov's New-Generation Warfare (NGW) doctrine seeks to counter the perceived shift in America's warfighting approach toward hybrid warfare:

NGW minimizes the role of the large-scale military operations of the industrial war era and instead combines hard and soft power across military and nonmilitary domains. It capitalizes on indirect action, informational operations, paramilitaries, and special operations forces backed by sophisticated military capabilities, both conventional and nuclear.²

Although Russian military strategists increasingly conceived of modern warfare primarily in terms of "nonmilitary tools and political conflict," NGW nevertheless espouses a realistic appraisal

¹ The Kremlin understood the West's modern warfighting approach to include "undeclared, regime-change oriented, nonmilitary in nature, destructive of civilian infrastructure, of short duration, occurring in all physical environments, and characterized by high maneuverability, simultaneity, unified action, and the use of precision-guided munitions." Lt Col Nicholas Sinclair, "A Logic All Its Own Russian Operational Art in the Syrian Campaign," *Military Review*, January–February 2020, p. 16.

² Dmitry Adamsky, *Russian Lessons from the Syrian Operation and the Culture of Military Innovation*, Garmisch-Partenkirchen, Germany: Marshall Center, Report No. 047, February 2020. Note that there is considerable disagreement among scholars of Russian military strategy over the origins and interpretation of NGW. In particular, some Western observers believe that General Gerasimov's role in the development of NGW has been overstated in the mainstream literature, while others are less convinced that NGW represents a coherent and systematic response to recent Western military developments.

of the “importance of military power.”³ Moreover, Gerasimov and other military leaders have publicly cited the emerging “strategy of limited action” as a key strategic underpinning of the military’s expeditionary campaign in Syria.⁴ According to proponents of this approach, military intervention should be undertaken with a constrained set of forces and resources allocated to achieve a limited set of objectives. Russian strategic planners viewed the Syria conflict as an ideal operational setting in which to apply the central tenets of both NGW and the strategy of limited action. The Kremlin was reluctant to directly confront an “ideologically stronger” Islamist adversary it viewed as “a well-organized, effectively trained, and adequately equipped terrorist army” composed of “ferocious fighters . . . in their own territory.”⁵ With the Syrian skies already congested with Turkish and U.S. aircraft, Russia was also sensitive to the risks of escalation with peer expeditionary forces.

Russian strategists therefore devised a limited-liability military intervention that would obviate the need to commit overwhelming ground forces, limit conspicuous losses, and avoid sunk costs. Russia’s lean approach embodied a small theater footprint (by U.S. standards), with Russian aerospace and naval forces providing support to allied Syrian, Iranian, and Shi’a militia ground forces.⁶ Russian Spetsnaz special forces embedded with Syrian brigades primarily in an advisory capacity (although they also provided intelligence and targeting information to deployed Russian aviation forces), while most other Russian ground forces consisted of nominally independent private military contractors. Russia’s naval presence in the eastern Mediterranean established a logistical supply chain to Tartus and generated sea-launched cruise missile strikes. Aside from the sea-based “Syrian Express,” Russia conducted much of its intertheater resupply with strategic airlift that “typically flew routes over the Caspian Sea and through Iranian [and Iraqi] airspace.”⁷

Russia’s expeditionary C2 infrastructure was heavily influenced by the U.S. concept of network-centric warfare. Russia stood up a joint planning cell at Hmeimim to coordinate operational planning with Syrian and other regime-allied forces, along with a coordination center in Baghdad that “facilitated intelligence sharing and deconflicted air operations” with Russian regional partners.⁸ Operational planning flowed in real-time through the Moscow-based National

³ Andrew S. Bowen, *Russian Armed Forces: Military Doctrine and Strategy*, Washington, D.C.: Congressional Research Service, CRS Report No. IF11625, August 20, 2020.

⁴ Dara Massicot, “Anticipating a New Russian Military Doctrine in 2020: What It Might Contain and Why It Matters,” *War on the Rocks*, September 9, 2019.

⁵ Adamsky, 2020; Algirdas Revaitis, “Russian Perception of Its Network-Centric Warfare Capabilities in Syria,” *Journal on Baltic Security*, Vol. 6, No. 1, 2020, pp. 36–37.

⁶ Jones, 2019, p. 1; Kofman, 2020, pp. 41–43; Kofman and Rojansky, 2018, p. 13.

⁷ Kofman, 2020, p. 46.

⁸ Analyst Michael Kofman (2020, p. 47) notes that initially, operational planning “began with a cell in the Russian General Staff, [and] details were filled in by the operational group commander in Khmeimim in charge of Russian forces on the ground” in conjunction with the Syrian General Staff. However, “the Syrian command proved incompetent for the task, and much of the operational-level planning reverted to the Russian commander in Syria.” See also Jones, 2019, p. 3.

Defense Management Center, which contains an automated battlespace monitoring and analysis system that created a common operating picture for the Russian General Staff.⁹ At the tactical level, updated Russian doctrine sought to establish kill chains that flowed from sensors to warfighters through reconnaissance-strike and reconnaissance-fire loops.¹⁰ Structuring the intervention around NGW concepts required a combined-arms, “system-of-systems” approach that integrated “intelligence, surveillance, and reconnaissance capabilities (ISR), command and control (C2), and precision standoff fires.”¹¹ In practical terms, Russia’s adaptive response to Western-style network-centric warfare in Syria demanded a stronger reliance on automation, at both the C2 and ISR levels, and precision strikes/fires than previous Russian engagements.¹²

The VKS organized fires in Syria on a “zonal principle”:

Long-range Kalibr sea-launched cruise missiles, air launched Kh-101 cruise missiles, and Tu-22M3 bombers were employed within a radius of 4,000 kilometers. Medium engagements up to 500 kilometers were supported by Su-24 bombers and [Su-34] fighters carrying special computer subsystems. Near engagements used reconnaissance-strike loops, the Strelets reconnaissance, command and control, and communication complex, and the Su-24M bomber.¹³

This approach aligned with conventional Russian operational planning, which delineated near- and medium-range from long-range strike operations. Thus, Su-24 and Su-34 fighter-bomber aircraft retained responsibility for most strike operations from Hmeimim. In contrast, Russian CONOPS prioritized Su-25 strike aircraft for fixed-wing CAS. Table 3.1 presents ranges to key targets from Russia’s operating bases in Syria, Russia, and Iran.

Table 3.1. Ranges to Key Targets from Main Russian Operating Bases

Country	Base	Aircraft (combat radius in nautical miles)	Approximate Range (nm) to:					
			Aleppo	Raqqqa	Hama	Homs	Damascus	Deir al-Zour
Syria	Hmeimim	Su-24 (515–565) Su-25 (200) Su-34 (590) Su-35 (840)	75	150	45	60	120	205
	Tiyas	Su-25 (200)	90	95	50	50	105	125

⁹ Thomas, 2019, p. 11; Kofman, 2020, p. 47.

¹⁰ Thomas, 2019, p. 12.

¹¹ Adamsky, 2020.

¹² Adamsky, 2020; Kofman, 2020, p. 59; Thomas, 2019, p. 12. This is not to suggest that Russia’s ability to integrate command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) with an effective use of precision-guided munitions (PGMs) was always successful. In fact, its record on these counts is quite mixed (see Chapter 4).

¹³ Thomas, 2019, p. 12.

Country	Base	Aircraft (combat radius in nautical miles)	Approximate Range (nm) to:					Deir al-Zour
			Aleppo	Raqqa	Hama	Homs	Damascus	
	Deir al-Zour	Su-25 (200)	155	70	165	175	220	<5
Russia	Mozdok (via Iran)	Su-34 (590) Tu-22 (1,100–1,300) Tu-95 (3,450) Tu-160 (1,080)	1,189	1,084	1,209	1,214	1,249	1,014
	Engels (via Iran)	Su-34 (590) Tu-22 (1,100–1,300) Tu-95 (3,450) Tu-160 (1,080)	1,656	1,551	1,676	1,681	1,716	1,481
Iran	Shahid Nojeh (Hamadan)	Su-34 (590) Tu-22 (1,100–1,300) Tu-95 (3,450) Tu-160 (1,080)	645	540	665	670	705	470

SOURCE: Google Maps distance calculation.

NOTE: Straight-line distances are shown, but sortie distances from Russian bases were often much longer due to Turkish overflight restrictions that typically required transit through Iran and Iraq. Therefore, we display total transit distances from Mozdok and Engels via Iran.

As Table 3.1 demonstrates, most opposition-held areas in the north, west, and south of Syria were well within the combat radii of deployed fighter-bomber and strike aircraft stationed at Hmeimim.¹⁴ This enabled the VKS to plan near-range strike and CAS missions in accordance with Russian military CONOPS. The major outlier to this pattern was Deir al-Zour. Indeed, although Su-24 and Su-34 strike aircraft operating from Hmeimim could range Deir al-Zour easily, the VKS appears to have been reluctant to employ them in support of SAA in this region (see Chapter 4). Instead, the VKS allocated long-range aviation forces, stationed at air bases in southwestern Russia, to strike missions farther from Hmeimim—particularly preplanned operations against static ISIS targets in Raqqa and Deir al-Zour.

Russian operational plans initially assigned deployed Su-25s the primary CAS role, consistent with prior air campaigns (e.g., Afghanistan, Chechnya). As we describe in Chapter 2, however, older Su-25s were unsuited to the SAA's operational needs in its counter-ISIS offensives in Homs and Deir al-Zour. Therefore, beginning in early 2016, Russia increasingly fulfilled its CAS responsibilities with advanced attack helicopters, which were night capable and equipped with modernized targeting and self-protection systems. The Su-25 eventually resumed its role as a CAS workhorse in 2017 but only after the VKS deployed an upgraded variant (Su-25SM3) and had established a basing posture that was more conducive to fixed-wing CAS operations.

¹⁴ Although older-model Su-25 aircraft have a combat radius of approximately only 200 nm with external stores, the strike aircraft—Su-24s and Su-34s—the VKS doctrinally employed in strike missions reach considerably farther, at nearly 550 nm and 590 nm, respectively.

Deployment Patterns and Concepts of Employment for Russian Aircraft

Fixed-Wing Combat Aircraft

The fixed-wing combat aircraft at Hmeimim constituted the core of Russian airpower in Syria throughout the campaign. The initial composition of the Russian air wing stationed at Hmeimim resembled the air-to-ground strike packages employed in prior Russian engagements:

- two attack squadrons, composed of twelve Su-24M/M2 air-to-ground bombers and twelve Su-25SM/UB strike aircraft for CAS
- one fighter-bomber squadron, composed of four Su-30SM air superiority fighters and four Su-34 fighter-bombers to deliver air-to-air support and precision-guided effects.¹⁵

The heavy representation of older Su-24 and Su-25 aircraft variants among the deployed force reflected prevailing VKS doctrine, CONEMP demonstrated in recent air campaigns (e.g., Georgia, Chechnya), and the prevalence of aging aircraft in Russia's fixed-wing combat aircraft inventory. The surprise was not the VKS's reliance on primarily older aircraft early in the campaign but rather the immediate presence of the Su-34, seeing its first combat action, and a modernized variant of the Su-30 air superiority fighter. Although the VKS possessed over 200 Su-24 and Su-25 aircraft each, the Su-34 was in early production at the time of the Russian deployment, and fewer than 50 had yet been delivered into service.¹⁶ As the Su-34 demonstrated its ability to effectively deliver precision-guided strikes, the VKS ultimately rotated in a full squadron, often split between Hmeimim and Mozdok air base in southern Russia, to supplement its strike efforts.¹⁷

Figure 3.1 outlines the maximum fixed-wing AOB at each operating location.

The VKS initially employed most of its fixed-wing aircraft in a strike role. The Su-24M2 was the workhorse of early strike operations, but even some Su-25 and Su-30 aircraft were used in "nontraditional" strike roles (though a residual detachment of Su-25s was placed on alert status to perform CAS).¹⁸ As the campaign evolved and it became clear that Russia's dual objectives of bolstering the regime and degrading the opposition were largely accomplished, the VKS experimented with new capabilities and CONEMP for a higher-end fight. For instance, after a Turkish F-16 shot down a Russian Su-24 (see Chapter 2), the VKS tasked all deployed

¹⁵ The initial presence of fighter-bomber aircraft at Hmeimim constituted less than a full squadron; however, the squadron was ultimately rounded out with subsequent rotations of Su-34 *Fullback* and Su-35 *Flanker-E* aircraft beginning in December 2015.

¹⁶ See Lt Col John R. Barnett, "The Costs of Russia's Air Expeditionary Campaign," *PolicyWatch*, Washington Institute for Near East Policy, December 11, 2015; and Gustav Gressel, *Lessons from Russia's Intervention in Syria*, Berlin: European Council on Foreign Relations, February 5, 2016.

¹⁷ Lavrov (2018, pp. 22–23) estimates that the Su-24 composed "half of all combat sorties" through the spring of 2017, at which point the Su-34 and other newer aircraft models began to adopt a greater role in strike missions.

¹⁸ Lavrov, 2018, pp. 3–4.

Figure 3.1. Russian Fixed-Wing Air Order of Battle, by Operating Base



Platform	Max on Station
Hmeimim Air Base	
Su-24M/M2	14
Su-25SM/UB	12
Su-27SM3	3
Su-30SM	4
Su-34	14
Su-35/S	6
Su-57	4
ADM Kuznetsov Aircraft Carrier (Tartus)	
MiG-29K/SMT	4
Su-33	10
Tiyas Military Air Base ("T-4")	
Su-25SM	4
Deir al-Zour Air Base	
Su-25SM	2

Su-30 fighters with providing air superiority and air-to-air escort on strike missions. Later, the VKS deployed newer fixed-wing capabilities (Su-35, Su-57) to experiment with fulfilling similar roles.

The VKS stationed multiple flight crews and technicians at Hmeimim. This enabled a single Su-24 to conduct “up to 6 sorties per day.”¹⁹ Strikes were conducted by “pairs of aircraft,” consistent with Russian TTPs.²⁰ The VKS gradually scaled up each aircraft’s target objectives to three to four targets per strike sortie, representing a “significant change in tactics during the operation.”²¹ These employment patterns illustrate the relative effectiveness of Russia’s lean expeditionary approach: by maintaining a high daily sortie tempo, “a relatively small number of aircraft” was able to have an appreciable impact on “the ground situation in Syria with limited resources.”²² The VKS used two crews per air frame “both to sustain the intensity of operations, but also to give squadrons more experience.”²³ As we describe in Chapter 4, aircrew inexperience

¹⁹ Lavrov, 2020, p. 92.

²⁰ Lavrov, 2018, pp. 3–4.

²¹ Lavrov, 2018, pp. 3–4.

