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OUTLOOK

Two to tango: Russian-Iranian drone cooperation

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Drone technology has been employed by the Armed Forces of the Russian Federation since the early stages of the full-scale invasion, where Iranian drones and loitering munitions were used in Ukraine. The joint effort between Russia and Iran to manufacture and design Unmanned Aerial Systems (UAS) has increased the number of drones on the battlefield and improved their functionality overall, benefiting the two militaries simultaneously. Through time and directed effort, Russian and Iranian drones have become harder to counter and are difficult to track, as proved by the slow advancement of infantry and mechanized units on the battlefield.[1] Furthermore, UAS can over-

Summary

Iran and Russia are strengthening their partnership through collaboration on Unmanned Aerial Systems (UAS) development and deployment.

Iran's drone programme presents a multifaceted challenge to NATO. The acquisition of Western technology through reverse engineering, coupled with Iran's growing reputation as a drone supplier, enhances its military capabilities and global influence.

Russia's use of Iranian drones in Ukraine exposes vulnerabilities in NATO-provided defence systems and undermines efforts to protect member states and partner countries. The proliferation of this technology to other state and non-state actors complicates NATO's defence strategies.

It is important for NATO to understand the drone warfare dynamics shaped by the Russia-Iran partnership. Analysing their innovations and integration into military doctrines is crucial for anticipating threats and developing countermeasures.

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1 For an elaboration of this point, see Giangiuseppe Pili, "Sea Drones at War," *European Security & Defence*, 2024, https://euro-sd.com/2024/09/articles/40191/sea-drones-at-war-tactical-operational-and-strategic-analysis-of-maritime-uncrewed-systems/

whelm opponents' anti-missile aerial defence systems with inexpensive loitering munitions and enable military options and capabilities from Intelligence, Surveillance and Reconnaissance (ISR), remote sensing acquisition, to targeting and destruction of military and civilian targets.[2]

This unprecedented partnership on drone production and development fosters a convergence that has the potential to drive further technological advancements, such as nuclear weapons developments, which could pose greater risks to NATO and its Allies. The frequent deployment of Iranian-designed drones by Russia underscores its substantial drone capabilities, indicating a high level of technological, intelligence and military collaboration with Iran. This, in turn, points to a potential political convergence between the two nations, as such extensive military support, coupled with the exchange of intelligence and economic resources, is a clear marker of strategic alignment. Moreover, adding further concerns for the short- to medium-term, the production of old and new lines of Shahed-related UAS can even expand Iran's economic leverage.

This report assesses the relationship between Russia and Iran that enables ongoing supply and usage of Unmanned Aerial Systems (UAS) for the two countries. It aims to illuminate the broader strategic implications of this "drone relationship" and its potential to shape global security dynamics. It also examines how drone cooperation has influenced the strategic alignment between Russia and Iran in their joint production and development of UAS, as well as the implications for modern warfare.[3] In particular, the study outlines why it is so important to monitor and track the two countries' UAS designs as the Iran-Russia "joint venture" has become one of the key drivers of drone production and innovation globally, with repercussions for major ongoing and future conflicts, including the war in Ukraine, Middle Eastern conflicts and tensions in East Asia.

The analysis is grounded in extensive Open-Source Intelligence (OSINT) methodologies, including geolocation, geospatial analysis and alternative analytical approaches, ensuring a comprehensive and detailed understanding of how UAS were actually developed and used by Iran and Russia. The report is structured as follows: we first provide an overview of Russian-Iranian relations, then look at their concrete areas of cooperation when it comes to drones, specifically in Ukraine and the Middle East. We end with an outlook on where this relationship could be headed and what it means for NATO.

Russia and Iran – A close relationship

For quite some time, Russia and Iran pursued their foreign policies independently, with moments of tension. However, the geopolitical landscape and the wars in Ukraine and in the Middle East brought the two countries together. The historical implications of the relationship between Russia and Iran highlight the complexity and importance of the partnership that is currently evolving. Without delving into a long historical reconstruction, Figure 1 provides a general overview of key historical events that have shaped foreign relations between Russia and post-revolutionary Iran.[4]

Following the collapse of the Soviet Union in 1991, Russia attempted to establish friendly relations with Iran, shifting from a latent ideological rivalry to cooperation. Their partnership grew around strategic interests, including collaboration in nuclear development and arms sales.[5] Specifically, the inflection point in their relationship occurred in 2015 as they significantly increased military cooperation[6] to support the recently fallen Al-Assad regime in Syria.[7] The conflict in Ukraine has further deepened the ties between the Russian and Iranian regimes through increased military collaboration to counter Western influence, as Iran has been providing Russia with significant military aid, including artillery munitions[8] and UAS.[9] This cooperation in drone technology significantly impacted the battlefield in Ukraine.[10] Considering the strategic importance of UAS on the battlefield in both Ukraine and the Middle East, the technological and military exchange between the two regional powers can only be fully appreciated by examining the specific role played by these ever-changing weapon platforms, which are likely to gain in prominence in future warfare.[11]

2 For instance, see Jack Watling, *The Arms of the Future: Technology and Close Combat in the Twenty-First Century*, Bloomsbury Publishing, 2023.

3 N. Blakcori, "The Evolving UAS Threat: Lessons from the Russian-Ukrainian War Since 2022 on Future Air Defence Challenges and Requirements," Integrated Air and Missile Defense Center of Excellence, 2024 https://iamd-coe.org/wp-content/uploads/2024/02/The-Evolving-UAS-Threat-Lessons-from-the-Russian-Ukrainian-War-Since-2022-on-Future-Air-Defence-Challenges-and-Requirements.pdf, retrieved on 11 September 2024.

4 For a detailed account of Russian-Iranian relations, see Ariane Tabatabai and Dina Esfandiary, *Triple-Axis: Iran's Relations with Russia and China*, Bloomsbury Publishing, 2018.

5 Carl Nicholas Kitaneh Fitzpatrick, Katherine Lawlor, "Russia and Iran Double Down On Their Strategic Partnership," Institute for the Study of War, 2022, https://www.understandingwar.org/backgrounder/russiaand-iran-double-down-their-strategic-partnership, retrieved on 11 November 2024.

6 Elizabeth Robbins, "Russia and Iran Deepen Military Cooperation," FDD, 22 August 2023, https://www.fdd.org/analysis/2023/08/22/russia-and-iran-deepen-military-cooperation/, retrieved on 19 December 2024.

