COI STRATEGY AND DEFENCE

Hybrid CoE Working Paper 10

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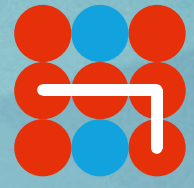
FRANK CHRISTIAN SPRENGEL



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COI Strategy and Defence focuses on hybrid warfare, related strategies and resulting implications for security policy, military and defence. It aims at discovering the essence and nature of hybrid warfare as well as the logic and pattern of hybrid strategies in order to develop an analytical framework for the assessment of current and future hybrid warfare situations.

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Hybrid CoE is an international hub for practitioners and experts, building Participating States' and institutions' capabilities and enhancing EU-NATO cooperation in countering hybrid threats, located in Helsinki, Finland.

Contents

List of abbreviations

A2/AD = anti-access/area denial
AWACS = airborne warning and control system
BLOS = beyond line of sight
CAS = close air support
C4ISR = command, control, communications, computers, intelligence, surveillance, and reconnaissance
COTS = commercial off-the-shelf
EW = electronic warfare
GNA = Government of National Accordance
HALE = high-altitude long-endurance
IPO = initial public offering
IRGC = Islamic Revolutionary Guards Corps
ISIS = Islamic State of Iraq and the Levant
ISR = intelligence, surveillance and reconnaissance
JADC2 = joint all-domain command & control
LNA = Libyan National Army
LOS = line of sight
MALE = medium-altitude long-endurance
PSYOP = psychological operations
RAF = Royal Air Force
RMA = revolution in military affairs
RPG = rocket-propelled grenade
SAR = synthetic-aperture radar
SEAD = suppression of enemy air defences
SIGINT/ELINT = signals/electronic intelligence
TA = target acquisition
TUAV = tactical unmanned aerial vehicle
UAS = unmanned aircraft systems
UCAV = unmanned combat aerial vehicle

Preface: Hybrid warfare and the use of drones

Revolutionary change in military affairs is an integral part of the history of conflict and war. It can be brought about by multiple factors – political, social, economic or organizational, among others. New technological developments are one of the most decisive catalysts for such change, with technology driving this revolution in military affairs with unprecedented speed today. Drone warfare capabilities are a particularly prominent example in this regard, integrating sensor technology with precision strike effectors and communications. Various technological trends like artificial intelligence (AI), robotics, cyber, cloud computing, microelectronics, nanomaterials, space assets and laser technology are used and combined for this reason. Miniaturization, low-cost mass production and stealth technology are complementing these developments. Even now, drone warfare capabilities provide game-changing potential on real-world battlefields. It can be expected that a trend towards AI-based autonomous systems and swarming will further exponentiate these revolutionary developments in the near future and bring masses of drones into the battlespace.

The military and warfare-related implications of these developments can hardly be overestimated. The 44-day war over the disputed region of Nagorno-Karabakh (2020) provides a foretaste of the decisive impact that these capabilities are able to exert on the outcome of a war. In this case, Azerbaijan was able to reconquer lost territories from Armenia/Artsakh by military means even after a long period of time and against an entrenched and militarily well-prepared opponent. Drone warfare capabilities, provided to Azerbaijan primarily by Turkey, proved to be the decisive offensive game-changer for Azerbaijan.

At the same time, it shows that actors who are unable to defend themselves properly against drone-based attack vectors are marked down as mere victims on the battlefield. Experiences from hybrid warfare battlefields in Ukraine, Syria, Libya and Yemen underline the growing importance and effectiveness of these systems, particularly for hybrid warfare actors. The same goes for the use of drones in a rather improvised or limited manner – such as for cross-border reconnaissance to guide artillery fire – as was the case during the first years of the war in and around Ukraine.

In other cases, like in Libya, it became evident that the deployment of only a small number of sophisticated systems, proliferated to proxy forces, can make a game-changing difference to the balance of power on the ground. The special value of drones for deniable, asymmetric and non-linear attacks, as well as for cross-domain operations combined with the indirect use of proxy actors, was evidenced during the successful attack on the oil processing facilities of Saudi Aramco (2019). The success of these attacks, despite three layers of air defence systems, underlines the vulnerability of any kind of critical infrastructure to drone-based attack vectors. Even militarily strong actors like Russia seem to be highly concerned about these technological developments. The fact that Russia stopped charter flights to Turkey in April 2021 to discourage Turkey from further proliferation of drone warfare technology to Ukraine underlines this.