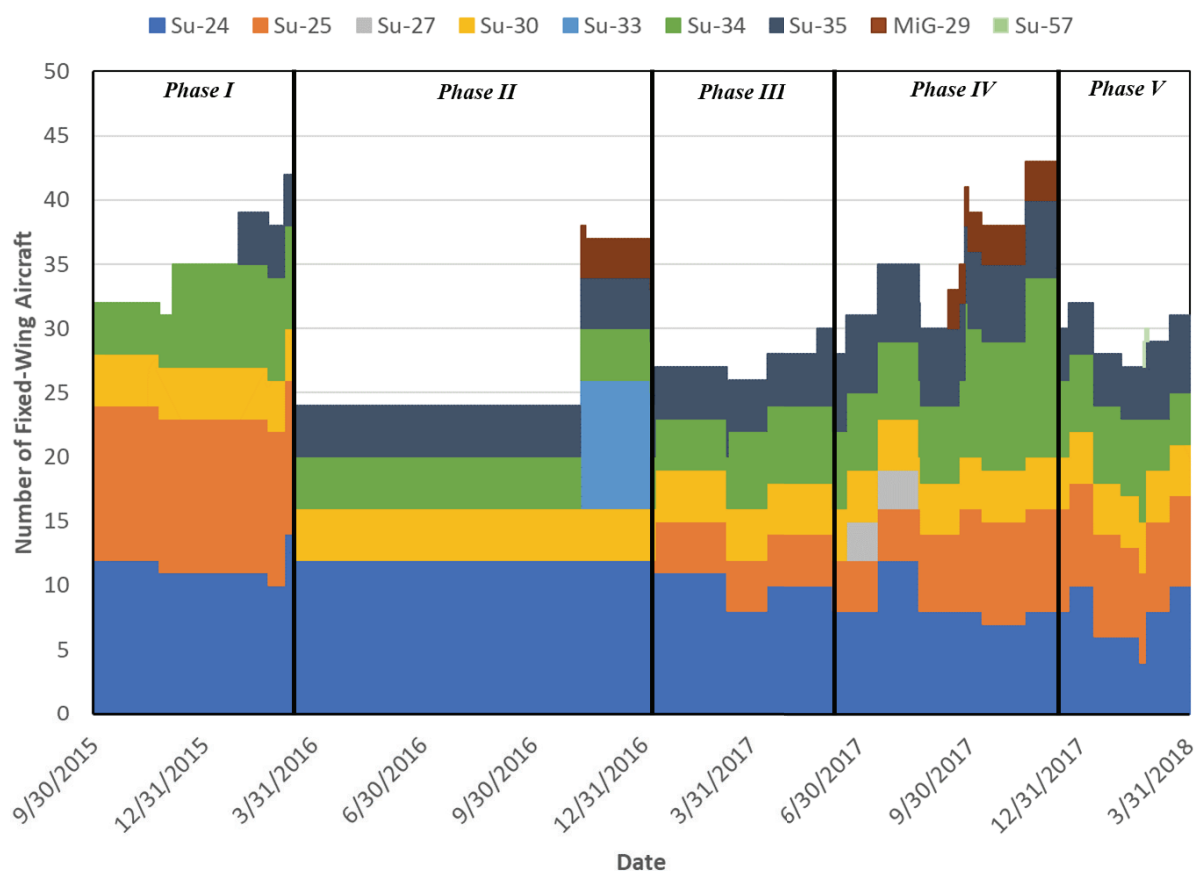
²² Lavrov, 2020, p. 92.

²³ Kofman, 2020, p. 53.

was a significant constraint on VKS operational planning, and Russian air operations initially prioritized minimizing risk and limiting aircrew burdens.

While the VKS continually experimented with the composition of its deployed strike packages, the size of its fixed-wing combat aviation force stationed at Hmeimim remained remarkably consistent throughout the campaign (reflecting the VKS's lean expeditionary approach). As seen in Figure 3.2, the median number of fixed-wing combat aircraft stationed at Hmeimim from September 15, 2015, through March 31, 2018, was 30, and the number averaged between 24 and 30 for over half the Russian air campaign in Syria.²⁴ This trend was punctuated at three distinct points in the campaign by short-term spikes in the number of deployed fixed-wing aircraft, each corresponding to critical operational phases requiring the VKS to scale its air capabilities to meet the rising operational tempo. In general, the VKS maintained steady rotations every three to four months. These dynamics are also displayed in the figure.

Figure 3.2. Deployed Russian Fixed-Wing Combat Aircraft, by Type and Operational Phase



NOTE: All aircraft and airstrike counts are estimated from open sources.

²⁴ All figures are estimates derived from the RAND TRADS-OS Database. For further information on data and methodology, see Chapter 1.

Rotary-Wing Aircraft

Following the first arrival of Russian rotary-wing aircraft (four helicopters, by intertheater transport aircraft) to the Syrian theater on September 15, 2015, the VKS rotary-wing presence ramped up to sixteen helicopters by September 20. The initial force included twelve Mi-24P *Hind-F* attack helicopters and four Mi-8AMTSh *Hip* transport helicopters, composing three complete helicopter detachments of four Mi-24s and one Mi-8 each. Although the Mi-24 is used in a multirole air assault role, it is one of the VKS's older platforms (having entered service by the early 1980s) and is daylight-only. Thus, initially, the VKS used the deployed helicopter units primarily to perform base-protection and CSAR missions.²⁵ However, as deployed rotary-wing assets became more central to Syrian ground operations, particularly in a CAS role, the number, variety, and CONEMP of VKS helicopters in Syria expanded significantly. Table 3.2 and Figure 3.3 show the maximum rotary-wing AOB at each operating location, and the growth and expanding variety of the deployed rotary-wing force over time, respectively.

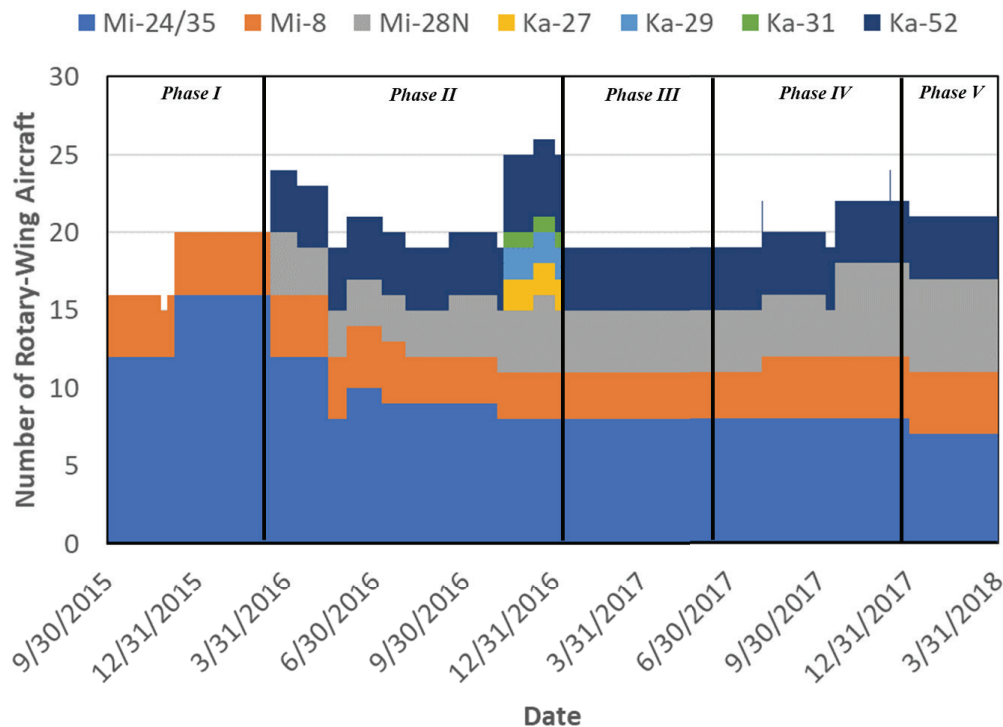
Table 3.2. Russian Rotary-Wing Air Order of Battle, by Operating Base

Platform	Max on Station
Hmeimim air base	
Mi-8	4
Mi-24P/Mi-35M	12
Mi-28N	5
Ka-52	4
Hama military air base	
Mi-8	1
Mi-24P/Mi-35M	4
ADM Kuznetsov aircraft carrier (Tartus)	
Ka-27/29/31	5
Ka-52	1
Tiyas military air base ("T-4")	
Mi-8	1
Mi-24P/Mi-35M	5
Ka-52	4
Mi-28N	4
Al-Shayrat air base	
Mi-8	1
Mi-24P/Mi-35M	8
Ka-52	4
Mi-28N	4

²⁵ Lavrov, 2018, pp. 22–23.

Platform	Max on Station
Deir al-Zour air base	
Mi-8	1
Ka-52	2
Kuweires air base	
Mi-8	1
Ka-52	4

Figure 3.3. Deployed Russian Rotary-Wing Aircraft, by Variant



NOTE: Most commercial satellite imagery does not distinguish between Mi-24P and Mi-35M variants of the Mil Mi-24 Hind helicopter, given the subtle identifiable differences; therefore, we do not attempt to do so here.

As Figure 3.3 indicates, Russia's early deployed helicopter population in Syria of 16 in September 2015 represented the lowest monthly total as of March 2018. The observed inventory peaked at least at 26 during the deployment of the *Kuznetsov* in December 2016, and it remained at a steady state of about 20 from the previous December until March 2018. As with the VKS's fixed-wing rotational patterns, the shifts in rotary-wing deployments likewise reflected important inflection points in Russian air operations and mirrored increased operational demands. Peak demands for rotary assets typically occurred in response to counter-ISIS operations, from the recapture of Palmyra in March 2016 to the battle for Deir al-Zour in fall 2017.

Enabler Aircraft

A key lesson learned from Russia's recent operational experiences in Georgia and Chechnya was the importance of air-to-ground integration.²⁶ To this end, Russia heavily used Spetsnaz forces early in the Syrian intervention for "target acquisition and designation for airstrikes," ground-based ISR, ground-to-air communications, and battle damage assessment (BDA).²⁷ Initial airstrikes were "largely pre-planned on static targets," confined to the "immediate frontline" of the Syrian conflict.²⁸ Russia's preliminary ELINT and signals intelligence (SIGINT) efforts likewise revolved around a network of "ground-based listening stations" constructed at SAA bases in regime-held territory.²⁹ The Russian CONOPS thus de-emphasized persistent and penetrating airborne ISR, relative to their U.S. counterparts. Still, battlefield results demonstrated the poor fit of Russian operational philosophies in an expeditionary warfare setting: Friendly fire, lack of dynamic targeting, minimal freedom of access, and poor theater-wide C2 together indicated the need for the VKS to introduce enabler aircraft and experiment with new CONEMP in Syria.

To enhance operational effectiveness, the VKS initiated rotations of increasingly sophisticated enabler aircraft.³⁰ Table 3.3 displays the Russian enabler aircraft reported by available public sources.

Table 3.3. Russian Enabler Aircraft in Syria

Platform	Platform Type	Mission Set
Antonov An-30 Clank	Fixed-wing	ISR
Beriev A-50M/U Mainstay	Fixed-wing	AEW&C
Ilyushin Il-20M Coot-A	Fixed-wing	ELINT/SIGINT/EW
Ilyushin Il-22M Coot-B	Fixed-wing	SIGINT/AWACS/C2
Ilyushin Il-22PP Porubschik	Fixed-wing	EW
Tupolev Tu-214R	Fixed-wing	Multi-INT
Eleron-3SV	UAV	ISR
Granat-1/2/4	UAV	ISR
IAI Searcher II ("Forpost")	UAV	ISR
STC Orlan-10	UAV	ISR/EW

NOTES: AEW&C = airborne early warning & control; EW = electronic warfare; AWACS = airborne warning and control system; Multi-INT = multiple intelligence.

²⁶ This was also a key tenet of NGW. See, for example, Bowen, 2020. We are grateful to Becca Wasser for pointing this out.

²⁷ Aleksey Nikolsky, "Russian Special Operations Forces in Syria," *Armed Forces*, Moscow Defense Brief #2, 2017, p. 9; See also Fainberg, 2017; and Thomas, 2019.

²⁸ Gressel, 2016; IHS Jane's, "Russia Learns Military Lessons in Syria," *Jane's IHS Intelligence Review*, 2017; and Lavrov, 2018.

²⁹ Gressel, 2016.

³⁰ By *enablers*, we mean assets that serve primarily in a supporting role to combat aircraft delivering air-to-air and air-to-ground effects. Enabler aircraft comprise a range of missions, notably ISR, C2, AEW&C, command post, mobility, and tanking. See the next three sections.

The VKS employed a range of fixed-wing enabler aircraft to execute core mission sets. Most of these platforms flew sorties out of Hmeimim, which could accommodate heavy fixed-wing aircraft. By contrast, most forward Russian air bases had not been renovated to host a dedicated presence of manned enabler aircraft. To address the resulting coverage deficiencies in remote geographic areas, the VKS largely relied on a significant contingent of deployed UAVs to create a theater-wide ISR network, relay targeting data for strike operations, control airstrikes, and provide BDA in less-accessible operational areas.³¹ Public reporting noted the presence of Russian UAVs throughout Syria, often stationed with SAA ground forces. By some estimates, Russian UAVs flew “more sorties than manned aviation over Syria.”³²

Unmanned Aerial Vehicles

Autonomy was a heavy emphasis of Russia’s recent military modernization effort. In addition to scaling up production of unmanned systems, the Russian military developed new CONOPS and TTPs that it tested in Syria.³³ At the outset of the Syrian conflict, Russia’s UAV inventory was quite limited by U.S. military standards. Beginning in 2011, however, the Russian military ramped up its investment in light UAVs (e.g., Orlan-10) and medium-altitude, long-endurance (MALE) UAVs (e.g., Forpost), which it deployed in high volumes to the Syrian theater.³⁴ According to the Russian General Staff and MoD, the Russian military employed up to 70 UAVs in daily ISR missions.³⁵ As the Russian military scaled its deployed UAV presence and iteratively refined CONOPS and TTPs, total unmanned ISR missions increased from about 6,000 to 16,000, and finally to 25,000, in the first three years of the campaign.³⁶

At the beginning of the campaign, Russia embedded UAV companies with Russian and Syrian Army brigades “to more easily facilitate command and control as well as maintenance.”³⁷ The evolution of Russia’s network-centric warfare doctrine in Syria eventually led the General Staff to realign UAV development under the VKS’s direction. Although light UAV companies can be operated and maintained with a light footprint and minimal operational basing, Forpost

³¹ The Orlan-10 light UAV and Granat-1 hand-launched UAV were often used by the Russian Army as an artillery spotter in close ground tactical situations. Meanwhile, the MALE Forpost was often used for medium-range target designation and monitoring.

³² Giles relays Russian government statements outlining plans to introduce a UAV company “into every maneuver brigade” (Keir Giles, *Assessing Russia’s Reorganized and Rearmed Military*, Washington, D.C.: Task Force on U.S. Policy Toward Russia, Ukraine, and Eurasia, Carnegie Endowment for International Peace, 2017, p. 3). See also Kofman and Rojansky, 2018.

³³ Samuel Bendett, “Russian Unmanned Vehicle Developments: Syria and Beyond,” in Samuel Bendett, Stephen Blank, Joe Cheravitch, Michael B. Petersen, and Andreas Turunen, eds., *Improvisation and Adaptability in the Russian Military*, Washington, D.C.: CSIS, 2020, p. 38.

³⁴ Bendett, 2020, p. 39.

³⁵ Bendett, 2020, p. 41; Lavrov, 2020, p. 102.

³⁶ Bendett, 2020, p. 41; Lavrov, 2020, p. 102. Note that these numbers are derived from official Russian military figures and may therefore be unreliable.

³⁷ Bendett, 2020, p. 44.

UAVs require a runway to operate and, therefore, were typically observed alongside VKS forces at Russian-operated airfields.

The initial composition and employment of deployed Russian UAVs reflected the Russian military's evolving doctrine regarding unmanned platforms. Most deployed UAVs at the outset were light Orlan-10s and Granat-1s, which are cheap and do not require a runway to operate. The Russian military originally planned to establish a constellation of attritable light UAVs that it would use exclusively on the front lines as artillery spotters.³⁸ Russian light UAVs feature extremely rudimentary target-acquisition capabilities and are constrained by short full-motion video broadcast ranges. Consequently, light UAVs do not “directly communicate with the fire direction centers” of Russian artillery batteries; UAV operators “determine target coordinates and relay that information to forward observers . . . who in turn relate the information to the fire direction centers.”³⁹ Light UAV feeds transmitted through ground command posts and were therefore primarily applicable in a crude artillery spotting role.