7 Nicole Grajewski, in "The Fall of Assad: What's Next for Syria and Lessons from History," *Harvard Belfer Center*, 2024, https://www.belfercenter.org/quick-take/fall-assad-whats-next-syria-and-lessons-history

8 Sofiia Syngaivska, "Fresh Iranian Ammo Fuels Russian Offensives, 130 mm Shells for the M-46 Guns Are in Action," *Defence Express*, August 2024, https://en.defence-ua.com/weapon_and_tech/fresh_iranian_ammo_fuels_russian_offensives_130_mm_shells_for_the_m_46_guns_are_in_action-11459.html

9 Michelle Grise, "The Drivers of and Outlook for Russian-Iranian Cooperation," Rand Corporation, 2023, https://www.rand.org/content/dam/rand/pubs/perspectives/PEA2800/PEA2829- 1/RAND_PEA2829-1.pdf, retrieved on 11June 2024.

10 Anna Desmarais, "How Iran's 'Kamikaze' Shahed Drones Are Being Used in Ukraine," *Euronews*, 22 April 2024, https://www.euronews.com/next/2024/04/22/how-irans-kamikaze-shahed-drones-are-being-used-in-ukraine

11 Zachary Kellenborg, "Swarm Clouds On The Horizon? Exploring the Future of Drone Swarm Proliferation," *Modern War*, August 2024, https://mwi.westpoint.edu/swarm-clouds-on-the-horizon-exploring-the-future-of-drone-swarm-proliferation/

Figure 1. Timeline of key events in the developing relationship between Russia and post-revolutionary Iran
Source. Iran Primer, Iranica, Authors.

Drone diplomacy – Iran and Russia's covert alliance

Iran's supply of UAS to Russia is a key indicator of their deepening military partnership.[12] This relationship spans the technological, military and intelligence sectors and is an example of how shared geopolitical interests can forge closer partnerships. Tehran has delivered an estimated amount ranging from 600 to more than 3,000 drones via the Caspian Sea, an essential internal route controlled almost entirely by the two countries.[13] The deliveries included the Shahed 131/136 and Mohajer-6 models, which Russia has utilized to strike critical infrastructure in Ukraine, often resulting in civilian casualties.[14] These drones are preferred for their cost-effectiveness and lethality, which have enabled Russia to sustain attacks despite Western sanctions hindering Russian access to advanced weaponry.[15]

The drone exchanges have escalated beyond mere transactions, indicating an increasingly interdependent relationship. Iran has also aided Russia by increasing production capabilities through plans that include expanding weapons and precursors manufacturing plants in the Tatarstan region, which are set to be operational in 2025.[16] This demonstrates a long-term commitment by Russia and Iran to deepening their military collaboration.[17] And it allows for the mass production of Shahed drones within Russian territory, permitting continued operations through a steady supply.

Iran's motivations for the provision of this type of loitering munitions implemented through drones stem from both strategic and ideological perspectives, which seem to be stable enough across time. Supreme Leader Ayatollah Khamenei's enduring goal of resisting Western influence aligns with Russia's objectives in Ukraine, and Iran views this cooperation as a means to undermine both NATO and U.S. influence.[18] Additionally, Iran sees this as an opportunity to strengthen its global status by acquiring an international reputation for drone production outside

12 Desmarais, "How Iran's 'Kamikaze' Shahed Drones Are Being Used in Ukraine."
13 The actual number of drones provided by Iran is unknown.
14 Iranintl.com. "How Iran's Drones Supercharged Russia's 1,000-Day Fight in Ukraine," 19 November 2024, https://www.iranintl.com/en/202411197064, retrieved on 17 December 2024.
15 Michelle Grise and Alexandra Evans, "The Drivers Of and Outlook For Russian-Iranian Cooperation," Rand Corporation, 2023, retrieved on 11 June 2024, https://www.rand.org/pubs/perspectives/PEA2829-1.html
16 Nigar Bayramli, "Iran, Russia's Tatarstan Discuss Expansion of Ties," *Caspian News*, February 2024, https://caspiannews.com/news-detail/iran-russias-tatarstan-discuss-expansion-of-ties-2024-2-16-33/
17 Max Bergmann, "Collaboration for a Price: Russian Military-Technical Cooperation with China, Iran, and North Korea," Center for Strategic & International Studies, 2024, https://www.csis.org/analysis/collaboration-price-russian-military-technical-cooperation-china-iran-and-north-korea, retrieved on 11 June 2024.
18 Nasser Hadian, "Explainer: Iran's Strategic Pivot to Russia," United States Institute of Peace, 2023, https://iranprimer.usip.org/blog/2023/apr/21/explainer-iran%E2%80%99s-strategic-pivoteast, retrieved on 11 June 2024.

Figure 2. Shahed Drone Trade Route in the Caspian Sea
Sources: Bloomberg, Authors.

Western countries and for deliveries of drones to allies and partners.[19]

In return for Iran's provision of drones, Moscow has facilitated the transfer of confiscated Western military equipment for reverse engineering, including the Javelin anti-tank and Stinger anti-aircraft systems.[20] This cooperation improves Iranian military capabilities and technology development, as well as reinforcing its role as a key player in global conflicts. In addition, Iran is securing political backing from Russia, a key permanent member of the United Nations Security Council, which wields significant political and legal influence.[21] This support has important implications for the dynamics concerning the nuclear issue.[22] Such convergences in economic, military and technological terms highlight the growing alignment between the two regional powers, with the conflict in Ukraine serving as a key connection for their military and strategic collaboration. Cooperation over UAS signals both Russia's and Iran's intent to reshape geopolitical dynamics in both Europe and the Middle East in order to counter Western influence.

Airborne strategies: drone operations in Ukraine and their impact across the region

Although the Shahed 131/136 is an Iranian drone, it is filled with various Western technologies.[23,24] Indeed, 55 components of the drone are reported to originate from the U.S., 13 from Switzerland, and 6 from Japan, for a total

19 Ibid
20 Kieron Monks, "Iran's Pirate Weapons Industry is Cloning Western Military Hardware for Russia," INews, 2023, https://inews.co.uk/news/world/iran-pirate-weapons-industry-cloning-westernmilitary-ukraine-russia2238170#:~:text=Iran%20has%20come%20to%20specialise%20in%20reverse%20engineering,on%20designs%20from%20the%20US%2C%20Russia%20and%20China, retrieved on 11 June 2024.
21 The analyst thanks a reviewer for this excellent point.
22 Dan Sabbagh, "Alarm in UK and US Over Possible Iran-Russia Nuclear Deal," *The Guardian*, September 2024, available at https://www.theguardian.com/politics/2024/sep/14/alarm-in-uk-and-us-over-possible-iran-russia-nuclear-deal
23 David Albright, "Electronics in the Shahed-136 Kamikaze Drone," Institute For Science and Internal Security, 2023, https://isis-online.org/uploads/isis-reports/documents/Electronics_in_the_Shahed-136_Kamikaze_Drone_November_14_2023_FINAL.pdf, retrieved on 29 July 2024.
24 The Shahed 136 is a newer model of the Shahed 131.

of 89 foreign components.[25] Overall, 80-82% of both drones' electronic components are made in the West by companies such as Texas Instruments, Analog Devices, and Amphenol.[26] Iranian manufacturers are buying parts from Western companies covertly, which makes it increasingly difficult to restrict the Iranians' access to these parts. However, if these Western companies developed the necessary technology to combat this illicit trade, there could be a potential chokepoint for Iranian drone production.