Hybrid warfare tends to blur different modes of warfare, as a result of which the use of force is particularly multifaceted within this specific style of warfare. It includes symmetrical warfighting at all possible levels of escalation. At the same time, hybrid warfare may apply asymmetrical, non-linear, indirect, covert, subversive or irregular approaches conducted by a combination of state, non-state, pseudo-state or proxy actors. In principle, hybrid warfare actors tend to adopt strategies of limited warfare with a comparatively small military footprint in order to maintain the manageability of the use of force, control the risk of escalation, and contain the political costs and damage caused by the use of force. Unmanned, long-distance precision-strike weapons systems, like drone warfare capabilities, are virtually ideal for supporting such approaches. The same goes for the silent, covert and deniable use of force that is instrumental for

hybrid warfare actors in hampering the identification and attribution of their activities, creating ambiguity and confusion, and paralyzing the decision-making process of the opponent. Drone warfare capabilities are an ideal instrument for enabling such scalable and tailor-made hybrid operations in the grey zones of the interfaces between war and peace, friend and foe, internal and external, as well as state and non-state fields of responsibility. They enable cross-domain operations as well as attacks from within, and can readily be combined with other instruments of power to orchestrate multi-vector attacks. As these capabilities are comparatively cheap and easy to access and handle while being highly effective at the same time, they are a key instrument for proliferation and indirect hybrid operations via empowered proxy actors. Finally, and of most concern, they provide options for offensive hybrid operations in particular.

These close links to hybrid warfare in combination with the speed of the ongoing technological revolution, several trends converging in the field of drone warfare, and the resulting game-changing capabilities motivated the European Centre of Excellence for Countering Hybrid Threats to take a closer look at the use of drones. Hence, Hybrid CoE's Community of Interest on Strategy and Defence (COI S&D) is addressing this topic within its workstrand on Hybrid Warfare: Future and Technologies (HYFUTEC). The overarching goal of this endeavour is to improve awareness and broaden understanding of the potential for the use of drones/unmanned aircraft systems (UAS) in the context of hybrid warfare. Its purpose is to inspire defensive measures, build own capabilities, and indicate options for countering drone-based hybrid attack vectors.

As a first step, a situational awareness picture regarding the current use of drones in the context of hybrid conflict/warfare needs to be built. To this end, this Hybrid CoE Working Paper identifies and analyzes lessons regarding the use of drones on five current battlefields: Ukraine, Syria, Libya, Yemen and Nagorno-Karabakh.

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Introduction[1]

The security environment has changed drastically in recent decades. Above all, this affects the way in which violent conflicts are conducted, including by military means. It can be observed that these conflicts are also supplemented with means from other domains and thus interwoven with them. This results in disputes involving multidomain hybrid attacks, and reflects the new reality of war and conflict management in the 21st century.

Conflicts are becoming increasingly characterized by their inherent frictions and chameleon-like nature in general, which is something that military theorist Carl von Clausewitz recognized as early as the nineteenth century. This state of affairs is all too apparent in the ambiguity of modern hybrid conflicts. The obvious deception and confusion inflicted by an adversary or adversaries has become an important part of the hybrid conflict/warfare toolbox. The interplay between covert and non-covert modes of operation and the ambiguities of one's own actions play an important role in these forms of conflict. Hybrid conflicts are also characterized by their multi- and inter-dimensionality, which underlines the nature of such conflicts.

Unmanned aerial vehicles (UAVs), commonly referred to as drones, duly represent a means of choice for hybrid actors. UAVs are airborne systems that can be operated in conjunction with a ground-control station in the area of the direct line of sight (LOS), or beyond this area (BLOS) via a relay/satellite link.[2]

UAVs favour particularly active and offensive action within a conflict and can thus help hybrid actors gain an operational advantage for the purpose of imposing their own will. UAVs allow the true purpose of the adversary's actions to be only guessed at, as the systems' multifaceted application (multi-role capability) helps obscure this true purpose of the deployment. As a result, the purpose of use and communication about it can differ diametrically from each other. This is a characteristic of UAVs that applies to all multi-role capable systems of this type. Comparing UAVs to a battle tank, it is noticeable that the communicative attribution of the mission's purpose will generally be easier with the latter.

UAVs also become all the more interesting for use in multiple domains of the hybrid conflict field due to their multi-role capability. They can be used for intelligence, surveillance and reconnaissance (ISR) missions just as they can for kinetic attack operations. Such a system can serve classical military, propaganda, media or even psychological purposes, either sequentially or in parallel. In addition, the degree of autonomy, if any, of these systems creates the impression that UAVs could make their own decisions (although this is not technically true at this time). This offers the hybrid actor the possibility to reject the responsibility for use of the system and, for example, to blame a set action on the semi or fully autonomous acting system and its technical components. Such a circumstance can be termed technical deniability. The UAV thus provides the hybrid actor with the agility needed for flexible mission and operation designs.