By contrast, MALE UAVs such as the Forpost, were used in a wider range of missions. In addition to ground-centric missions (artillery spotting, reconnaissance fire), Russia increasingly employed Forpost UAVs in air-centric roles (target designation and control, penetrating ISR and BDA, reconnaissance strike). As Figure 3.4 illustrates, MALE UAV datalinks typically transmitted imagery either directly to the air operations center at Hmeimim or through an associated airborne command post platform like the Il-22M *Coot-B*, which coordinated airborne C2 with the National Defense Management Center in Moscow. The higher cost of MALE UAVs, runway congestion at Russian air bases, and doctrinal preference for using special operators in target acquisition and designation roles thus led the VKS to initially employ Forpost UAVs in a relatively limited capacity. Over time, the Forpost has seen its ISR mission set expand in response to coverage gaps, a poor record of dynamic targeting on strike sorties, and Russia's desire to maintain a lean expeditionary footprint.

Although Russia's decision to scale up its deployed UAV force helped relieve the stress on special operations forces as tactical air controllers and expanded the scope of persistent theater-wide coverage, the VKS's reliance on UAVs to fulfill much of its ISR and BDA responsibilities in Syria came at a cost. The deployed Forpost and Orlan-10 UAVs were unarmed and equipped with minimal self-protection capabilities,⁴⁰ limiting their ability to conduct dual reconnaissance-strike missions and leaving them vulnerable to enemy fires.⁴¹ Public sources reported several downed Russian UAVs throughout the campaign. Russia's relatively high rate of attrition among

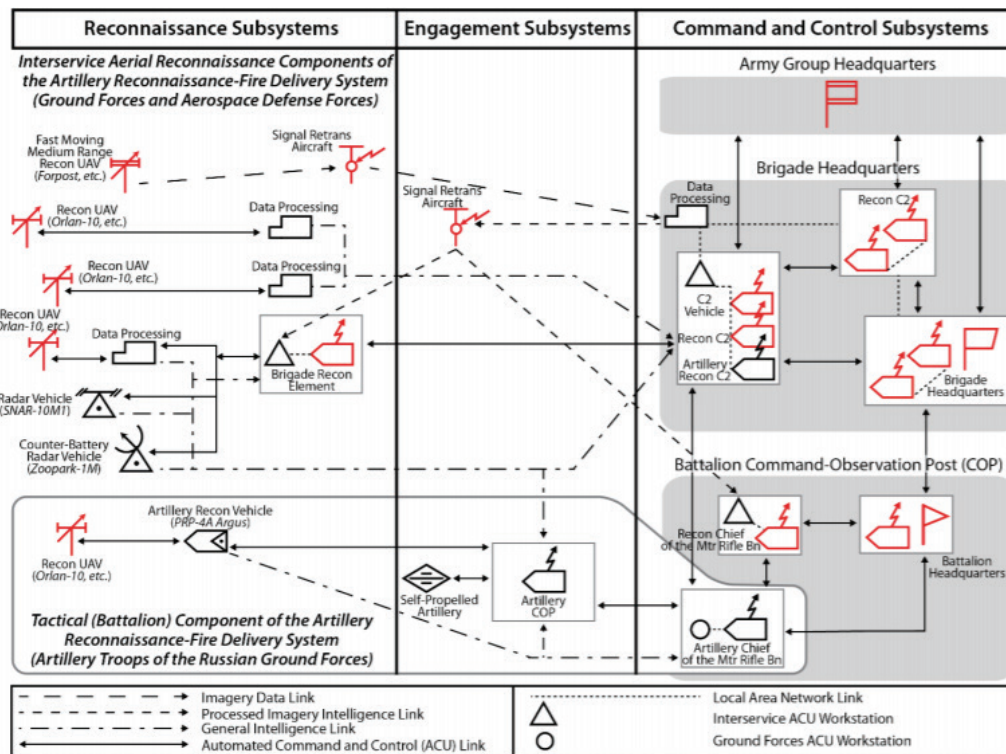
³⁸ Lester W. Grau and Charles K. Bartles, *The Russian Way of War: Force Structure, Tactics, and Modernization of the Russian Ground Forces*, Fort Leavenworth, Kan.: Foreign Military Studies Office, 2016, p. 373.

³⁹ Grau and Bartles, 2016, p. 373.

⁴⁰ Since the end of this research project, Russia has since deployed the armed *Orion* UAV to the Syrian theater.

⁴¹ Giles, 2017; Kofman and Rojansky, 2018.

Figure 3.4. Russian UAV Reconnaissance-Fire Delivery System



SOURCE: Lester W. Grau and Charles K. Bartles, *The Russian Reconnaissance Fire Complex Comes of Age*, Oxford: Changing Character of War Centre, University of Oxford, May 2018, p. 11. (Used with permission.)

its core theater ISR assets reflected two key developments in Russia’s expeditionary paradigm. First, Russia favored airborne ISR capabilities that provided a “more immediate and tangible impact on close-combat land warfare.”⁴² Second, Russia demonstrated the ability to rapidly field a high volume of “attributable UAVs for artillery support,” a model that it will likely sustain in future ground-based operations.

There is some evidence, however, that the VKS’s ongoing challenges in consistently closing the reconnaissance-strike loop and in effectively delivering precision effects have led the VKS to increase its use of UAV-driven targeting for precision-strike missions and to invest in several new technologies.⁴³ The VKS and Russian Army have tested “light drones with designators” and are currently developing several unmanned combat aerial vehicle (UCAV) variants.⁴⁴

At the same time, the Russian military’s CONEMP for its deployed UAVs came at the expense of a well-developed penetrating ISR capability. Some observers have cited this deficiency as a primary factor in the regime’s devastating loss of Palmyra to ISIS and in early

⁴² Shield, 2018, p. 237.

⁴³ Bendett, 2020, pp. 41–42; Kofman, 2020, p. 54.

⁴⁴ Lavrov, 2020, p. 102.

opposition gains in Idlib.⁴⁵ The UAV constellation appeared to be neither capable of reliably generating sufficient ISR to enable on-demand defensive CAS nor designed for penetrating ISR coverage. As noted, these shortfalls likely contributed to major battlefield losses against lower-end opponents in this counterinsurgency setting, raising doubts about Russia's expected level of overall operational effectiveness in a future fight against higher-end opponents.

It is also worth noting that for much of the campaign, the VKS was not concerned with target selection and vetting. Most targets in early operations were either large, stationary, and preplanned or were bombed indiscriminately with "dumb" munitions. Operational priorities and military doctrine thus de-emphasized an effective targeting capability. Nevertheless, as the situation on the ground changed, ISR shortfalls became more glaring and required the VKS to focus on developing a more-capable UAV constellation.

Manned ISR Aircraft

At the outset of the intervention, runway capacity constraints at Hmeimim and Russia's limited operational experience with dedicated manned ISR aircraft led the VKS to deploy only a small number of manned fixed-wing enabler aircraft. The legacy Il-20M *Coot-A*, a variant of the older Il-18 turboprop cargo aircraft that is equipped for ELINT/SIGINT missions, flew most of the ISR sorties out of Hmeimim early in the campaign. The Il-20M "controlled the radio communication data of the Islamists and searched for probable targets using modern infra-red systems and radars."⁴⁶ The VKS later supplemented its deployed Il-20M force with other dedicated ISR aircraft (notably, the An-30 *Clank*). Initially, theater ISR responsibilities were split among older legacy aircraft, with some combat aircraft likewise performing dual strike-reconnaissance missions.

As Russia began to experiment with new capabilities, however, the VKS deployed some of its newer manned enabler aircraft to the theater. The Tu-214R, first delivered from the production lines in 2011, was used in an airborne ISR role to provide electro-optical and SIGINT support to dynamic targeting, often in coordination with the advanced Su-35 multi-role aircraft. The A-50U *Mainstay* (first delivered also in 2011) may have been used in ISR missions, but it was primarily designed to provide AEW&C. Finally, the Il-22M, which has SIGINT capabilities, was employed in AEW&C, C2, and command post roles. In particular, the Il-22M coordinated airborne C2 with the National Defense Management Center in Moscow via satellite communications.⁴⁷

Some analysts have noted that Russia's allocation of dedicated ISR assets to Syria is "remarkably small for a modern air campaign,"⁴⁸ with the ratio of ISR-to-strike assets

⁴⁵ Shield, 2018, p. 237.

⁴⁶ Revaitis, 2020, pp. 40–41.

⁴⁷ Revaitis, 2020, pp. 40–41.

⁴⁸ Shield, 2018, p. 219.

considerably lower than that established by coalition air forces under CJTF-OIR. This allocation is likely due to differences in operational philosophies between the United States and Russia regarding the employment of airpower, as well as the VKS's lack of experience conducting expeditionary warfare. The VKS has not significantly focused on enabler aircraft for dedicated or multi-role missions as part of its modernization effort. According to IHS Jane's, the VKS sent its only two Tu-214R aircraft in inventory to Syria, while there was an inventory of only six A-50Us. To compensate for its lack of dedicated ISR assets, the VKS has upgraded some combat aircraft (e.g., Su-24MR, Su-24MP, MiG-25R) with multimission EW and ISR suites, though this approach has its limits in small-scale operations such as the Syria campaign. To optimize its limited resources, it is likely that the VKS will continue to employ fixed-wing combat aircraft in a multi-role context in future campaigns.

Intertheater Aircraft: Long-Range Strike, Tanking, and Airlift

Satellite imagery identified Russian long-range bombers being transferred to Mozdok air base as early as October 2015. Clearly, intertheater strike was a key capability that the VKS sought to deploy since the beginning of the intervention. The combination of Russian CONOPS with concerns about aircrew quality led the VKS to consistently assign long-range bombers stationed in southwestern Russia to counter-ISIS strike missions in Raqqa and Deir al-Zour.

At first, the VKS deployed a half squadron of Tu-22M3 *Backfire* bombers to Mozdok. It later supplemented this contingent with another half squadron of Tu-22M3s and a full squadron each of Tu-95MS *Bear* and Tu-160 *Blackjack* bombers. The long-range aviation forces at Mozdok and Engels were also routinely accompanied by a half- or full squadron of Su-34 fighter-bombers and Su-27/30 fighters. The VKS rarely maintained a continuous bomber presence at Mozdok, but it conducted frequent rotations that typically coincided with either public displays of retaliation against ISIS or major ground operations.

Russian Tu-95 and Tu-160 bombers were equipped with Kh-101 and Kh-555 air-launched, satellite-guided cruise missiles. However, the VKS generally preferred to employ its Tu-22M3 bombers, equipped with only unguided munitions, in counter-ISIS strike operations. Lavrov speculates that this decision may have been driven by cost concerns: "sorties by Tu-22M3s with unguided bombs were much cheaper."⁴⁹ As we discuss in Chapter 4, cost and munitions production and stockpile constraints appear to have driven many VKS employment decisions regarding the use of PGMs and PGM-equipped aircraft.

Another limitation of the Tu-22M3 is that it cannot be refueled in midair.⁵⁰ The lack of midair refueling constrains the ability to strike longer-distanced targets or maximize time on station, requiring either more forward basing or the usage of other aircraft. To minimize operational risk, Russia appears to have initiated an informal agreement with Iran to use Shahid

⁴⁹ Lavrov, 2018, p. 23.

⁵⁰ Lavrov, 2018, p. 23.

Nojeh air base in Hamadan for long-range strike operations.⁵¹ This cut the range of operations and risk significantly for the deployed Tu-22 and Su-34 aircraft. Even though Russia's adaptive basing posture was therefore a key enabler in its long-range strike operations in Syria, its capability deficiencies could be a liability in future campaigns with a larger area of responsibility (AOR) and fewer regional basing options. The VKS possessed neither a robust intertheater tanking capability nor a willingness to use higher-end but expensive PGMs on strike missions. Aware of this operational constraint, the VKS sporadically conducted operational exercises to test the ability of Il-78 tankers to refuel Tu-160 bombers on long-range strike operations.⁵²

To provide intertheater airlift and tanking capabilities in Syria, the VKS used a combination of An-124, Il-18D, Il-62, Il-76M, and Il-78M fixed-wing aircraft. As one analyst argues, "Strategic mobility is one area in which Russia revealed adaptability and increased capability."⁵³ The Russian military built up its intertheater resupply infrastructure (nicknamed the Syrian Express) prior to its intervention in 2015. This facilitated a steady resupply via both airlift and sealift from Russia.

Runway capacity limitations at most Russian forward air bases required the VKS to rely on deployed rotary-wing (Mi-8) and smaller fixed-wing (An-26, An-30) transport aircraft to provide intratheater lift. The relatively confined AOR was conducive to the VKS's dearth of dedicated tanking capabilities. However, in a potential future engagement in a larger AOR, outside Russia's near-abroad, against a higher-end opponent, this deficiency could create operational and logistical challenges. As noted above, the VKS sporadically experimented with tanker-enabled long-range strike operations, a capability it is likely to build on in the coming years.

Hub and Spokes: Russia's Distributed Basing Approach

The VKS quickly faced key operational shortcomings at the outset of its air campaign. Hmeimim was limited to at most two runways at any one time, creating daily congestion at Russia's primary air operations hub in Syria.⁵⁴ Russian freedom of movement and intelligence-gathering capabilities were initially constrained to the area immediately surrounding Hmeimim. Pilot inexperience and technical deficiencies exhibited by the legacy Russian platforms resulted in multiple downed aircraft and helicopters early in the campaign. The VKS's physical footprint in Syria thus posed operational risks and yielded an inefficient allocation of airpower.

⁵¹ Following assertions from some Iranian politicians in August 2016 that Russia's use of Shahid Nojeh violated the Iranian constitution, Russia abandoned the base shortly thereafter. There have been reports, however, that the VKS has tacitly continued to use it. See Mohsen Milani, "Iran and Russia's Uncomfortable Alliance: Their Cooperation in Syria in Context," *Foreign Affairs*, August 31, 2016; and Tom O'Connor, "Russian Military Can Now Bomb Syrian Rebels and ISIS from Iran," *Newsweek*, March 28, 2017.

⁵² Revaitis, 2020, p. 41.

⁵³ Hamilton, 2018, pp. 12–13.

⁵⁴ Sean O'Connor and Jeremy Binnie, "Russia Deploys Additional Su-34s to Syria," *Jane's Defence Weekly*, December 11, 2015.

Russian military planners adapted to these early operational challenges by pursuing a distributed basing approach. Initially, the VKS sought to use a limited set of secondary air bases outside the primary hub at Hmeimim as temporary staging locations for Russian helicopters to conduct CSAR missions. Over time, however, the VKS developed a robust, permanent basing network designed to host both fixed- and rotary-wing aircraft and to meet a range of operational priorities. In this hub-and-spokes model, Hmeimim air base served as both the logistical hub for the VKS's expeditionary force and supply chain, and the operational hub that generated the bulk of Russian strike sorties. Throughout the campaign, the VKS incorporated a growing series of geographically distributed bases (e.g., al-Shayrat, Tiyas, Deir al-Zour) as spokes in the network. Russia's experimentation in Syria with an enduring distributed-basing model was an important adaptation in Russian military strategy, having clearly been influenced by emerging concepts such as NGW and the strategy of limited action.

The evolution of the Russian hub-and-spokes basing model offered three critical benefits to the VKS air campaign. First, the model allowed aircraft to be forward-based outside of Hmeimim, fostering the potential for more-responsive air operations. Second, incorporating a geographically distributed network of air bases enabled the VKS to perform mission sets (particularly in more geographically isolated counter-ISIS operations) that force limitations rendered infeasible or ineffective from Hmeimim. These included CSAR, penetrating ISR, and offensive CAS. Third, opening additional air bases to fixed-wing aircraft enabled the VKS to relieve the congestion at Hmeimim and scale up the deployed combat aviation force to meet operational demand.