Iran has been exporting the Shahed 131/136 to Russia. However, with the Alabuga factory, Russia has been able to produce the same Iranian-designed drones directly, inside its territory, as opposed to importing the majority of them from Iran.[27] This speeds up the production of Shahed 131/136 drones for Russian military use. With expedited production, Russia is able to launch large numbers of Shahed drones, which enhances their capacity to overwhelm Ukrainian air defence and to target infrastructure. This increases Russia's ability to threaten Ukraine and strengthens its overall UAS capabilities.[28]

Through this exchange of military capabilities, Russia is able to provide Iranian drone producers and technicians with feedback to improve their existing drone technology. This has helped Iran advance its UAS designs without major testing but with the help of direct data collection from the battlefield, yielding a reduced financial burden without loss of research and development capacity. The results of the Iranian-designed drones allow for integration directly by the Russian producers. For instance, the Russian-made Shahed-136 has integrated the GLONASS as the main navigation system.[29] The modifications make the drones interoperable with their own system and provide a market for Iran to begin offering customization of drones for specific military strategies and attacks.

According to the Atlantic Council, Iran has been able to earn some USD 1.75 billion through this transaction with Russia.[30,31] The cost of building a Shahed 131/136 drone is approximately USD 20,000 to 50,000 each, far cheaper than the average anti-air missile.[32,33] These drones, albeit a cost-efficient option, are relatively slow. However, they have been used in swarms[34] or in great numbers, with the purpose of saturating anti-air missile capabilities. These tactics allow for diversification in the use of additional UAS with increased targeting ability to reach difficult objectives. Since these drones lack precision, they are primarily used to target infrastructure rather than smaller moving objects such as artillery.[35] Considering the success of the Shahed platform on the battlefield, Iran has further pursued its drone technology research and development and is now producing new drones. In this way, Iran has secured relative dominance in this crucial developing military commodity, which combines relatively low cost and high precision.

Russia was previously the leading exporter of weapons,[36,37] but following the full-scale invasion of Ukraine, Russia has had to redirect the majority of weapons production to the war effort. Moreover, sanctions from Western countries have also hindered Russia's weapons manufacturing. Considering Russia's limited capacity in terms of manpower and the mainly internal consumption of its military production, Iran can significantly sustain part of the Russian needs for drone production, possibly leading to an overall improvement of the relationship between the two countries.[38] With Iran playing a more critical role in conflicts within the Middle East, and Russia possibly leaving Syria after the fall of Assad, it is likely that Moscow will supply resources to the Iranians.

Unknowingly, Western companies have been selling parts overseas to third-party distributors, a process called "transshipping," which ultimately allows illicit actors to acquire the goods without submitting to export controls, enabling adversarial actors to procure such goods from these companies. In order to complicate the tracking process, several Iran reverse-engineers components, obtained through downed drones, were stamped with Western companies' logos. It can be inferred that these actions are being taken to attempt to hide the illegal counterfeit operations from their adversaries as well as from countries and organizations that may take countermeasures if these operations were to be discovered. Illegal buying and smug-

25 Martin Fornusek, "Most of 2,500 Foreign Components Ukraine Found in Russian Weapons Come From US," *The Kyiv Independent*, 2023, https://kyivindependent.com/ukraine-launches-database-of-foreign-components-found-in-russian-weapons/, retrieved on 29 July 2024.

26 Ibid

27 Clare Sebastian, et. al., "Russia Is Intensifying Its Air War in Ukraine. A Secretive Factory Is Ramping Up Drone Production To Fuel the Offensive," December 2024, available at https://edition.cnn.com/2024/12/27/europe/russia-ukraine-war-drones-alabuga-factory-intl-invs/index.html

28 David Albright, "Alabuga's Greatly Expanded Production Rate of Shahed 136 Drones," Institute for Science and International Security, 2024.

29 Ashish Dangwal, "Russia Has 'Upgraded' Iranian Shahed-136 Kamikaze Drones To Boost Its Lethality & Accuracy- Military Experts," *The Eurasian Times*, 2022, https://www.eurasiantimes.com/hitting-bulls-eye-russia-has-upgraded-iranian-shahed-136-kamikaze/, retrieved on 26 August 2024.

30 Danny Citrinowicz, "Iran Is On Its Way To Replacing Russia As a Leading Arms Exporter," Atlantic Council, 2024, https://www.atlanticcouncil.org/blogs/iransource/iran-drone-uavs-russia/, retrieved on 29 July 2024.

31 Oded Yaron, "Gold for Drones: Massive Leak Reveals the Iranian Shahed Project in Russia," Haaretz.com, 21 February 2024, https://www.haaretz.com/israel-news/security-aviation/2024-02-21/ty-article-magazine/gold-for-drones-massive-leak-reveals-the-iranian-shahed-project-in-russia/0000018d-bb85-dd5e-a59d-ffb729890000

32 Asami Terajima, "Explainer: Iran's Cheap, Effective Shahed Drones And How Russia Uses Them In Ukraine," *Kyiv Independent*, 2024, https://kyivindependent.com/explainer-irans-cheap-effective-shahed-drones-and-how-russia-uses-them-in-ukraine/, retrieved on 29 July 2024.

33 Yaron, "Gold For Drones."

34 The media often refers to these drones as being used in swarms; however, this term is not always used correctly. A "swarm" typically refers to drones coordinating together in a cohesive attack on a target or a few objectives. Yet, there is no evidence of such coordination in these cases. Instead, these drones are generally launched in large numbers to overwhelm Ukraine's air defence, increasing the chances of hitting a target despite the limited precision of these UAS. It is important to note when using the term "swarm" it is used like the media references the term, to describe large numbers being launched rather than implying there is a strategic cohesion between the UAS.