However, this mutability and multi-role capability can also lead to misperceptions on the part of the actor facing the use of such a system. As a result, it is possible that the conflict dynamics will be catalyzed in one direction or the other by the announced or actual use of these systems.

UAV systems can therefore disruptively change the dynamics in conflicts, as they are able to ensure the empowerment of actors in a way that was not possible in the past. UAVs can also be described as "the little man's air force". The systems can be procured and operated by conflict actors themselves, or they can be provided by third parties to be deployed in the interests of the end user. This creates an "instant deployment value" that can lead

1 The views presented here are those of the author and do not represent the opinions of the organizations for which he works, or on behalf of which he appears in public. All information used comes from publicly available sources.
2 Singer, *Wired for War: The Robotics Revolution and Conflict in the 21st Century*.

to premises about the mutual capabilities (striking power and readiness) between adversaries having to be discarded with the outbreak of hostilities, and hence to considerations about balance and imbalance in the run-up to conflicts no longer appearing reliable.

Moreover, the reliable identification and attribution of systems in use is often impossible at first glance because the patterns of use are often similar in external characteristics (appearance, digital/electronic signatures, etc.), but can also be camouflaged in parts and in terms of ownership and authorship through modifications and production processes (e.g. through computer-aided design and 3D printing processes).

The proliferation rate at which UAV systems have manifested themselves worldwide to varying degrees of technical maturity underlines the critical nature of the trend towards the increasing use of such systems in hybrid conflicts. This will likely change hybrid conflict dynamics as a whole. The escalatory capability that can be attributed to UAV use unfolds asymmetrically-exponentially rather than symmetrically-linearly, which distinguishes their impact power from other means of engagement in numerous dimensions of the hybrid conflict field.

This trend is accompanied by a change in the actors that take part in conflict-related actions. Previously it was mainly state or governmental organizations and actors. Lately, the quality of the non-state actor of violence, once supported or at least tolerated by the state, has recently been increasing in its relevance in these forms of conflict.

On the one hand, this is related to the successive erosion of the de facto bipolar confrontation, which seems to have given way to a superficially more diverse disorder since the end of the East-West conflict. On the other hand, it is related to the hybrid nature of conflict realities, which has gradually instituted a struggle for zones of power and influence in various parts of the international arena.

The role of technology in this struggle for influence and power has always been significant,[3] but in today's conflicts it has reached a new dynamic, as traditional (mostly military-dominated) development and procurement processes have been partly transferred to private structures, or completely replaced by them.[4] Thus, private UAV system developers have been able to develop a different dynamic in the area of research, development and market readiness as opposed to previous state-controlled approaches. The development of the role of UAVs and their influence on the hybrid conflicts of our time will be one of the key focuses of this study.

UAVs are divided into different classes (high-altitude long-endurance (HALE); medium-altitude long-endurance (MALE); and tactical unmanned aerial vehicle (TUAV)). This paper focuses primarily, but not exclusively, on systems of the MALE and TUAV classes. HALE systems are usually very expensive to procure, operate and deploy, and are located in the sub-strategic area. They currently have no significant influence on conflict and proliferation dynamics, and are therefore not dealt with in this study.

In some of the conflicts presented below, the sources repeatedly blur the lines between (i) **UAVs**, (ii) **cruise missiles**, (iii) **ballistic missiles** and (iv) **loitering munitions**. This is partly because they are often used together in these conflicts, and partly because they can be compared with each other in terms of their operational effect. Nevertheless, these are systems that can be distinguished from each other, and it is important to understand their different characteristics in order to measure their respective operational value more effectively. Therefore, the essential differences will be briefly discussed so that the combination of these reconnaissance and effective means can be fully understood in the conflicts, as well as the way they differ from the UAV system as such, and its unique selling points in hybrid conflicts (see Table 1).

The tendencies of hybrid conflict/warfare will be examined along with five selected conflicts, which can be distinguished from each other geographically and with regard to the actors involved on the ground. The conflict regions are Ukraine, Syria, Libya, Yemen, and the conflict over the Nagorno-Karabakh region.

3 Cf. revolution in military affairs (RMA).
4 Cf. commercial off-the-shelf (COTS).

First of all, the underlying conflicts will be briefly outlined before the specific use of UAVs in each case is discussed on the basis of examples and types of operation. In addition, other actors will be identified and any trends and special features in the conflicts from the perspective of hybrid methods highlighted.