Hmeimim contained the VKS's main expeditionary air operations center and joint planning cell, which planned daily air operations and coordinated with the Russian General Staff at the National Defense Management Center in Moscow. As noted above, Hmeimim also served as the VKS's primary aviation logistics hub: Russian engineers had renovated the runways at Hmeimim to receive heavy intertheater lift and cargo aircraft, enabling an air-based supply chain to operate in parallel to the sea-based "Syrian Express." The Russian military deployed a limited number of engineers, maintainers, and logistics staff to support air operations; however, the VKS's lean expeditionary approach relied heavily on private contractors to fulfill most operational support roles. Analyst Michael Kofman notes that an "entire village of defense industry specialists was present" at Hmeimim to support combat air operations.⁵⁵ By contrast, accommodations at secondary air bases were initially sparse. This reflected both the limited role and lower operational priority the VKS envisioned for its forward bases. Indeed, the VKS allocated the bulk of its fixed-wing combat aircraft to counteropposition strike missions in the northwest throughout the first year of the campaign. As we describe below, technical and aircrew limitations rendered fixed-wing CAS largely ineffective in early counter-ISIS operations. Rotary-wing assets therefore increasingly filled the operational gaps posed by Russia's Su-25 aircraft, creating a demand for forward-based attack helicopters.

⁵⁵ Kofman, 2020, p. 12.

Rotary-Wing Hub-and-Spokes Basing Patterns

The VKS initially employed rotary-wing assets in base protection and defensive CAS roles to secure Russia's MOB at Hmeimim, as well as CSAR for downed Russian pilots. However, the limited combat radii of the Mi-8 and Mi-24 helicopters limited the coverage area of Russian CSAR generated from Hmeimim. This was problematic for three key reasons. First, CSAR mission effectiveness is predicated on the relative coverage (time on station) that allocated forces are able to sustain and their response time during search-and-rescue events. These were indeed constraints on Russia's ability to execute its CSAR responsibilities early in the campaign. Second, the VKS consistently exhibited concerns regarding aircrew inexperience across mission sets (see Chapter 4). Minimizing operational risks was therefore an overriding priority in Russian operational planning. In terms of CSAR, this meant that establishing a permanent distributed-basing posture would be essential to maximize coverage and responsiveness. Finally, Russia's relatively high attrition during the first year of the campaign created immediate operational demand for CSAR.

As Russian Su-25 aircraft began to support the regime's northwest Syria offensive in a CAS role, the VKS therefore transferred a helicopter detachment to Hama air base for about ten days in early October 2015 to generate more-responsive CSAR. This temporary rotation of a single helicopter detachment represented the VKS's first experimentation with using forward bases to fill a limited operational role. The VKS subsequently created an enduring network of rotary-wing bases designed to optimize responsiveness to forward air operations and maximize time on station for CAS and CSAR missions. Russia's rotary-wing basing patterns over time in Syria are shown in Figure 3.5.

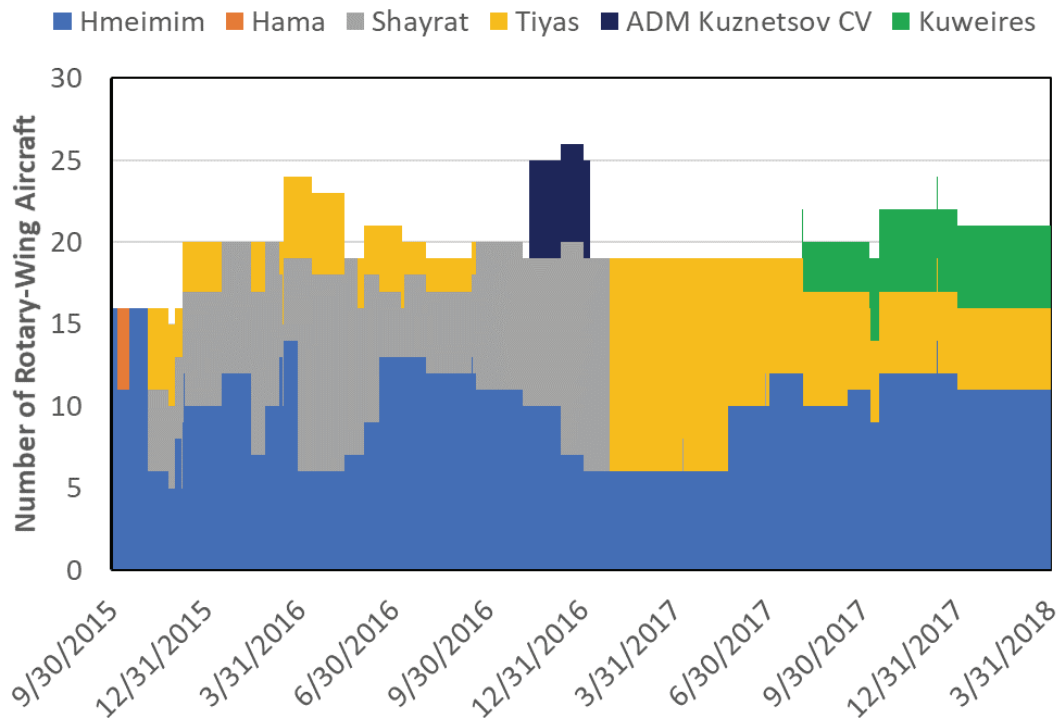
The VKS based a daily average of more than half of its rotary-wing fleet at forward locations throughout the Syria campaign. On nearly two-thirds of the days covered by this analysis, helicopters operated simultaneously out of at least three distinct base locations.

For the first half of the campaign, the VKS's core forward operating location was al-Shayrat air base in the Homs governorate.⁵⁶ Beginning in November 2015, the VKS stationed a unit of four Mi-24s and one Mi-8 at Shayrat to conduct CSAR missions in support of the Syrian regime's ground operations clearing the Homs-Hama highway, parts of which were controlled by opposition forces. Doing so was a prerequisite to secure the area surrounding Russia's MOB at Hmeimim and to establish SAA supply lines to the south. Over time, however, Shayrat evolved into a central transit and logistics hub, which was "used as a forward refueling and rearming base" for Russian helicopters.⁵⁷ Russian engineers also expanded the runway aprons and hangar space at Shayrat to accommodate medium fixed-wing cargo aircraft, relieving some congestion at Hmeimim and redistributing the VKS's logistics footprint to forward operating locations.

⁵⁶ Throughout this report, "al-Shayrat" and "Shayrat" are used interchangeably.

⁵⁷ Bodansky, 2016, p. 6.

Figure 3.5. Deployed Russian Rotary-Wing Aircraft, by Base Location



NOTES: Aircraft numbers are estimated from open sources. ADM Kuznetsov CV = *Admiral Kuznetsov* aircraft carrier.

The built infrastructure and moderate contractor support at Shayrat allowed the VKS to permanently base as many as three full helicopter units there at once. Even as the VKS expanded its basing network to other forward locations, the maintenance and refueling capacity at Shayrat facilitated a permanent forward operating posture. As the VKS began to support counter-ISIS operations in Palmyra in winter and spring 2016, helicopter detachments began daily or weekly rotations from Shayrat to the Tiyas (“T-4”) air base in Homs Province. The rotation patterns between Shayrat and Tiyas reflected the evolving CAS role that Russian attack helicopters increasingly adopted in counter-ISIS operations. By the end of 2016, the VKS fully stood Tiyas up as a permanent forward rotary-wing base, with maintenance and logistics capabilities and personnel comparable to those at Shayrat.

In addition to the diversity of rotary-wing basing locations, the VKS likewise displayed a willingness to experiment with the configuration of forward-based helicopter detachments. Two CAS detachments were stationed at Shayrat throughout early 2016, followed by a detachment each of Mi-24/35s, Ka-52s, and Mi-28s leading up to the recapture of Palmyra in March. Russian rotary-wing basing trends evolved in parallel to the regime’s counter-ISIS focus. The Tiyas air base, which had based a Russian attack helicopter unit for much of the previous year and a half, gained an increased force presence in spring 2017 to support the next phases in the regime’s offensive in Deir al-Zour and eastern Homs.

Russian operational planning thus increasingly prioritized short rotations of advanced attack helicopter units to forward air bases beginning in 2016. Because the higher-priority campaign against the Syrian opposition was also a higher-end fight,⁵⁸ the VKS disproportionately allocated fixed-wing resources to the Syrian regime's northwest offensive. The geographic conditions in the regime's counter-ISIS operations were likewise not conducive to on-demand CAS from the Russian fixed-wing Su-25s based at Hmeimim. The VKS's hub-and-spokes basing approach for helicopter units demonstrated effective adaptability to the operational setting and enabled the VKS to efficiently allocate resources.

However, the hub-and-spokes approach also exhibited several shortcomings, including poor base protection and limited applicability to different operational contexts in future conflicts. An attack by ISIS on Tiyaas air base in May 2016 destroyed four Russian Mi-24/35 helicopters.⁵⁹ Russian forward operating locations were consistently under threat from ISIS, and the United States likewise struck the airfield adjacent to Russia's logistics hub at Shayrat in April 2017 with a cruise missile strike. Russia struggled to effectively protect its rotary-wing assets and built infrastructure at forward bases, due in equal parts to its lack of shelter capacity and lean force presence.

Beyond these base protection deficiencies, there are at least eight documented incidents that resulted in helicopter losses. The first shoot-down, by opposition forces in November 2015, was the result of the Mi-24's daylight-only and minimal self-protection capabilities. Even after Russia replaced its obsolete Mi-24s with modernized Mi-35M, Ka-52, and Mi-28N attack helicopters, Russian rotary-wing forces experienced a spate of accidents throughout 2016. Pilot error caused a Mi-28N to crash at night, despite the fact that the Mi-28N is night capable. Three more helicopters, including advanced Mi-35 and Mi-28 variants, were shot down by opposition and ISIS ground fire in the last half of 2016. Finally, two more helicopters (one Mi-24 and one Mi-28N) crashed in 2017 as the result of either pilot error or a technical malfunction. The operational responsiveness, congestion relief, and resource allocation efficiency the VKS's hub-and-spokes basing strategy produced therefore came at the cost of higher rates of attrition.

Fixed-Wing Hub-and-Spokes Basing Patterns

The VKS employed an increasingly varied distribution of fixed-wing bases, opening at least the Tiyaas and Deir al-Zour air bases to Su-25s in July and November 2017, respectively.⁶⁰ After stationing all its deployed fixed-wing combat aircraft at Hmeimim 100 percent of the time during the first year of the campaign, the VKS based a daily average of at least 5 percent of its deployed fixed-wing force at forward locations following the theater presence of the *Kuznetsov* in

⁵⁸ Opposition forces possessed surface-to-air capabilities, unlike ISIS.

⁵⁹ Wintour, 2016.

⁶⁰ The VKS's ability and willingness to forward-base fixed-wing aircraft may, moreover, explain its decision to redeploy Su-25s in January 2017 after nearly a year of absence from the theater.

November 2016.⁶¹ In addition to facilitating a larger overall deployed fixed-wing force, these moves coincided with major phases in the air campaign against ISIS in Deir al-Zour.

The *Kuznetsov*'s deployment represented a critical change in Russia's philosophy regarding the employment of airpower—a philosophical change that likely exceeded its operational impact. Throughout the first year of Russia's air campaign, the VKS had generated all of its fixed-wing sorties from Hmeimim, the main Russian air operating base in Syria. Russian engineers were observed making runway improvements at multiple other bases, including al-Shayrat and Tiyas, throughout 2015 and 2016, to accommodate Russian fixed-wing aircraft.⁶² Nevertheless, the VKS refrained from staging any combat aircraft outside of Hmeimim for forward operations. The deployment of the *Kuznetsov*, however, demonstrated a newfound Russian willingness to project airpower from outside its primary fixed-wing hub. As we describe in Chapter 2, Russian carrier-based aviation suffered a series of setbacks that required nearly the full air wing to temporarily base at Hmeimim. Still, Russia's willingness to experiment with generating fixed-wing sorties outside of Hmeimim represented a key adaptation.

Initially, this shift primarily affected the regime's Aleppo offensive, but it quickly permeated VKS operational planning for counter-ISIS missions as well. Although Hmeimim continued to serve as the foundation of Russian air operations, the VKS increasingly applied the hub-and-spokes basing model to its fixed-wing aircraft. This dynamic is displayed in Figure 3.6.

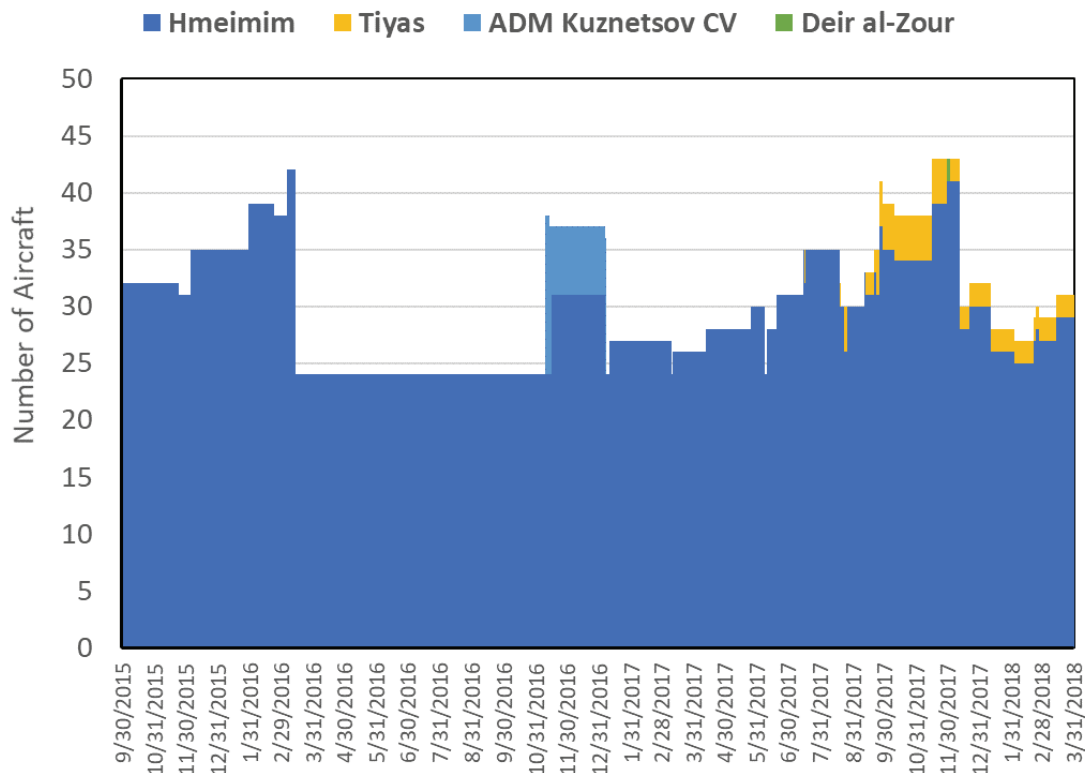
The trends displayed in Figures 3.5 and 3.6 suggest that the VKS was far more reluctant to distribute its fixed-wing assets concurrently at multiple forward bases than it was its helicopter units. This reflects a combination of factors. First, most accessible Syrian air bases contained neither suitable runway space nor shelter capacity at the outset to accommodate a robust forward presence of Russian fixed-wing aircraft. As noted above, commercial satellite imagery observed Russian engineers at multiple air bases over the course of the next year building out the infrastructure to accommodate fixed-wing aircraft. Second, distributed basing was not an operational imperative for strike missions since most targets were well within the combat radii of Russian strike aircraft stationed at Hmeimim.

The Su-25 was a key exception: the combination of technical deficiencies (minimal targeting and self-protection capabilities), aircrew inexperience, and a smaller combat radius significantly hindered the Su-25's ability to consistently and effectively provide CAS in more geographically remote counter-ISIS operations. After the VKS rotated its entire Su-25 squadron out of the Syrian theater in March 2016, the hub-and-spokes model became even less applicable to fixed-wing operations. However, the VKS shifted its focus to counter-ISIS operations in 2017 and rotated a squadron of upgraded Su-25SM3s back to the theater. By that point, Tiyas air base had been sufficiently improved to accommodate a limited fixed-wing presence.

⁶¹ These figures are the authors' calculations of data derived from daily estimates in the RAND TRADS-OS Database.

⁶² Barnett, 2015.