35 There are no clear sources on the use of the Shaheds on moving targets, for which Russia tends to use the internally produced Lancets instead.

36 Danny Citrinowicz, "Iran Is On Its Way to Replacing Russia As a Leading Arms Exporter."

37 Ibid.

38 Ibid.

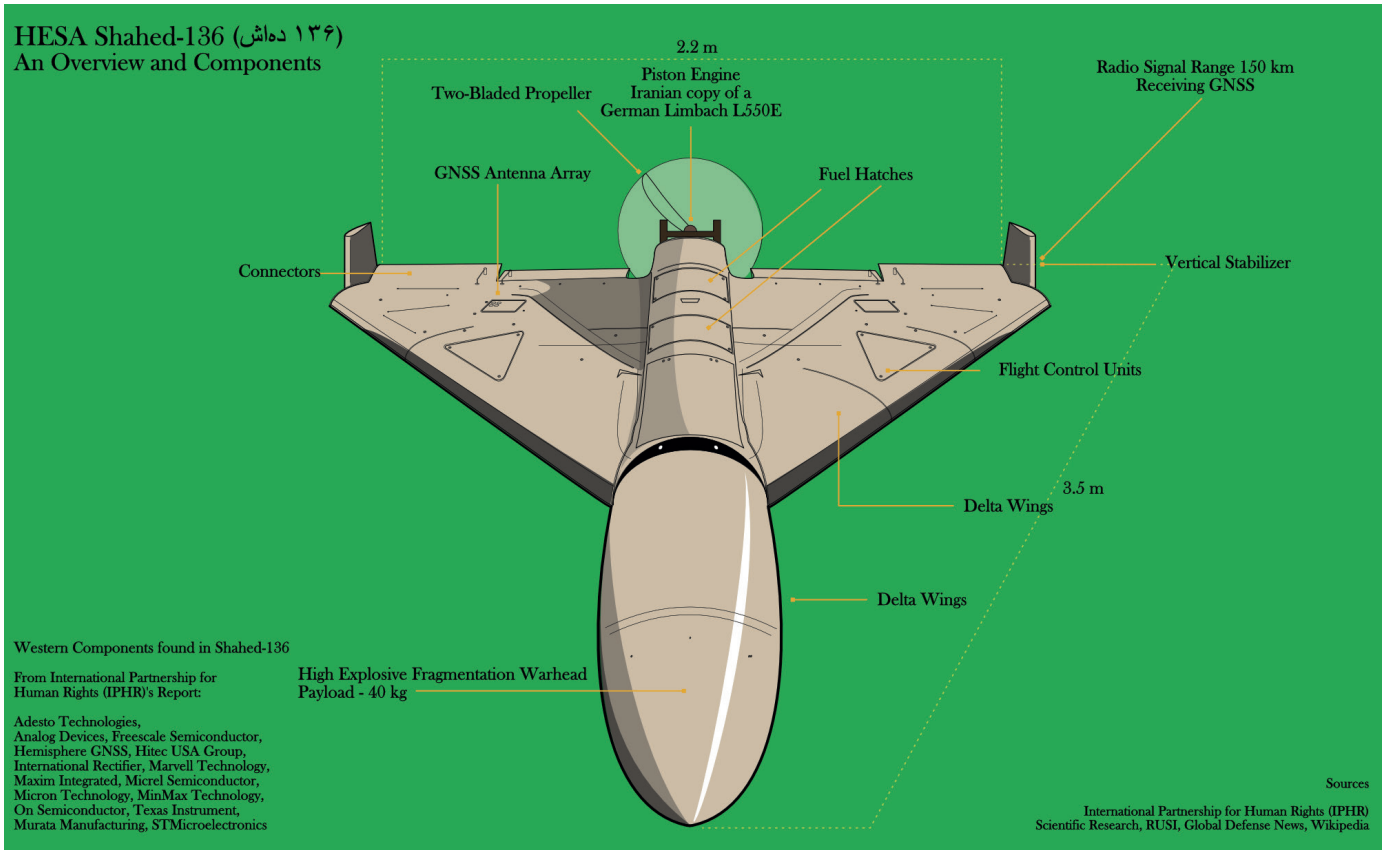

Figure 3. Image of Shahed drone 136 or 131
Sources: Bloomberg, Authors.

gling of the components are cheaper and easier for Iran than producing the goods required for micro-component manufacturing, which requires higher-quality chemicals, as well as expensive and precision industries so rare that only a few countries have them. The smuggled parts are sent to Iran to be reverse-engineered and then used for navigation and data processing inside the UAS.

LLC Alabuga Development is a Russian firm involved in the manufacturing of the Iranian-designed drone, which built the infrastructure for industrial drone production. An Iranian company that helped in the development of the Shahed drone is Sarmad Electronic Sepahan,[39] which reverse-engineers components, reproduces them in Iran and then sells them to Russia.[40] Another Iranian company involved in industrial drone production is Iran Aircraft Manufacturing Industrial Company/Shahed Aviation Industries Research Center,[41] a subsidiary of Iran Aviation Industries Organization (IAIO), which is a state-owned aerospace company controlled by Iran's Ministry of Defence and Armed Forces Logistics.[42]

The more frequently Russia launches these drones, the clearer it becomes that Russia has significant general drone capabilities, meaning there is increased communication between Russia and Iran at the technological, intelligence and military levels. In turn, this could suggest political convergence between the two countries as military assistance in exchange for intelligence and economic resources at this level clearly signals political alignment. Therefore, the number of drones Russia launches can be viewed as a proxy variable to how much Russia and Iran communicate and thus how developed their alliance has become.

According to open-source data georeferenced by analysts, since the end of May 2024, Russia has launched Shahed-131/136 drones into Ukrainian territory every 2-5 days (Figure 4). All these were part of swarm-like attacks, as the use of one single Shahed-131/136 did not prove to be effective against Ukraine's anti-aircraft defence systems, while it is indeed possible to overwhelm these systems with more such drones. Within this data collection, the lowest observed number of drones launched by Russia was 7, with the highest being 76, for an esteemed total of 632.[43] This number is given notwithstanding limited collection capabilities and must be understood as a minimal estimation. Figure 5 visualizes the place of impact

39 "Iran's Domestic Production of Drone Components," Ukraine Field Dispatch, Conflict Armament Research, Story Maps, July 2023 https://storymaps.arcgis.com/stories/2969f34c694a4f6bb6b33332d9a39bf6, retrieved 29 July 2024.