Figure 3.6. Deployed Russian Fixed-Wing Combat Aircraft, by Base Location



NOTES: Aircraft numbers are estimated from open sources. ADM Kuznetsov CV = *Admiral Kuznetsov* aircraft carrier.

The VKS's base protection concerns, coupled with the base's relatively austere logistical infrastructure, drove the VKS to limit its forward Su-25 rotations to a few days at a time. Beginning in July 2017, the VKS sporadically staged two to three Su-25s at Tiyas for single CAS sorties. To support Syrian ground operations in Deir al-Zour in August and September, the VKS began rotations of two Su-25s to Tiyas roughly every three to four days, with a peak of four Su-25s stationed at Tiyas from September through November. Each Su-25 pair was theoretically capable of flying multiple daily sorties from Tiyas, though in practice, the limited maintainer presence relative to Hmeimim constrained the VKS's forward fixed-wing CAS sortie rate. While the VKS maintained a permanent fixed-wing presence at Tiyas (and later at Deir al-Zour) throughout the second half of 2017, capacity and personnel limitations therefore required shorter fixed-wing than rotary-wing rotations and generated a lower daily sortie rate than at Hmeimim.

Conclusion

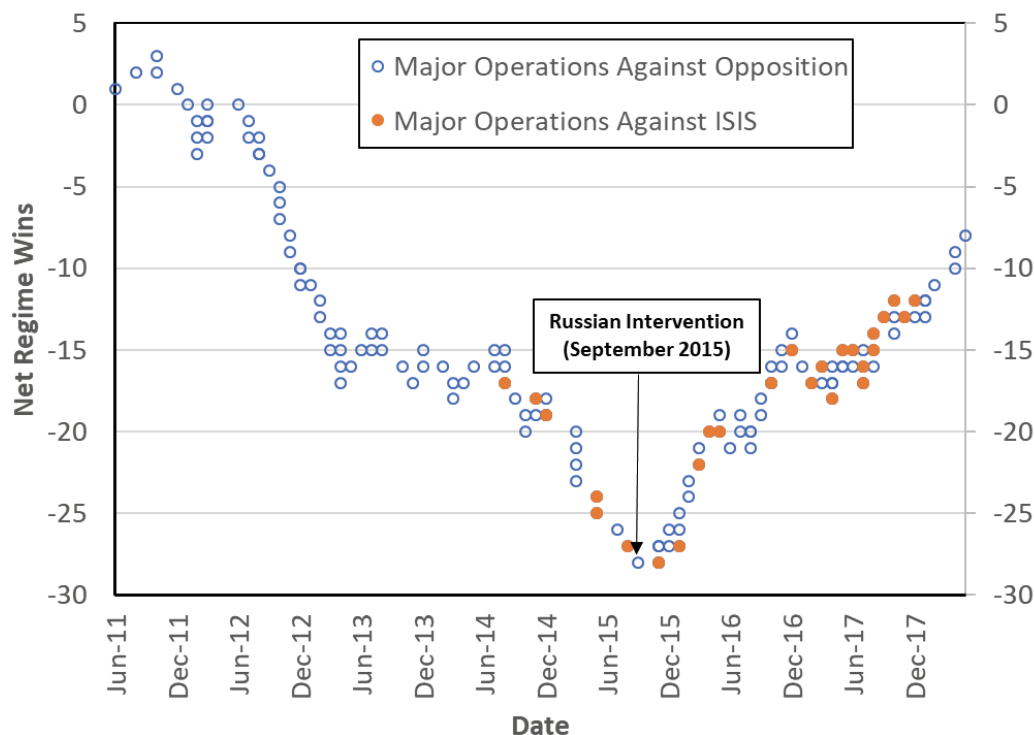
The physical attributes of Hmeimim air base proved critical to Russian operations in Syria. The proximity of Hmeimim to key opposition locations in northwest Syria such as Latakia, Hama, Idlib, and Aleppo facilitated effective VKS fixed-wing CAS and strike missions in

support of the SAA's numerous northwest offensives. In contrast, the relative geographic remoteness of ISIS forces in the eastern provinces of Homs, Raqqa, and Deir al-Zour often stretched or exceeded the effective combat radii of Russia's fixed-wing aircraft and/or the capabilities of VKS aircrews. The logistical challenges of generating dedicated air support for multiple, geographically separated fronts informed VKS operational planning and crucially shaped the direction of Russia's counter-ISIS mission. Addressing these challenges allowed the VKS to experiment with adaptive CONEMP and expeditionary force deployment and basing methods that the VKS will likely incorporate into future campaigns.

4. Strengths and Weaknesses of Russian Airpower in Syria

During the first four years of the Syrian civil war, the Assad regime experienced a dramatic series of losses on the battlefield. We estimate that, at its operational nadir in September 2015, the SAA had lost, on net, 30 more major operations than it had won. The overwhelming majority of these losses had come at the hands of the U.S.-backed opposition, but ISIS also began to secure major victories over the regime in late 2014. As the opposition consolidated its control over northwest Syria, and as ISIS progressively expanded its reach to the north and east, the regime appeared susceptible to imminent collapse. Against this backdrop, it is therefore difficult to observe Figure 4.1 and not conclude that Russia's decision to intervene in Syria played a decisive role in reversing the regime's fortunes.

Figure 4.1. Net Wins by Syrian-Allied Forces in Major Operations, 2011 to 2018



As Figure 4.1 indicates, the Russian intervention was a clear inflection point in the SAA's relative operational success. For reasons outlined below, the VKS's employment of airpower was, from the start of the campaign, significantly more effective in operations against the

opposition than in operations against ISIS.¹ In fact, the regime’s progress against ISIS stagnated after some early success in Homs; by contrast, there is a relatively strong correlation between Russian airstrikes and the regime’s success against the opposition after September 2015. To illustrate this point, Figure 4.2 overlays the weekly averages of daily Russian airstrikes (along the left axis) atop Russian aircraft deployment patterns (along the right axis).

Figure 4.2. Daily Russian Airstrikes, Expressed as a Weekly Average, vs. Deployed Aircraft

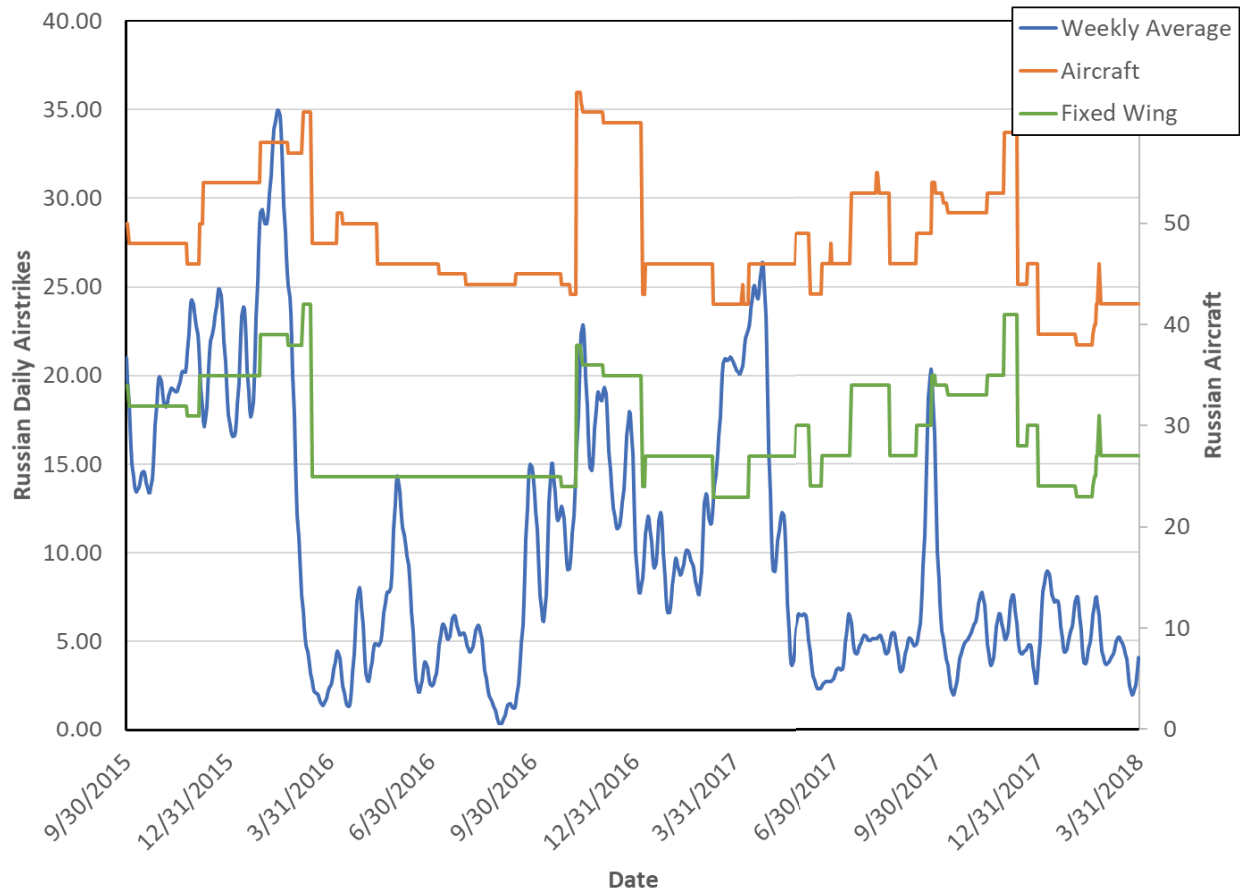


Figure 4.2 demonstrates two key takeaways regarding Russian air operations in Syria. First, periods of intensification in the tempo of daily airstrikes usually followed spikes in the number of deployed fixed-wing aircraft. Although the VKS continually experimented with the composition of its deployed strike packages, the baseline size of the fixed-wing combat aviation force stationed at Hmeimim remained consistent throughout the campaign. This trend was punctuated at three points by short-term spikes in the number of deployed fixed-wing aircraft,

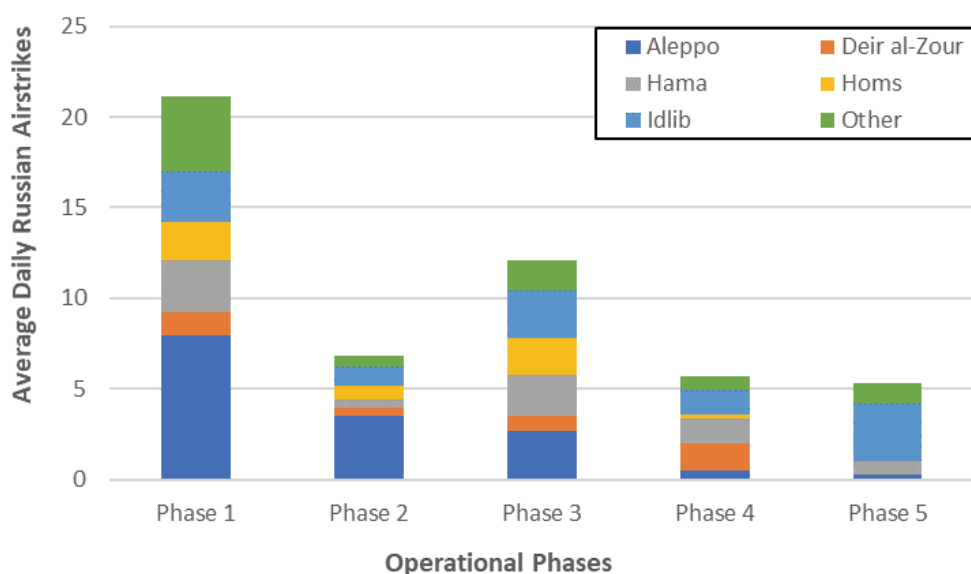
¹ These reasons include a more-favorable operational setting, the higher priority Russia initially placed on counteropposition operations, more-capable aviation assets allocated to counteropposition operations, better intelligence-gathering capabilities that yielded a clearer operational picture, and a closer proximity to Hmeimim that enabled the VKS to minimize pilot and technical errors.

each corresponding to critical operational phases requiring the VKS to scale up its air capabilities to meet the rising operational tempo.²

Second, Russian airstrike intensity reached a peak relatively early in the campaign, reflecting the VKS’s prioritization of airpower for the higher-end fight against the U.S.-backed opposition. In addition to the possession by some opposition groups of MANPADS, Russian run-ins with Turkish F-16 fighters early in the campaign led the VKS to task deployed Su-30s and Su-35s with ensuring air superiority and providing air-to-air escort on all bombing sorties. Moreover, the VKS sought to maximize pressure on opposition forces by inflicting heavy attrition, both in an effort to slow the opposition’s operational success and to compel political negotiations with the United States. For all these reasons, the VKS’s operations in the SAA’s northwest offensive absorbed the bulk of deployed Russian fixed-wing assets.

Figure 4.3 illustrates the overwhelming concentration of Russian airstrikes in opposition-held areas during the first year of the campaign, with northwestern provinces (Idlib, Hama, Aleppo, and Latakia [“Other”]) receiving a majority of Russian effects. The regime’s brutal assault on Western-backed opposition forces in Aleppo during the second half of 2016, enabled by a “relentless” Russian bombing campaign, was arguably the “culmination and turning point of the entire war.”³

Figure 4.3. Average Daily Russian Airstrikes, by Operational Phase and Syrian Governorate



² The one exception to this pattern occurred in spring 2017, when operational intensity increased even as the VKS reduced its deployed fixed-wing force. As we discuss below, this was driven by Russia’s different CONEMP against the opposition and ISIS. Specifically, VKS airpower in counter-ISIS missions was typically led by attack helicopter units, which explains why the spike in airstrikes during 2017, which disproportionately targeted ISIS-occupied territory in Homs, Raqqa, and Deir al-Zour, occurred without an increased fixed-wing force.

³ Lavrov, 2020, p. 92.

The Deir al-Zour Puzzle

From almost the beginning of the intervention, Russian actions indicated that breaking the yearlong ISIS siege of Deir al-Zour was a long-term operational priority, albeit subordinate to Russia's immediate objective of degrading the opposition.⁴ The VKS conducted sizable airlift and airdrop operations, in parallel to separate UN humanitarian aid efforts, supporting SAA forces trapped in Deir al-Zour city.⁵ As mentioned in Chapter 2, analysts have cited the presence of Russian private military contractors in Deir al-Zour as evidence of Russia's strategic interest in the province's oil and mineral resources. After Russian forces established a bridgehead on the Euphrates in 2017, Russian activity—both officially sanctioned VKS airstrikes and informal incursions by private military companies—on the eastern bank increased significantly, culminating in U.S. airstrikes in February 2018 that killed hundreds of Wagner Group contractors.

There is some debate among Western observers about the affiliation between the Kremlin and Russian private military companies like the Wagner Group. Although it is likely that these companies are nominally independent of direct Russian government influence, there is some evidence of close cooperation between the two. The MoD may have even provided financial and logistical support to Wagner prior to the Euphrates crossing. Rondeaux indicates that Wagner was linked both to close Putin ally Yevgeny Prigozhin and to the Internet Research Agency, a Russian disinformation proxy.⁶ Thomas reports the existence of “a contract on extracting oil from Syrian territory between Syrian authorities and the Russian firm EuroPolis” and states that the Wagner Group private military company was also reportedly originally hired “to protect [Syrian] oil extraction facilities, which some believe Assad had promised to transfer to Russian investors.”⁷ It has also been reported that the Kremlin's informal backing of Wagner and other private military companies may have stopped short of violating the U.S.-Russian deconfliction agreement; Putin is rumored to have withdrawn his support of the contractor following its firefight with U.S. forces in 2018.⁸

Aside from the Syrian government's interest in securing Syrian oil infrastructure (particularly east of the Euphrates), it is possible that Deir al-Zour simply represented a core hub of regional ISIS and U.S. operations—both of which Russia viewed as harmful to its strategic objectives. Why, then, did it take two years to finally liberate the city? Why did Russia prioritize other operational areas for strike missions out of Hmeimim for most of the campaign? Finally, why

⁴ Kofman (2020) argues that Russia viewed securing Deir al-Zour as a higher priority than did its allies.

⁵ At the same time, Russian aircraft have been accused of bombing humanitarian aid convoys to Deir al-Zour.

⁶ Rondeaux, 2019, p. 12.

⁷ Thomas, 2019, p. 21.

⁸ Neil Hauer, “The Rise and Fall of a Russian Mercenary Army,” *Foreign Policy*, October 2019.

did the VKS rely so heavily on intertheater strike capabilities in Deir al-Zour? These questions underscore the puzzle of Russia's employment of airpower in Deir al-Zour.

We contend that a combination of at least six key factors likely influenced the VKS's operational planning vis-à-vis Deir al-Zour. First, Russia's immediate strategic priorities in Syria at the outset were to stave off defeat for the Assad regime, degrade the U.S.-backed opposition, and compel a political settlement with the West. With the SAA initially focusing most of its best ground forces on retaking Aleppo from the U.S.-backed opposition, a major ground offensive against ISIS was, therefore, simply not feasible until 2017.

Second, the nature of the targets and irregular character of the adversary made a sustained bombing campaign less tractable in Deir al-Zour early in the campaign. In contrast, the U.S.-backed opposition may have been comparatively easier to target since they were essentially engaged with the Syrian regime in regular warfare. According to Lavrov:

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.⁹

Third, Russian CONOPS conventionally distinguished between strike and CAS missions in its tasking of Su-24 and Su-25 aircraft, respectively. Since initial strike operations prioritized counteropposition targets in the area surrounding Hmeimim, tasking the residual Su-25 aircraft with strike operations in ISIS-held locations in eastern Syria would have gone against Russian standard operating procedures.

Deir al-Zour was close enough to Hmeimim (205 nm) to be considered a medium-range target (less than 310 nm), for which Su-24 fighter-bombers would be conventionally tasked with carrying out strike operations. News reports and plane spotters have indeed sporadically observed Su-24s conducting operations in Deir al-Zour. Although Deir al-Zour was well within the combat radii of combat aircraft stationed at Hmeimim, most deployed Su-24 or Su-34 aircraft were perpetually allocated to the SAA's counteropposition operations in the northwest, west, and south. Therefore, the VKS could not reliably generate fixed-wing strike sorties to Deir al-Zour from Hmeimim. This limitation became apparent early in the campaign, prompting the VKS to rotate at least a dozen long-range strike aircraft and a squadron of Su-34s to Mozdok. Long-range strike thus constituted Russia's primary source of air support to entrenched SAA forces in Deir al-Zour for most of the campaign.

Fourth, it is equally plausible that the VKS chose to limit its CAS sorties to Deir al-Zour due to operational challenges. ISIS had captured Palmyra and much of the surrounding areas in Homs and Deir al-Zour by 2015. The highway from Palmyra to Deir al-Zour was virtually impassible throughout the first two years of Russia's intervention. This was, indeed, the basis for Russia's airdrop missions to Deir al-Zour.

⁹ Lavrov, 2018, p. 6.

The push to Deir al-Zour was phased sequentially, with SAA forces needing to decisively secure Palmyra and key transport arteries before concentrating on Deir al-Zour. This narrative aligns with Su-25 employment patterns. Indeed, the VKS used its Su-25s in a CAS role in Homs before replacing them with more operationally suited attack helicopters in 2016. It was not until the SAA had decisively secured most of Homs that the VKS returned the Su-25 to the theater and began conducting CAS sorties to Deir al-Zour out of the T-4 air base. Therefore, a combination of operational challenges and the Su-25's technical limitations plausibly explain the lack of Russian CAS in Deir al-Zour prior to 2017.

Fifth, a dearth of available ISR resources in Deir al-Zour early in the campaign may have reduced its operational value as a target for Russian airstrikes. At the outset of Russia's intervention, Russian CONOPS relied heavily on Spetsnaz forces to provide long-range reconnaissance and targeting for strike missions. Spetsnaz detachments embedded with SAA ground forces throughout the country to coordinate operations and have been observed at key battles for Aleppo, Damascus, Latakia, and Palmyra (among others).¹⁰ However, we were not able to find any publicly available evidence that Spetsnaz forces were present in Deir al-Zour prior to 2017 (although Russian private military contractors maintained a continuous presence there since at least 2012). Some Russian ground forces collocated with forward-based attack helicopters at Shayrat and T-4 beginning in late 2015; however, at least initially their primary objective was to retake Palmyra and clear the roadways in Homs.

Aerial ISR, typically from light- or medium-range UAVs, increasingly assumed the responsibility for reconnaissance and targeting missions for air operations in Syria. Since the scope of Russia's UAV employment was constrained at the outset, this meant that the VKS had limited ground-based and aerial ISR capabilities in Deir al-Zour until 2017. VKS aircraft exhibited a suboptimal capacity to perform dynamic targeting and were reluctant to consistently rely on PGMs, which meant that the bulk of Russian air operations in Deir al-Zour for the first two years consisted of long-range bombers striking large, static ISIS targets with "dumb" munitions. The VKS's decision to return the Su-25 to Syria paralleled both Russia's rising comfort with employing UAVs in longer-range ISR missions and the completed runways at T-4 air base. Shortly thereafter, Russian airstrikes in Deir al-Zour increased by 50 percent above levels in the previous operational phase. The VKS's preference for long-range strike operations and minimal CAS in Deir al-Zour may therefore have been the result of poor ISR capacity.

Sixth and finally, Russia was concerned with the risks of escalation since the beginning of its intervention. It was committed to a small footprint and a lean expeditionary approach, and Russian decisionmakers were reluctant to dedicate more resources than were necessary. Importantly, Deir al-Zour marked the point of convergence between the Russian and Coalition operations; with CJTF-OIR engaging ISIS along the eastern bank of the Euphrates River in Raqqa and Deir al-

¹⁰ Dynner, 2017, p. 2.

Zour, and the VKS operating exclusively to the west, Russia and the U.S. established the Euphrates as a formal deconfliction line in October 2015.

It is likely that the VKS was particularly sensitive to the risks of escalation with the West considering its concerns about aircrew quality and aircraft technical limitations. Most Russian pilots had no real combat experience when they first deployed in September 2015. Many analysts of Russian military strategy have observed that the VKS was sensitive to the risks that aircrew quality and inexperience posed to early air operations.¹¹ Friendly fire, pilot errors, poor targeting, and technical failures afflicted Russian air operations early in the campaign. At roughly 205 nm from Hmeimim air base (the hub of Russia's fixed-wing air operations), Deir al-Zour was at the extreme edge of the Su-25's combat radius, frequently cited as 200 nm with external stores. This posed sufficient risk that the VKS was likely averse to employing its Su-25s on longer CAS missions likely to strain the older aircraft and green pilots, who would also have to contend with higher-end peers in congested airspace.

Russian Airpower Against ISIS: Effective Adaptation or Subordinate to CJTF-OIR?

Whereas Russia's focused employment of airpower had a demonstrably positive impact on the SAA's battlefield reversals against the opposition, the VKS's operational effectiveness in counter-ISIS missions was less clear for much of the campaign. This contrast was driven by three factors. First, the VKS allocated fewer fixed-wing resources, on average, to the SAA's counter-ISIS operations, reflecting the lower strategic priority the regime had placed on countering ISIS.

Second, the VKS primarily tasked older, less-capable Su-25s with providing CAS to Syrian ground forces in counter-ISIS operations. As previously discussed, the Su-25 possessed significant operational limitations that, coupled with poor air-to-ground integration and C2, constrained the effectiveness of this particular package of Russian airpower. The VKS also appears to have been cognizant of its aircrew quality challenges, embodied in a series of aircraft losses, which led the VKS to adapt its CAS doctrine to the operational circumstances.

Third, although long-range bombers based at Mozdok and Engels air bases in southern Russia maintained a steady operational tempo of intertheater airstrikes, particularly in remote Deir al-Zour, the relatively lower strike rate in ISIS-held areas reflected both resource allocation priorities and distinct strategic objectives. Whereas the VKS's initial concentration of airpower in northwest Syria reflected Russia's immediate objective of degrading the Syrian opposition, Russia's primary strategic objectives vis-à-vis the Islamic State were merely (1) to slow ISIS advances in Deir al-Zour through a steady flow of strike sorties and (2) to provide CAS to Syrian ground troops in Homs. Consequently, Russian airpower was, for much of the early campaign, relatively ineffective in altering the regime's operational success against ISIS.

Despite this strategic demotion, the VKS explored adaptations in joint operational planning, CONEMP, forward basing and force posture, and advanced capabilities that eventually proved vital to Syrian counter-ISIS operations. Russia's increasing comfort with and reliance on

¹¹ See, for example, Jones, 2019, p. 2; Kofman, 2020, p. 52; Lavrov, 2018, p. 3; and Lavrov, 2020, p. 93.

unmanned aerial ISR throughout the campaign compensated for its relative dearth of ground-based intelligence and targeting capabilities in the deserts of eastern Syria. This enabled the VKS to “establish a more effective ‘kill chain’ and to improve reaction time from detection to target destruction,” a critical enabler for Russia’s ability to “send helicopters for free hunting to established ‘kill zones’ during day and night.”¹²

Aside from the regime’s recapture of Palmyra in March 2016, which was significantly aided by Russian airpower, ISIS forces continued to besiege Homs and Deir al-Zour with moderate success into early 2017. But by 2016, the VKS could quickly recognize multiple operational limitations and institute effective fixes. In March 2016, for instance, the VKS shifted away from older-model Su-25 aircraft and Mi-24P attack helicopters, which had entailed operational risks and technical deficiencies that were unsuited to a CAS role in counter-ISIS operations. Russia’s deployment of its most advanced attack helicopters that same month immediately improved operational effectiveness, leading to a decisive victory over ISIS in Palmyra. Subsequently, the upgraded Su-25SM injected comparable advances in CAS effectiveness to Russian counter-ISIS operations.

Limited C2, poor interservice communications, and poor air-to-ground integration had marred Russian air operations against ISIS early in the campaign. The VKS thus made operational planning and coordination with Syrian ground forces a priority. Likewise, Russian CONEMP from prior engagements in Georgia and Chechnya had proved unsuited to the geography and counterterrorism mission in Syria. Generating a preponderance of sorties from the fixed-wing hub at Hmeimim air base had prevented the VKS from flexibly adapting to evolving operational needs and had limited the scope of feasible operations in more-remote geographic areas. The evolution of the Russian hub-and-spokes basing model offered at least three critical benefits to the VKS air campaign. First, the model allowed aircraft to be forward-based outside of Hmeimim, fostering the potential for more-responsive air operations. Second, incorporating a geographically distributed network of air bases enabled the VKS to perform mission sets (particularly in more geographically isolated counter-ISIS operations) that force limitations rendered infeasible or ineffective from Hmeimim. These included CSAR, ISR, and CAS. Third, opening additional air bases to fixed-wing aircraft enabled the VKS to relieve the congestion at Hmeimim and scale up the deployed combat aviation force to meet operational demand.

The VKS’s experimentation with dynamic forward-based aircraft rotations and unit configurations enabled Russian forces to generate relatively timely CAS across a growing geographic area. The VKS forward-based a daily average of more than half of its rotary-wing fleet throughout the campaign (and, since 2017, a more-modest 5 percent of its fixed-wing fleet). Russian aircraft operated out of at least five distinct base locations. ISIS attacks on Russian-controlled air bases had also led Russian leadership to station unmanned aerial vehicles for surveillance and base protection forces at forward operating bases.

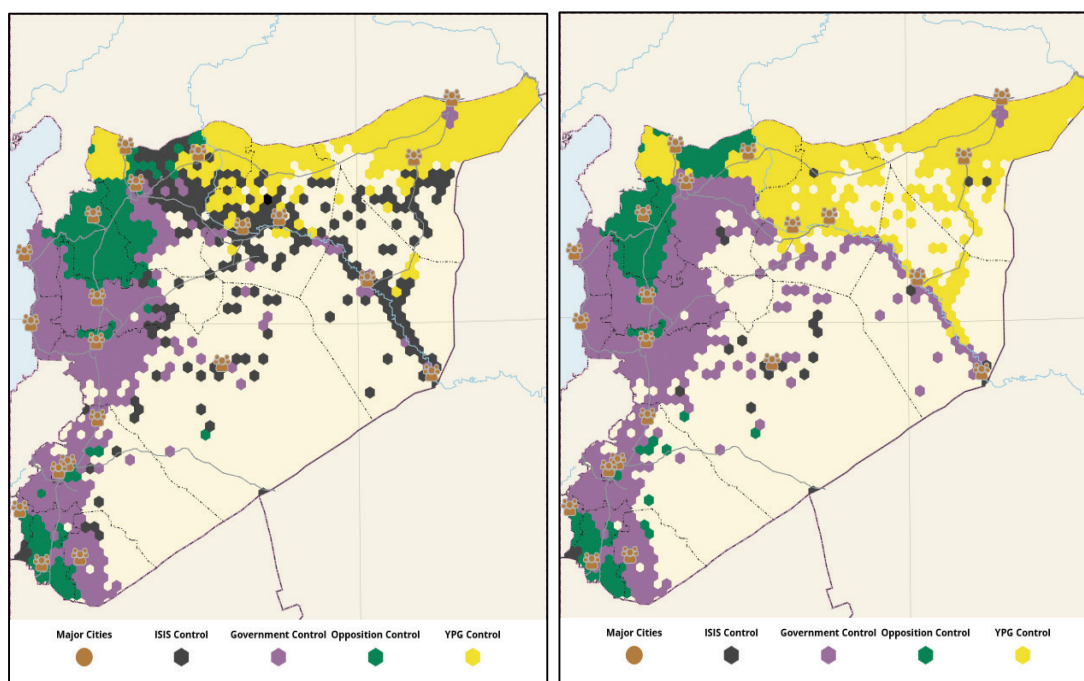
¹² Lavrov, 2020, p. 95.

The VKS's decision to base up to half a squadron of Su-25SM fighters at forward air bases starting in summer 2017 contributed to the SAA's victory against ISIS in Deir al-Zour. Government-allied air forces had previously not been able to effectively generate CAS in Deir al-Zour, which had severely hampered ground operations. Thus, the VKS's solution to the Su-25's limited combat radius—namely, to base Su-25s at forward operating locations—significantly enhanced the SAA's offensive in ISIS-occupied territory through the fall of 2017.

Whereas the operational effectiveness of Russian airpower had been modest through nearly the first two years of counter-ISIS operations, the VKS's various adaptations to the operational environment gradually developed Russian airpower into a critical enabler of the regime's erosion of ISIS control in eastern Syria. Russian air support played a vital role in the regime's initial recapture of Palmyra in 2016 and in clearing ISIS from eastern Homs in 2017.

By March 2018, ISIS had lost over 60 percent of its peak geographic control (see Figure 4.4). Despite the important role the VKS played in helping the SAA retake territory from ISIS in Hama and Homs, it would be an overstatement to suggest that Russian airpower was primarily responsible for rolling back ISIS in Syria.