40 Martin Fornusek, "Most of 2,500 Foreign Components Ukraine Found in Russian Weapons Come from US," *The Kyiv Independent*, 2023, https://kyivindependent.com/ukraine-launches-database-of-foreign-components-found-in-russian-weapons/, retrieved on 29 July 2024.

41 "Shahed Aviation Industries," Iran Watch, 2022, https://www.iranwatch.org/iranian-entities/shahed-aviation-industries, retrieved 29 July 2024.

42 "Shahed-136 Kamikaze UAV, Iran," Army Technology, 2023, https://www.army-technology.com/projects/shahed-136-kamikaze-uav-iran/?cf-view, retrieved on 29 July 2024.

43 Shahed Drone Data Set.

as geolocated by analysts. However, even with relatively limited access to data, this could mean that these drones are being produced at high rates with the aid of Iran. It is also important to consider another case study of the use of Shahed-136 drones to appreciate how the relationship in drone warfare is playing out between the Ukrainian battlefield and the Middle Eastern conflicts.

The frequency of these drone launches by Russia into Ukrainian territory allows both Iran and Russia to make alterations to the technology, correcting deficiencies and increasing the speed of production of new models to be as advanced as possible. In July 2024, when collecting data on the Shahed 131/136 drone attacks, Ukrainian air defence was successful in intercepting the majority of them; however, there was significant damage from debris as a result of these interceptions. As the month concluded, and in early August, Russia progressed to launching higher volumes of drones into Ukrainian airspace, making it increasingly difficult to intercept all drones. This strategic move overwhelmed Ukrainian air defence, which allowed several drones to reach their target. At the end of July and beginning of August, Russia would launch over twenty drones per attack, while in June, the attack volume was around ten drones per attack. Although this may not be an advancement in military technology, this tactical alteration can be used to the advantage of Iran if necessary. The frequency with which Russia uses these UAS allows for Iranian military advancement, which could be detrimental to NATO member states involvement in Middle Eastern conflicts.

Following the recent trend of drone launches and lack of indication that the Russo-Ukrainian war will be resolved, the production of Iranian UAS for Russia is likely to continue. With the timespan of the conflict, and Russia's need for weapons, the relationship could be extended to other Iranian weapons and drones, thus strengthening this strategic partnership and the accumulation of knowledge in the domain of drone warfare.

With the mass production of Shahed drones that Iran is currently delivering to Russia, there is a possibility that Iran could seek expansion to additional customers interested in gaining access to relatively cheap, battle-tested UAS. Future customers could be countries that are sufficiently aligned with Putin's regime. This unprecedented exchange of UAS between Russia and Iran has the potential to expand to additional adversarial countries. Depending on the nation-state concerned, this exchange of military technology could drastically alter the country's military capabilities. Moreover, both Russia and Iran are thwarting international efforts for peace and stabilization in Ukraine, the Caucasus and the Middle East, which have deep ties to NATO through the Organization's partnership frameworks. Such a transaction would be perilous to NATO and its Allies. If NATO is unaware of the already existing alliance, in

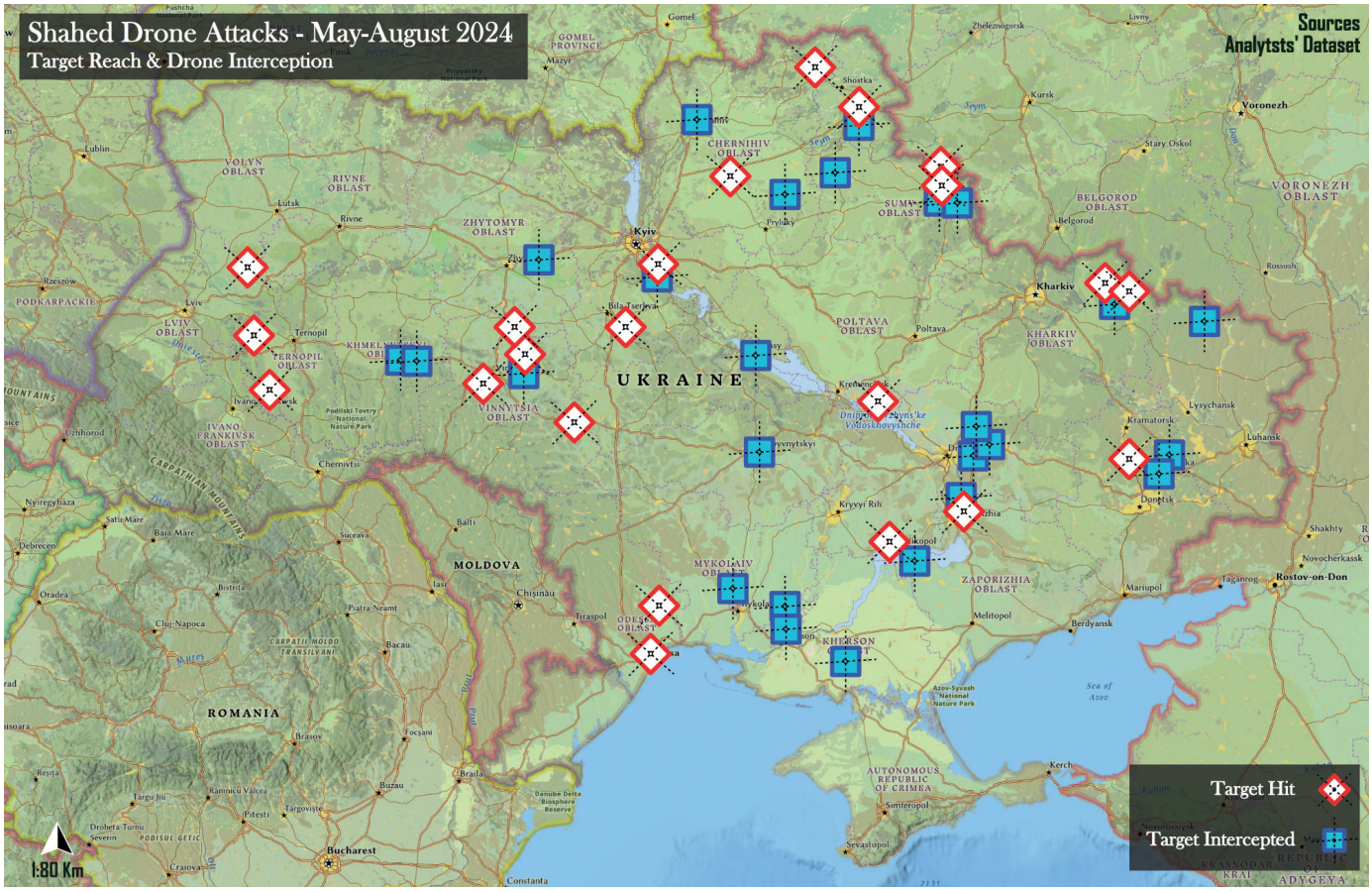

Figure 4. Shahed Drone Interception & Target Reach in Ukraine by region. Blue flames indicate interceptions while the red "X" indicates the target has been reached
Sources: Shahed Data Set

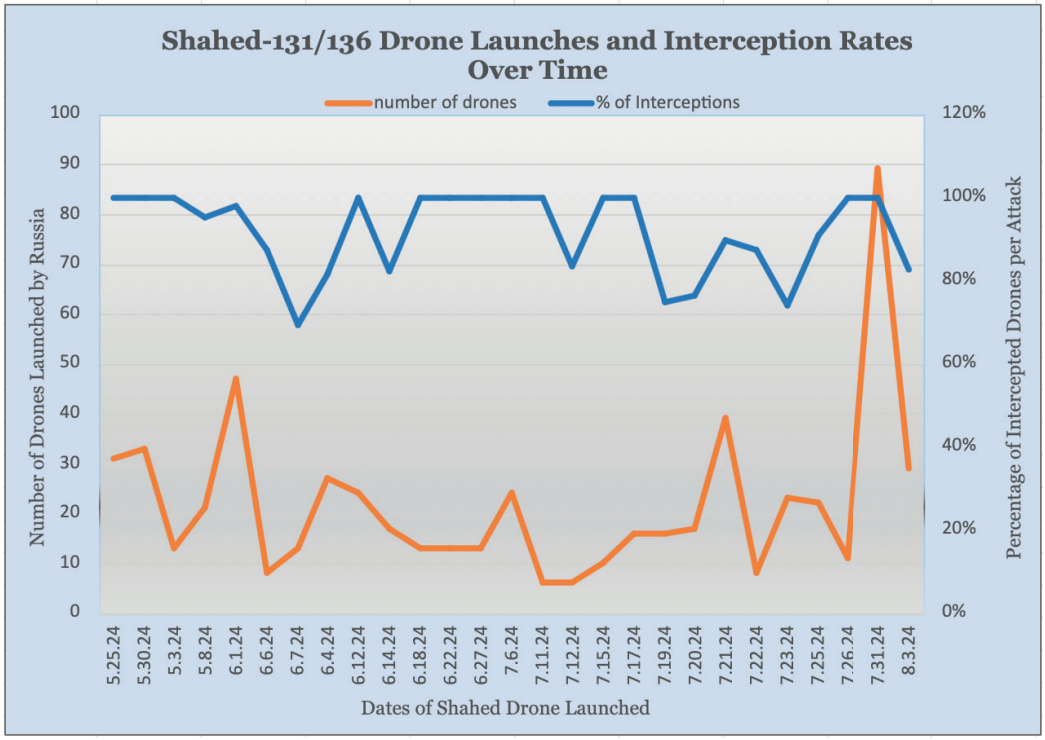

Figure 5. Shahed Drones Launched. For each given timeframe, the graph shows the lowest number of Shahed drones launched in a single attack, the highest number of drones launched in a single attack, and the average number of drones per attack.
Sources: Shahed Data Set

terms of the exchange of UAS, it will be increasingly difficult to understand additional relationships that may follow. Therefore, it is important to adopt appropriate measures in order to prevent unconventional moves and hybrid warfare.[44] Figure 6 gives a picture of the possible developments.

Implications for NATO

The supply of drones by Iran to Russia for use in Ukraine is significant for NATO because the ongoing military and technological exchange directly challenges the Alliance's ability to proactively avoid proliferation of emerging technologies to be used against Ukraine and Middle Eastern partners. First, the provision of Iranian drones bypasses the weapons sanctions placed upon both Russia and Iran, which exposes the need to rethink conventional deterrence strategies against unconventional threats as UAV-related dual-use technology transfers may be violating UNSCR 2231.[45] Russian usage of these drones to target infrastructure in Ukraine demonstrates their capability to potentially disrupt or overwhelm the defence systems delivered by NATO, especially since these weapons are cost-effective and easily accessible.[46] Moreover, Russia's own drone production definitely shows that lessons were learnt from Iranian deployed drones, and it is now capable of striking, immobilizing and even destroying NATO-produced tanks, including US M1 Abrams.[47] Therefore, this undermines NATO's efforts to ensure the protection of both member states and other partner countries.

Furthermore, the Shahed drone factory in Tatarstan is geographically extending the range of conflict in Ukraine, making it a valuable military target, which was already hit by the Armed Forces of Ukraine.[48] Ukraine was also able

44 Drone image: "Shahed-136 Kamikaze UAV, Iran," 2024, https://www.army-technology.com/projects/shahed-136-kamikaze-uav-iran/
45 UN Security Council, S/RES/2231 (2015) – "Resolution 2231 (2015) Adopted by the Security Council at its 7488th meeting, on 20 July 2015," United Nations, 2015, available at https://documents.un.org/doc/undoc/gen/n15/225/27/pdf/n1522527.pdf
46 Citrinowicz, "Iran Is On Its Way To Replacing Russia As A Leading Arms Exporter," 2024.
47 Nikolov, B., "ZALA Lancet Loitering Munition Downs US M1 Abrams in Ukraine," Bulgarian Military, March 2024, available at https://bulgarianmilitary.com/2024/03/31/zala-lancet-loitering-munition-downs-us-m1-abrams-in-ukraine/
48 Hanna Notte, Jim Lamson, "The Uncomfortable Reality of Russia and Iran's New Defense Relationship," *War on The Rocks*, July 2024, available at https://warontherocks.com/2024/07/the-uncomfortable-reality-of-russia-and-irans-new-defense-relationship/

to strike the Shahed-munition depot in Oktyabrsky, underscoring the importance attached to this weapon system.[49]

As these weapons gain traction, they will likely inspire other state and non-state actors to adopt similar military tactics, already exemplified by the Houthi militants, which would complicate NATO's defence strategy in critical strategic areas of the world.[50] Additionally, the reverse engineering of Western technology could pose a significant risk by enhancing Iranian military capabilities, which could be utilized to counter NATO directly in the Red Sea, the Persian Gulf, Eastern Europe and the Middle East, among other areas. Not only does this cooperation pose immediate threats, it also signals an evolving, multi-faceted challenge for NATO, as Iran is seeing its UAS battle-tested and demonstrated. That may allow it to find new customers and generate further revenue and strategic benefits.[51]

Although Iran and Russia are strengthening their relationship based on shared interests and opportunistic alignments, significant points of friction persist within their multifaceted exchanges. While their growing collaboration is evident in the exchange of UAS technology, these tensions have the potential to weaken their ties in the future, particularly as current conflicts de-escalate.