Figure 4.4. Map of Geographic Control in Syria, September 2015 and March 2018

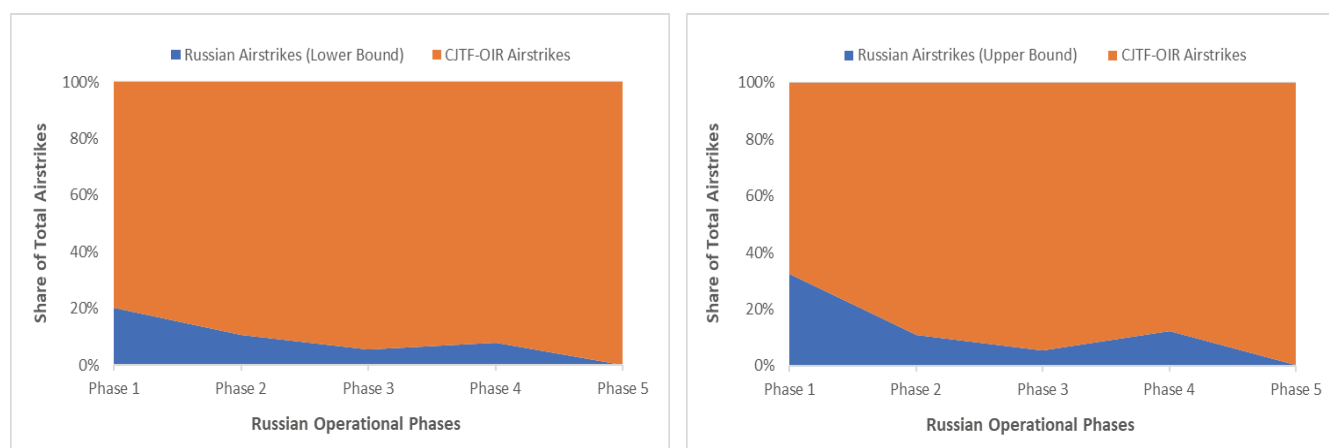


As the figure indicates, the geographic control over most of the territory previously held by ISIS in the north and northeast has accrued to the Kurdish YPG, not the Syrian government.¹³

¹³ Representations of geographic control also fail to adequately convey the fact that between 15,000 and 30,000 ISIS fighters remained in Syria and Iraq, with as many as 10,000 in Syria alone, as of 2019. See Jones, 2019, p. 6.

U.S. employment of airpower against ISIS predated Russia's by over a year, and CJTF-OIR's Operation Tidal Wave II overlapped Russia's long-range strike efforts in Deir al-Zour for the first two years of Russia's intervention. Indeed, the two forces' respective airstrike volumes in ISIS-controlled areas indicate a clear disparity in level of effort. Figure 4.5 displays lower and upper bounds, respectively, on total U.S. and Russian airstrikes in ISIS-controlled provinces (Deir al-Zour, Raqqa, and Hasaka) during each phase of the Russian air campaign.¹⁴

Figure 4.5. Lower and Upper Bounds on Russian and U.S. Airstrikes, Expressed as a Percent of Total Strikes, in ISIS-Controlled Provinces in Northeastern Syria



SOURCE: Wasser et al., 2021.

NOTES: Provinces include Deir al-Zour, Raqqa, and Hasaka.

The information displayed in Figures 4.4 and 4.5 contradict the notions that Russian airpower was either primarily responsible for the SAA's recapture of Deir al-Zour or uniquely effective at rolling back ISIS more broadly. In the next sections, we explore whether these trends are rooted in the VKS's and OIR's different levels of operational effectiveness, or if they reflect deconfliction efforts that effectively partitioned Russian and U.S. air operations in Syria.

Comparison with CJTF-OIR: Operational Effectiveness and Performance

We argue above that the YPG and SDF, supported by U.S. Coalition airpower, propelled the rollback of ISIS in northeastern Syria. By contrast, Russia concentrated the bulk of its airpower on opposition-controlled areas, peaking during the first two years of the campaign; the volume of its airstrikes against ISIS is comparably smaller. These trends are highlighted in Figures 4.6 and 4.7.¹⁵

¹⁴ As discussed in Chapter 1, we imputed bounded estimates of Russian airstrikes to facilitate a direct comparison with Wasser et al. (2021) Coalition airstrike data.

¹⁵ Figure 4.6 draws on the Russian and Coalition airstrike events from our original data set, while Figure 4.7 uses the bounded estimation approach described in Chapter 1 to facilitate a comparison with the Coalition airstrike data compiled by Wasser et al. (2021).

Figure 4.6. Daily Russian and U.S. Airstrikes, September 2015 to March 2018

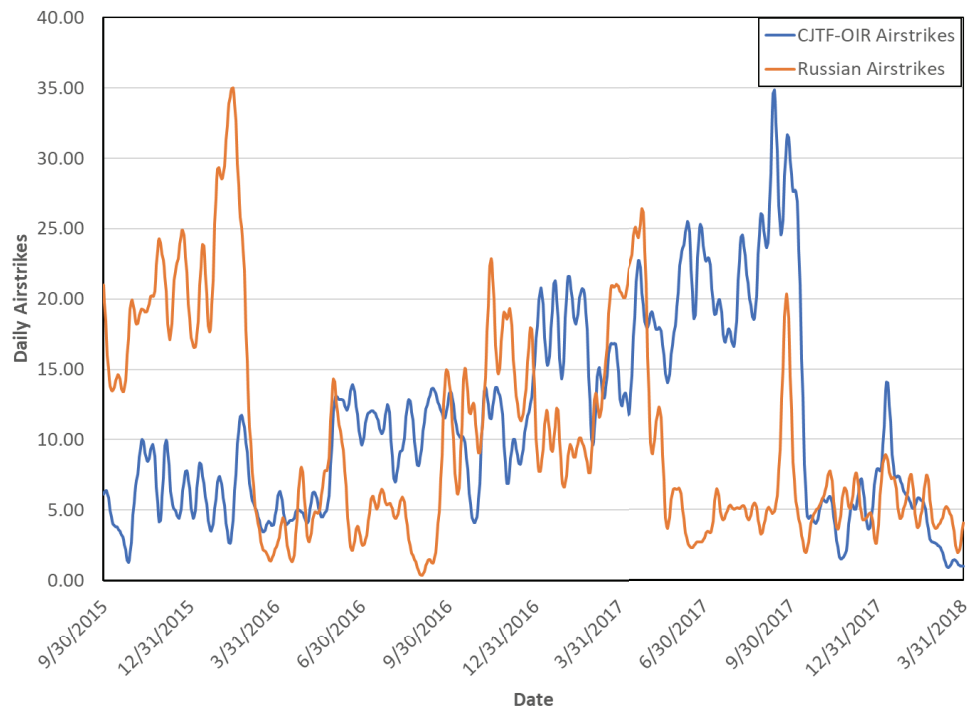
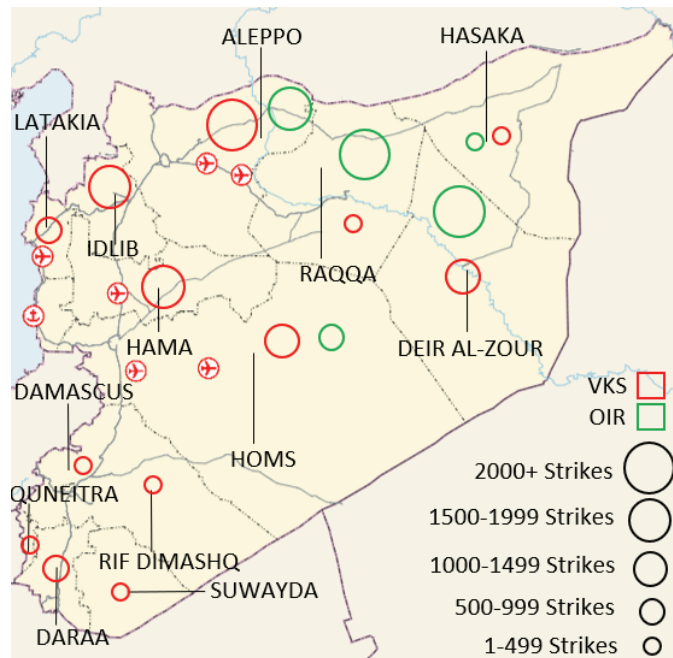


Figure 4.7. Total Estimated Russian and U.S. Airstrikes, by Syrian Province, September 2015 to March 2018



SOURCE: Wasser et al., 2021.

NOTE: Russian airstrike estimates are scaled and expressed as an upper bound.

Russia's strike activities ramped up dramatically in the first half-year of its intervention, culminating in its assault on U.S.-backed opposition forces in Aleppo. Following the SAA's decisive recapture of Aleppo in December 2016, Russian strike operations never reached the same tempo again (as of March 2018). As CJTF-OIR shifted its focus from Iraq to Syria, Coalition air operations targeted ISIS in Raqqa and Deir al-Zour with increasing intensity. By September 2017, average daily U.S. Coalition airstrikes in Syria doubled Russia's, even during the VKS's final air assault to break ISIS's blockade of Deir al-Zour. Likewise, at nearly 13,000 total airstrikes in north and eastern Syria¹⁶ from September 2015 through March 2018, we estimate that CJTF-OIR conducted between 50 percent and 200 percent more airstrikes, in aggregate, than did Russia in those regions. Across the entire Syrian theater, CJTF-OIR conducted at least 10 percent more airstrikes overall than the VKS during the period covered in this analysis.¹⁷ As effective as Russian airpower was at enabling the Syrian regime to degrade the opposition, it would therefore be misleading to suggest that Russian airpower was uniquely powerful or decisive against ISIS in Syria.

A comparison of targets and munitions employed by Russia and the United States further elucidates the differences between the two air campaigns. In the first months of Russia's intervention, deployed VKS aircraft exclusively struck stationary targets.¹⁸ Most airstrikes used unguided munitions that were dropped on preplanned targets. Older Russian fixed-wing aircraft, such as those used in Syria, possess extremely limited capability to conduct precision strikes. The Su-25 and Su-24 are not equipped with targeting pods, nor do they typically carry "smart" munitions.¹⁹ Even Russian strike aircraft upgraded with the new SVP-24 "digital sighting and navigation system" do not appear materially more accurate in unguided airstrikes.²⁰ The newer Su-34 variant, which often plays the primary delivery role in strike missions, can carry a range of PGMs, including KAB-1500L laser-guided bombs, Kh-25ML laser-guided missiles, and KAB-500S "GLONASS" satellite-guided bombs. However, the Su-34 played only a secondary role to the Su-24 in early strike missions.

Beyond the VKS's lack of experience with PGMs in an operational setting, Russia exhibited a reluctance to invest significantly in expensive guided weapon stocks.²¹ Even in strategic long-range strike operations, the VKS typically eschewed the PGM-equipped Tu-160 and Tu-195 for

¹⁶ Provinces in northeastern Syria used to derive this figure include Deir al-Zour, Raqqa, Hasaka, Aleppo, Homs, and Hama.

¹⁷ The first range was calculated based on the scaled and unscaled bounded estimates of Russian airstrikes, while the 10 percent figure is based on a direct comparison between Russian and Coalition airstrike events in our original data set.

¹⁸ Hamilton, 2018, p. 13; Lavrov, 2020, p. 94.

¹⁹ See Gressel, 2016; Lavrov, 2018; Shield, 2018; and Wetzel, 2017.

²⁰ Lavrov, 2018, pp. 2–3.

²¹ Kofman, 2020, pp. 52–53.

Tu-22M3s carrying unguided munitions.²² This tasking decision again likely reflected Russia's relatively limited stock of costly Kh-101 and Kh-555 satellite-guided cruise missiles. Whereas about 80 percent of munitions dropped in the first months of the campaign were unguided, some estimates for the entire air campaign range as high as 95 percent.²³ In fact, sea-launched cruise missiles likely constituted Russia's most consistent form of precision strike in Syria.

Russia had a "mixed" record of air-to-ground integration in Syria, marred by several instances of fratricide, making the VKS reluctant to use fixed-wing aircraft in CAS missions.²⁴ As described in Chapter 3, ISR was a significant constraint in strike operations. The VKS eventually adapted its ISR CONOPS to meet operational circumstances; however, it continued to lack a real-time reconnaissance-strike option.²⁵ The ability of deployed VKS fixed-wing aircraft to hit moving targets also does not appear to have appreciably increased during the campaign.²⁶ Russia prioritized its fleet of modernized attack helicopters, which is more optimally designed for dynamic targeting, for CAS missions, as CAS is predicated on dynamic targeting and precision strikes.

Whereas Russian airpower played an important role in saving the Assad regime and degrading the U.S.-backed opposition, the VKS's overall performance (in terms of targeting efficiency, force attrition, and joint force coordination) is therefore less clear. Many Western observers consider the results of Russian air-based kinetic involvement to be "questionable."²⁷ Assessments of Russian operational performance have "reliably confirmed errors in identification" by Russian targeting.²⁸ Moreover, some studies have found that published Russian government airstrike figures typically inflated airstrike target data. Official reports "declared each strike successful, and any target hit by even a close explosion of the single bomb was claimed as 'destroyed.'"²⁹ Russia's public assessment of its performance in strike missions was thus notably deceptive.³⁰

Disparities also exist between different estimates of total VKS sorties and targets engaged. The Russian government claims to have engaged over 96,000 targets, on 34,000 air-to-ground sorties, by August 2017.³¹ This equates to about 42 combat sorties per day across the entire

²² Revaitis, 2020, p. 47.

²³ See, for example, Adamsky, 2020.

²⁴ Shield, 2018, p. 224.

²⁵ Kofman and Rojansky, 2018, p. 17.

²⁶ Adamsky, 2020; Kofman and Rojansky, 2018, p. 17; Lavrov, 2020, pp. 99–100; Revaitis, 2020, p. 47.

²⁷ Sinclair, 2020, pp. 12–21.

²⁸ Lavrov, 2018, pp. 6–7.

²⁹ Lavrov, 2018, p. 4.

³⁰ Lavrov, 2018, p. 4.

³¹ Lavrov, 2018, p. 22.

campaign. Most Western assessments treat these figures as credible;³² however, our review of discrepancies in official Russian strike numbers indicate that the Russian government likely significantly overstates its published data. We suspect that official Russian strike releases are probably a better proxy for weapon releases than targets destroyed. Even if we take these figures as an upper bound on actual targets destroyed, Russian fixed-wing combat aircraft generated fewer sorties, destroyed fewer airstrike targets, and expended more munitions to do so than their Coalition counterparts.

By comparison, most of the U.S. Coalition's initial air-to-ground sorties in Syria supported requests for CAS by Kurdish forces, requiring mostly dynamic targeting.³³ This gradually changed as CJTF-OIR prosecuted Operation Tidal Wave II beginning in October 2015. Coalition aircraft primarily targeted ISIS oil and logistics infrastructure for much of the next two years. The Coalition demonstrated a greater willingness than Russia to strike targets with precision munitions, and U.S. aircraft exhibited better targeting performance due to both their technological advantages over most deployed Russian aircraft and the substantially higher number of U.S. ISR sorties.³⁴

The preceding analysis overwhelmingly indicates that the VKS's operational and technical performance in Syria was relatively less efficient and effective than the U.S. Air Force's. However, Russia recognized several shortcomings relatively early in its campaign and effectively adapted. For example, the VKS incrementally enhanced its ISR capabilities by scaling its aerial ISR sorties to nearly match U.S. levels by 2018. (However, as always, we remain skeptical of the credibility of published Russian sortie figures.)

The Deir al-Zour Puzzle Revisited: Russian Risk Aversion and U.S. Deconfliction

Figures 4.5–4.7 contradict the narrative that Russian airpower was instrumental in the SAA's recapture of Deir al-Zour in 2017. U.S. airstrikes far exceeded Russian airstrikes in ISIS-controlled areas since the beginning of Russia's intervention. It is possible to interpret this disparity as a statement of priorities; Russia's overriding strategic objective was to defeat the opposition, not ISIS, and the VKS's comparably high volume of airstrikes in northwest Syria conveys an inherent difference in priorities.

However, the geographic distribution of Russian and U.S. airstrikes in Syria, as shown in Figure 4.7, implies another possible explanation. Shortly after the VKS deployed to Syria in September 2015, the United States and Russia negotiated a memorandum of understanding “establishing a channel to ‘deconflict’ the two sides’ air operations over Syria.”³⁵ The deconfliction agreement instantiated flight safety protocols, created a telephone hotline between the Russian

³² See, for example, Barrie and Gethin, 2018; Hamilton, 2018; Kofman and Rojansky, 2018; and Lavrov, 2018.

³³ Wasser et al., 2021.

³⁴ Wasser et al., 2021.