The Tehran-Moscow axis: where is it heading and why does it matter?

Russia and Iran are deepening collaboration across military, economic and intelligence sectors amid global conflicts, with their relationship potentially evolving into two main scenarios. One possibility is a cooperative focus on civil and economic projects, driven by Iran's need for stability and Russia's economic dominance vis-a-vis near peers, although Russia may be hesitant in view of Iran's internal instability and available resources. Moreover, the shared oil market could lead to some restraint in deepening cooperation from a purely economic viewpoint. The second scenario involves a deeper military alliance, potentially including intelligence, technology and nuclear cooperation, mirroring Russia's ties with North Korea. Despite their growing ties, both nations face political, economic and military volatility that could challenge their partnership in the long term.

As currency to pay for munitions and military assistance, Russia has already provided partners, including Iran and North Korea, with otherwise unavailable technology.[52] Russia has diminished leverage over sophisticated technology, a crucial asset it previously relied upon to facili-

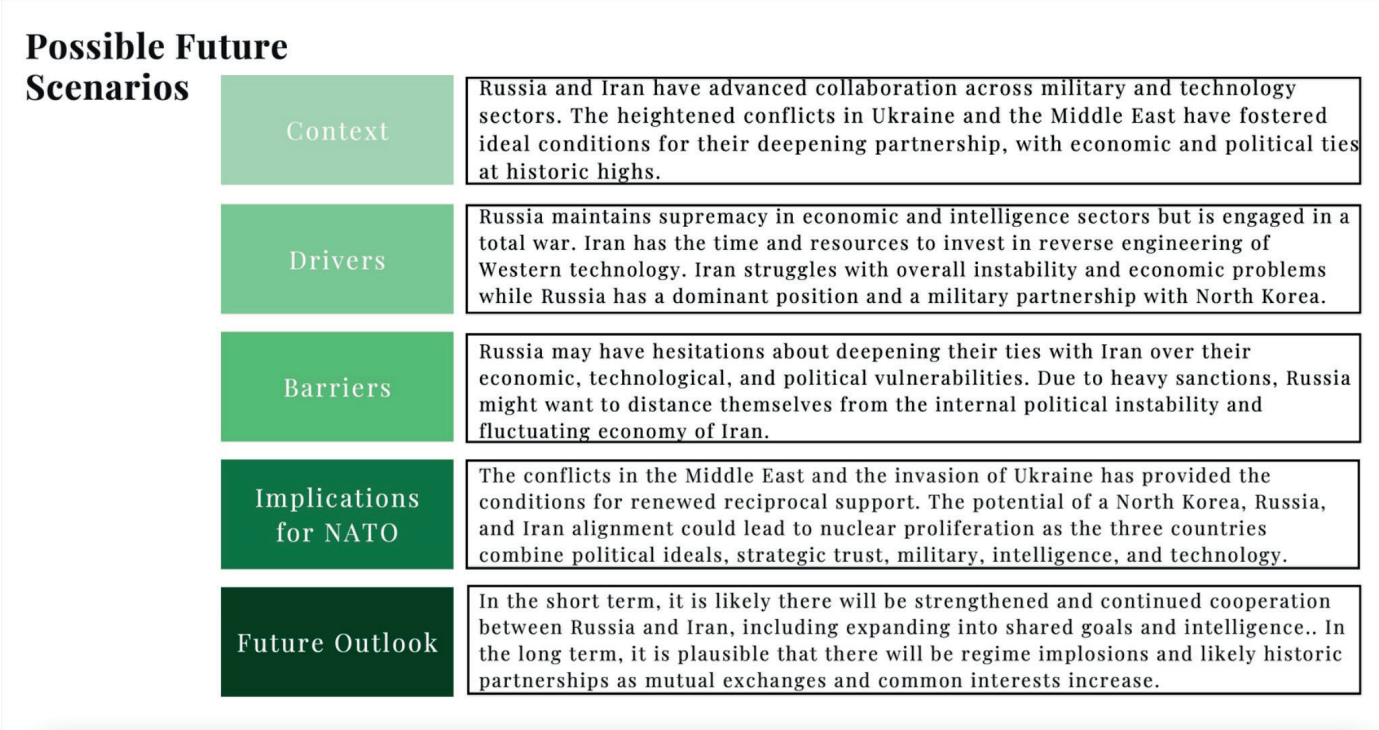

Figure 6. Main Indicators of Iranian and Russian Convergence
Sources: Authors.

49 David Axe, "Watch 400 Shahed Attack Drones Explode At The Same Time In Southern Russia," *Forbes*, October 2024, available at https://www.forbes.com/sites/davidaxe/2024/10/09/russia-has-acquired-more-than-8000-shahed-attack-drones-from-iran-ukraine-may-have-blown-up-five-percent-of-them-in-a-single-attack/

50 Scarr et al., "Red Sea attacks," Reuters, February 2, 2024, available at https://www.reuters.com/graphics/ISRAEL-PALESTINIANS/SHIPPING-ARMS/lgvdnngeyvo/

51 Daniel Salisbury, Darya Dolzikova, "Profiting From Proliferation? North Korea's Exports of Missile and Nuclear Technology," *RUSI*, December 2023, p. 40 available at https://static.rusi.org/onward-proliferation-dprk-occasional-paper-dec-2023.pdf

52 Notte, Lamson, "The Uncomfortable Reality of Russia and Iran's New Defense Relationship."

tate competitive exchanges without compromising major military national interests. However, UAS are the main conduit through which the two countries are maintaining a close relation and there is a convergence in technological advancement in loitering munitions, although Russia already has superiority in this domain, especially after the production of new lines with fibre optics that do not seem to exist in other militaries, including Iran.[53]

Russia's dependence on Iran for specific drone technology may increase, depending on Iran's own moves in the Middle East. Specifically, UAS have proved effective when used in high numbers, hence Russia needs Iran to keep up the drone production line. However, there are still significant points of friction that are unlikely to be resolved, including divergences in the cultural and ideological domains and in geopolitically close regions. According to Western analysts, the two countries are partnering in specific areas for opportunistic motives only.[54] However, it is doubtful whether this can be held as a constant premise for future judgement, specifically because of the stability of the interests shared by Iran and Russia, such as developing advanced UAS systems able to counter weapon systems and defences, including those of NATO countries. In fact, the instability observed in the Middle East and the war in Ukraine create stable conditions for joint operations between the two countries.