³⁵ Hamilton, Miller, and Stein, 2020, pp. 3–4.

air operations center at Hmeimim and the U.S. combined air operations center at al-Udeid air base, and formulated a “deconfliction line” along the Euphrates River from Raqqa to Deir al-Zour. It was understood that Russia would freely conduct air operations to the west of the Euphrates, while Coalition air operations would occur to the east.

Nevertheless, as we describe in Chapter 2, Russian aircraft routinely defied the deconfliction agreement and engaged in risky encounters with their U.S. counterparts near the deconfliction line. In June 2016, Russian aircraft used cluster munitions to strike areas “near the U.S. and British forces base at al-Tanf, on the Syrian-Iraqi border,” and struck again shortly thereafter despite “being warned via the deconfliction [hotline].”³⁶ Following the Euphrates River crossing in 2017, Russian aircraft struck known SDF locations east of the Euphrates, again violating the deconfliction agreement. Many Western observers attribute this behavior to the Kremlin’s desire to compel the United States to “amend deconfliction agreements in Russia’s favor.”³⁷ In particular, Russia “sought to establish de-escalation zones and zones for exclusive operations with the goal of securing an entire area for their own combat operations.”³⁸ Russian officials sought to progressively expand the deconfliction line south along the Middle Euphrates River Valley, and Russia and the United States eventually agreed to a “limited Russian and Syrian regime presence on the eastern side of the Euphrates, south of Deir Ezzor.”³⁹ Other risky maneuvers included Russian pilots’ willingness to intercept U.S. aircraft and perform intimidation tactics, including a near-collision between a Russian Su-25 and a U.S. F-22 in late 2017.⁴⁰

The consistent pattern of risky behavior and intimidation tactics by Russian pilots likely reflects, in part, Russia’s desire to deter Coalition air operations and establish a basis for exclusive zones of operations. Nevertheless, there is some belief among Western observers that at least some of the encounters were the result of Russian pilot or technical error.⁴¹ Although the VKS did occasionally use risky tactics for strategic ends, Russia conducted the bulk of its operations (at least officially)⁴² in accordance with the deconfliction agreement. As Figure 4.7 illustrates, about 85 percent of VKS airstrikes occurred in provinces to the west, southwest, and south of the Euphrates River—comparable to CJTF-OIR’s share of airstrikes to the east of the deconfliction line.

³⁶ Kofman, 2020, pp. 55–56.

³⁷ Borshchevskaya, 2020, pp. 34–35.

³⁸ Kofman, 2020, p. 55.

³⁹ Weiss and Ng, 2019.

⁴⁰ Weiss and Ng, 2019.

⁴¹ See, for example, Borshchevskaya, 2020; and Weiss and Ng, 2019.

⁴² An exception to this is the activities of Russian private military contractors such as the Wagner Group, which generally operated unconstrained by formal deconfliction agreements.

Although it is possible, again, to interpret this distribution as a reflection of the two campaigns' diverging priorities, another interpretation is that Russia was strategically risk averse (aside from engaging in risky maneuvers for specific tactical purposes). The VKS's "limited liability, limited risk" approach acknowledged the risks of escalation; the VKS was particularly sensitive to aircrew inexperience and aircraft technical limitations. Deadly encounters with peer forces, as when a Turkish F-16 shot down a Russian Su-24, led the VKS to make significant adjustments to its operational planning and TTPs, such as deploying advanced S-400 surface-to-air missile systems. Therefore, the deliberate, sequential nature of Russia's air campaign was plausibly driven by Russia's reluctance to escalate with a peer adversary. In this view, the deconfliction line was no less important to Russia's ability to adhere to its lean expeditionary approach than it was to the United States, despite Russia's periodic willingness to attempt asymmetric maneuvers against Coalition forces.

Conclusion

Since the start of Russia's intervention in Syria in 2015, Russian air operations planning and resource allocations prioritized the Syrian regime's offensive against the U.S.-backed opposition, with counter-ISIS operations constituting only a subsidiary priority. Russia's brutal and indiscriminate air campaign in northwestern Syria played a decisive role in the regime's recapture of Aleppo in December 2016; air support was also an important supporting factor in SAA advances against the opposition in Idlib, Daraa, and Damascus.

Key shortcomings emerged in Russia's initial counter-ISIS operations, leading to minimal operational effectiveness for much of the early campaign. In addition, personnel overstretch and high operating tempo, with regular rotations of aviation crews occurring every three to four months, appear to have posed significant challenges to the VKS in Syria.⁴³ But after mixed results, the VKS demonstrated a willingness to experiment and adapt in operational planning, CONEMP, TTPs, and force posture and basing. Russia's improvements in joint communications, air-to-ground integration, airborne C2, force protection, and targeting significantly enhanced the precision and lethality of Russian airpower against ISIS. Likewise, the VKS's transition from older Su-25 fixed-wing aircraft to advanced attack helicopters and, later, to upgraded Su-25SM aircraft enabled the service to adapt its capabilities to the operational environment. Finally, the VKS's growing reliance on forward operating bases to support operations in ISIS-held territory allowed Russian forces to flexibly respond to changing operational needs and provide timelier CAS to ground forces across a wider geographic area. Together, these adaptations ultimately contributed to the regime's success against ISIS.

⁴³ Giles, 2017.

5. Implications for Future Russian Air Campaigns

In this brief concluding chapter, we summarize preliminary lessons learned from Russia's intervention in Syria and suggest possible implications for future Russian air campaigns.

Conclusions

Russian airpower played a decisive role in reversing the fortunes of the Syrian regime. The Russian intervention ensured the survival of Syrian president Bashar al-Assad's regime, defeated his opposition, contributed to the rollback of ISIS (albeit in a subordinate role to U.S. Coalition airpower), and secured Russia's position in the region. Tactical effectiveness was mixed, but it was adequate to the mission and improved as the VKS adapted to the operational environment.

Russia's intervention was designed as a "limited-liability" expeditionary campaign, modeled after the U.S. air war in Kosovo, with a small theater footprint predicated on Russian aerospace and naval forces providing support to allied Syrian, Iranian, and Shi'a militia ground forces. Russian strategists sought to avoid committing overwhelming ground forces, limit conspicuous losses, and avoid sunk costs.

The VKS's initial concentration of airpower in northwest Syria reflected Russia's primary strategic objectives of saving the Assad regime and degrading the Western-backed opposition. Russian airstrike intensity reached a peak early in the campaign, reflecting the VKS's prioritization of airpower for the higher-end fight against the U.S.-backed opposition. The VKS sought to maximize pressure on opposition forces by inflicting heavy attrition, both in an effort to slow the opposition's operational success and to compel political negotiations with the United States.

Although Russian airpower emerged as a key enabler of the regime's erosion of ISIS control in eastern Syria, Russian airpower was neither primarily responsible for the Syrian regime's recapture of Deir al-Zour nor uniquely effective against ISIS. We estimate that the U.S.-led OIR conducted between 50 percent and 200 percent more airstrikes, in aggregate, than did Russia in north, central, and eastern Syria¹ from September 2015 through March 2018. The Kurdish YPG and SDF, supported by U.S. coalition airpower, ultimately propelled the rollback of ISIS in northeastern Syria. Whereas Russian air support played a vital role in the regime's initial recapture of Palmyra in 2016 and in clearing ISIS from eastern Homs in 2017, it would be misleading to suggest that Russian airpower was uniquely powerful or decisive against ISIS in Syria.

¹ This estimate includes the Deir al-Zour, Raqqa, Hasaka, Aleppo, Homs, and Hama Provinces.

Russia's preliminary strategic objectives with respect to ISIS were merely to slow its advance while protecting Syrian ground troops. It is also likely that the VKS was reluctant to stray too far from its primary operational hub, Hmeimim air base, in its operations against ISIS, given concerns about aircrew and aircraft quality.

The VKS's employment of airpower was, therefore, significantly more effective in engagements against the opposition than in conflicts against ISIS. The regime's progress against ISIS stagnated after some early success, whereas the regime's success against the opposition was consistently strong after the introduction of Russian airpower.

The VKS explored adaptations in joint operational planning with Syrian ground forces, CONEMP, forward basing and force posture, and advanced capabilities to enhance the effectiveness of counter-ISIS operations. Key VKS adaptations included increasingly relying on unmanned aerial ISR to compensate for the dearth of ground-based intelligence and targeting capabilities in the deserts of eastern Syria, deploying Russia's most-advanced attack helicopters to assume the primary CAS role in ground operations, and creating an enduring network of distributed air bases.

The VKS increasingly experimented with a hub-and-spokes distributed basing model. Opening additional air bases enabled the VKS to relieve congestion at Hmeimim air base, forward-base aircraft elsewhere, scale up the deployed combat aviation force, and operate more responsively. The VKS gradually adopted the hub-and-spokes model for both fixed-wing and rotary-wing aircraft. However, the hub-and-spokes approach exhibited several shortcomings, including poor base protection and high attrition rates.

Russia had limited experience employing PGMs and was reluctant to invest significantly in expensive guided weapon stocks. About 80 percent of munitions dropped in the first months of the campaign were unguided; some estimates for the entire air campaign range as high as 95 percent. Even in strategic long-range strike operations, the VKS typically eschewed PGM-equipped bombers for Tu-22M3s carrying unguided munitions. These tasking decisions likely reflected Russia's relatively limited stock of costly satellite-guided cruise missiles. By contrast, sea-launched cruise missiles likely constituted Russia's most consistent form of precision strike in Syria.

Russia had a mixed record of air-to-ground integration in Syria, marred by several instances of fratricide, making the VKS reluctant to use fixed-wing aircraft in CAS missions. The ability of deployed VKS fixed-wing aircraft to hit moving targets does not appear to have appreciably increased during the campaign. Russia prioritized its fleet of modernized attack helicopters, which is more optimally designed for dynamic targeting, for CAS missions.

Russia's limited allocation of dedicated manned ISR assets to Syria created significant operational constraints, including a consistent lack of on-demand ISR. ISR was also a significant constraint in strike operations. The VKS eventually adapted its ISR doctrine to meet operational circumstances, but it continued to lack a real-time reconnaissance-strike option. To compensate for its lack of dedicated ISR assets, the VKS has upgraded some of its combat

aircraft with multi-mission EW and ISR suites. The Russian military has subsequently heavily invested in UAVs, enabling the VKS to scale up a fleet of UAVs in Syria to assume most of the ISR responsibilities.

At the same time, the Russian military's CONEMP for its deployed UAVs came at the expense of a well-developed penetrating ISR capability. The UAV constellation, which primarily relied on light UAVs to act as artillery spotters and provide BDA, appeared to be capable of neither reliably generating ISR to enable on-demand CAS nor designed for penetrating ISR coverage. These shortfalls likely contributed to major battlefield losses against ISIS and the Syrian opposition.

Implications for Future Russian Air Campaigns

Russia demonstrated a makeshift expeditionary capability in Syria that can deliver significant effects, but it is unclear how effectively Russia might be able to export this capability to other theaters. The geography in Syria was uniquely favorable for the VKS's heavy reliance on rotary-wing operations.² Additionally, the conflict was "low intensity" and Russian forces rarely encountered adversaries with advanced air-to-air or surface-to-air capabilities.³

At a tactical level, the VKS improved its effectiveness as it adapted to the operational environment. The VKS's ability to apply the hub-and-spokes basing model demonstrated an adaptability to the operational setting and enabled an efficient allocation of resources. However, this approach also exhibited shortcomings that suggest a limited applicability to different operational contexts in future conflicts.

For much of the Syria campaign, the VKS was not concerned with target selection and vetting. Most targets in early operations were either large, stationary, and preplanned or were bombed indiscriminately with "dumb" munitions. Operational priorities and CONOPS de-emphasized an effective targeting capability. Russia's relatively undeveloped targeting and precision-strike capabilities could be significant constraints against an adversary capable of denying Russia's less-capable ISR and strike aircraft.

Throughout the Syria intervention, Russia iteratively refined CONEMP for manned and unmanned enabler aircraft that it will likely apply to future conflicts. The VKS increasingly experimented with new capabilities in airborne ISR roles to provide electro-optical and signals intelligence support to dynamic targeting, as well as AEW&C, C2, and command

² Shield (2018, p. 232) notes that "the geography is more favorable in Syria for rotary-wing operations than it was in much of either Chechnya or Afghanistan," particularly in "the empty expanses of central Syria where Russian rotary-wing assets have been pushed forward and appear to be most active. The lower elevation and less mountainous landscape present fewer night and poor weather navigation hazards, alleviate the tax on engine performance induced by high altitude flight, and reduce helicopters' vulnerability to the mountain-saddle small-arms ambushes that proved effective for both Chechen rebels and the Afghan mujahideen."

³ Revaitis, 2020, pp. 48–49.

post roles. High rates of attrition among the VKS's deployed UAV force likewise led Russia to invest in combat UAVs with self-protection suites and the ability to conduct dual reconnaissance-strike missions.

The VKS heavily relied on long-range strike capabilities in its campaign against ISIS, but its application of these capabilities demonstrated critical limitations. The VKS consistently prioritized long-range bombers equipped with cheaper, “dumb” munitions due to concerns over the cost of PGMs. The heavily used Tu-22M3 cannot be refueled in midair, requiring Russia to rely on an adaptive basing posture to enable its long-range strike operations. Although the VKS conducted limited operational tests to experiment with aerial refueling in long-range strike operations, these capability deficiencies could be a liability in future campaigns with a larger area of operations and fewer regional basing options. The VKS displayed neither a robust intertheater tanking capability nor a willingness to use higher-end but expensive PGMs on strike missions.

Abbreviations

AEW&C	airborne early warning and control
AOB	air order of battle
AOR	area of responsibility
BDA	battle damage assessment
C2	command and control
CAS	close air support
CJTF-OIR	Combined Joint Task Force–Operation Inherent Resolve
CONEMP	concepts of employment
CONOPS	concepts of operations
CSAR	combat search and rescue
ELINT	electronic signals intelligence
EW	electronic warfare
FLIR/TV	forward-looking infrared television
GEOINT	geospatial intelligence
GLONASS	Globalnaya Navigatsionnaya Sputnikovaya Sistema, or Global Navigation Satellite System
ISIS	Islamic State in Iraq and Syria
ISR	intelligence, surveillance, and reconnaissance
MALE	medium-altitude, long-endurance
MANPADS	man-portable air defense system
MOB	main operating base
MoD	Ministry of Defense
Multi-INT	multiple intelligence
NATO	North Atlantic Treaty Organization
NGW	New-Generation Warfare
nm	nautical miles

OIR	Operation Inherent Resolve
PGM	precision-guided munition
SAA	Syrian Arab Army
SDF	Syrian Democratic Forces
SIGINT	signals intelligence
TOW	tube-launched, optically tracked, wire-guided
TRADS-OS	Time-Phased Russian Aircraft Deployed to Syria-Open Source Database
TTP	tactics, techniques, and procedures
UAV	unmanned aerial vehicle
UCAV	unmanned combat aerial vehicle
USAFE-AFAFRICA	U.S. Air Forces Europe – Air Forces Africa
VKS	Russian Aerospace Forces
YPG	Yekîneyên Parastina Gel (Kurdish People’s Protection Unit)

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The introduction of Russian airpower in Syria has been widely cited as a turning point in the Syrian civil war. To assess the strengths, weaknesses, and adaptations of Russian airpower in Syria, the authors developed a database that integrates operational histories, Russian airstrikes, and disposition of Russian aircraft from September 2015 to March 2018. In this report, the authors use these resources to analyze the relative effectiveness of Russian airpower against the Syrian opposition and ISIS. The authors also compare the application of airpower in Syria by Russia and the U.S. Coalition.

The authors find that Russia's employment of airpower was significantly more effective in engagements against the opposition than in conflicts against ISIS. They conclude that although Russia made key adaptations in Syria in joint operational planning, concepts of employment, forward basing, and advanced capabilities, it is unclear how effectively Russia might be able to export its expeditionary capability to other theaters.

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