It is crucial to understand fully how drone warfare is evolving as a result of the cooperation between Russia and Iran, for several reasons. First, the technological innovations resulting from this partnership will enhance both countries' capacity to export affordable weapons, which can be deployed in various regions, particularly where Russian or Iranian proxies or paramilitary groups are active, such as in divided Syria, Yemen[55] and Sub-Saharan Africa.[56] If Iran and Russia keep developing diversified UAS designs, it is quite likely that NATO countries will have to monitor them in already destabilized neighbouring regions, such as the Eastern Mediterranean and North Africa.[57]

Second, Russia and Iran are capable of producing a variety of battle-tested drones, whose efficiency and effectiveness can be statistically analysed by their R&D complexes.[58] It was already noted that the West has not kept pace with the evolution of drones in Russia, and this is an unacceptable path.[59] As a result, "we see more and more that there is a capability gap between warfighting nations and non-warfighting nations, so you can see in Ukraine that both sides are already conducting a revolution."[60] With such a level of military experience and manufacturing, both Iran and Russia can use their UAS experience to adjust their drones to their specific proxies' needs, as a technology is useless unless properly adapted.[61]

Third, while Western analysts have argued for the full integration of UAS at all military levels, from tactics to strategy, NATO countries, despite their investments in drone technology, rely heavily on the Ukrainian experience to understand drone warfare. This reliance introduces limitations, as Ukraine's military organization and industrial base differ significantly from those of NATO. Conversely, Russia and Iran are conducting first-hand, collaborative studies of UAS technology, which are being directly reflected in their evolving military doctrines.

As a result, it is imperative for NATO to study Russian and Iranian adaptations of UAS technology and their integration into military doctrines. This will allow NATO to anticipate future threats, understand evolving drone warfare capabilities, and assess the long-term economic and technological impacts of these developments, particularly given the influence of the two countries' proxies and close partners, including China.

The current clash between Iran and Israel, and the US precision bombing of the Iranian sites related to the nuclear program, proved to be a test of the Iranian and Russian relations, which gave some insights into where the two states and regimes are. According to the official Kremlin press release, Putin met in the Kremlin with Foreign Minister of the Islamic Republic of Iran Abbas Araghchi on 23 June 2025[62] stating that the American intervention was completely "unjustified."[63] However, at the same time, the Kremlin did not offer any specific visible support according to Israeli sources.[64] This is in line with what could have been expected from the previous analysis as the current Iranian–Russian Treaty on Comprehensive Strategic Partnership signed on 17 January 2025 was specifically focused on fostering closer ties politically and economically but did

53 David Humbling, "Russian Fiber Optic Drone Beats Any Jammer," *Forbes*, March 2024, available at https://www.forbes.com/sites/davidhambling/2024/03/08/russian-fiber-optic-drone-can-beat-any-jammer/

54 Nicole Grajewski, in Podcast: Silicon Curtain, "The Russia-Iran Relationship is Growing Stronger but are they Best of Frenemies?" *YouTube*, May 2024, available at https://www.youtube.com/watch?v=A4ObkM-ez8E at 9:17

55 "Moscow double-dealing in Yemen," November 2024, *All Eyes on Wagner*, available at https://alleyesonwagner.org/2024/11/26/moscow-double-dealing-in-yemen/

56 "How Wagner's Ruthless Image Crumbled in Mali," *New York Times*, November 2024, available at https://www.nytimes.com/2024/11/01/world/africa/russia-wagner-mercenaries-mali.html

57 Giangiuseppe Pili, Alessio Armenzoni, Gary C. Kessler and Diane M. Zorri, "Playing the long game - Russia in the Mediterranean," *Outlook* 3/2025, NATO Defense College, February 2025.

58 James Byrne, et al., "The Orlan Complex: Tracking the Supply Chains of Russia's Most Successful UAV," *RUSI*, December 2022, available at https://rusi.org/explore-our-research/publications/special-resources/orlan-complex-tracking-supply-chains-russias-most-successful-uav

59 Strongly recommended is the last part of Col. Colonel Markus Reisner, "War for Ukraine - a war of attrition," Österreichs Bundesheer, October 2024, available at https://www.youtube.com/watch?v=Bv2fjrJt3LU

60 Col. Markus Reisner, "War For Ukraine - A War Of Attrition," Österreichs Bundesheer, October 2024, available at https://www.youtube.com/watch?v=Bv2fjrJt3LU

61 See Dr Jack Watling's noteworthy discussion of the longbow in Jack Watling, "CAS 2024 Dr Jack Watling," The Cove - Australian Army, October 2024, available at https://www.youtube.com/watch?v=2YVkyIGpTwM&list=PLqoeEkRB3yVzIkEtrprRVhPg0a2hz9_lD&index=5

62 "Meeting With Foreign Minister of Iran Abbas Araghchi," Kremlin.Ru, 23 June 2025, available at http://en.kremlin.ru/events/president/news/77237

63 Dmitry Antonov, Marina Bobrova, "Putin Tells Iranian Foreign Minister There Was No Jjustification For US Attack," Reuters, 23 June 2025, available at https://www.reuters.com/world/middle-east/putin-tells-iranian-foreign-minister-there-was-no-justification-us-attack-2025-06-23/

64 "Putin Slams Attacks On Iran, But Offers No Support To Key Ally," *Times of Israel*, 24 June 2025, available at https://www.timesofisrael.com/putin-slams-attacks-on-iran-but-offers-no-support-to-key-ally/

not include security guarantees.[65] As a result, the current Russian posture reflects only political support and no military commitments. The Russian deputy foreign minister seemed to suggest that diplomacy is now the way to solve the current conflict.[66]

All in all, the current situation does not seem to change significantly what already outlined in the previous analysis for the medium term, as Iran needs Russia and vice versa. At the same time, it is hard to see how the weakness of a key partner - Iran - could be good for Russia. Ultimately, the areas of friction between the two countries remain untouched as much as their areas of convergence, including trade and drones.

65 Elena Giordano, "Russia and Iran To Sign Partnership Treaty This Week," *Politico*, 13 January 2025, available at https://www.politico.eu/article/russia-and-iran-to-sign-partnership-treaty-on-january-17/

66 Reuters, "Russian Deputy Foreign Minister Sees Little Chance Now Of Reviving Iran Nuclear Deal," Reuters, 24 June 2025, available at https://www.reuters.com/world/middle-east/russian-deputy-foreign-minister-sees-little-chance-now-reviving-iran-nuclear-2025-06-24/

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