TABLE 1. Basic characteristics of different weapons systems

UAVs are characterized by remote controllability and reusability. They can be equipped for different military and intelligence purposes and can be deployed in various escalating ways. The versions used differ widely from each other (e.g. in their duration of use, service ceiling, and payload). UAVs are launched from launching devices, for example by a catapult (in some cases in conjunction with a rocket propulsion system) or by conventional take-off on a runway. Furthermore, some types have a vertical take-off and landing capability, which in turn reduces the infrastructure conditions required for their operation and deployment. This enables their use from ships, for example. All of these systems are guided or monitored for the most part by ground-based control stations, depending on their degree of autonomy. UAVs can take over any of the operational scenarios of conventional military systems in the air force sector and are appealing compared to conventional manned aircraft due to their relatively low lifecycle costs.

Cruise missiles are systems powered by a jet engine (turbine) and characterized by a flight path similar to that of a conventional aircraft, as well as comparable mission speeds. Cruise missiles are available with a wide range of warheads and sensors, which can be conventional or non-conventional. Newer versions of these systems can be modified in terms of the explosive power delivered to the target in flight via satellite link. The unique selling point of these systems is a contour flight capability, which is made possible in part independently of satellites by built-in inertial navigation systems, and which makes the detection of these systems difficult despite their comparatively low speed (compared to a fighter jet). Therefore, airborne warning and control system (AWACS) aircraft are usually required for their detection (especially over land). Cruise missiles can duly operate in a semi-autonomous mode. These systems can be deployed from the air, from the ground, or even from surface and underwater vehicles. It is essential that the destruction of the system is intended when it is deployed, and this is sometimes associated with high financial costs. During deployment, the sensors, communications equipment and all other components of the system are irrevocably destroyed.

Ballistic missiles are characterized by their ballistic trajectory, their primarily kinetic purpose, the destruction of the system during deployment,[5] and their propulsion system, which can be based on either liquid or solid rocket fuel and which determines their possible uses in the long term. Missiles are designed to reach high speeds and can also be armed conventionally or non-conventionally. Like cruise missiles, they can be launched from ground-, air-, sea- or underwater-based platforms. They are usually detected by geostationary satellites.[6]

Loitering munitions comprise a category of weapons and agents that can be used for different purposes. On the one hand, this can be the kinetic effect in the target, but on the other hand it can also be battlefield illumination. As a rule, these systems are not designed for reusability. Their operational added value in relation to rocket or tube artillery shells, for example, is that they give the operational command an intervention on the time of effect after the weapon has been fired, and thus enable a more optimal effect in the target with regard to a wide variety of aspects (e.g. avoidance of collateral damage).

5 Only civilian systems from Space-X are a current exception.
6 Singer, 'China's ambiguous missile strategy is risky'.

Ukraine

The conflict between the government of Ukraine and pro-Russian forces in the Donetsk and Luhansk regions as well as in the Crimean Peninsula, which was annexed by Russian unmarked forces in 2014 and is home to the largest ice-free deep-water port of the armed forces of the Russian Federation in the Black Sea, can be described as an almost frozen conflict. While the use of military assets in the breakaway Ukrainian regions of Donetsk and Luhansk is recurrent, the intensity of some of them varies greatly.[7]

Use of UAVs

The use of UAVs in the conflict, especially with regard to developments in the Donetsk and Luhansk regions, can be described as mainly intelligence, surveillance and reconnaissance (ISR), target acquisition (TA), signals/electronic intelligence (SIGINT/ELINT) and electronic warfare (EW).

On the one hand this is due to the existing UAV patterns, which only underwent further development in the course of the conflict and are still doing so (from TUAV to MALE patterns), and on the other hand to the classic operational doctrines[8] of the parties involved in the conflict, which currently only seem to assign UAVs a more active role.

A UAV-linked weapon effect can be illustrated in the Ukraine conflict by means of two key examples, the first of which was the explosion of an ammunition depot in Balakliya, about 100 kilometres from the front, on 22 March 2017. The explosion delayed the supply of rockets and artillery shells for Ukrainian troops on the front in Donbas.[9] According to media reports, the use of a Russian UAV in combination with an explosive charge led to this incident. However, human error was not ruled out as a reason for the incident. Ukraine has repeatedly found/shot down Russian UAV systems (e.g. Orlan-10), which seem to have been used primarily for ISR/TA purposes.[10]

A second notable incident relates to the combined use of UAVs for artillery observation and fire control purposes at the beginning of the conflict on 11 July 2014. In Zelenopillya, the Russian Federation used UAVs in combination with heavy tube and rocket artillery systems, and nearly destroyed two battalions of the Ukrainian army within moments.[11] Russia seems to have actively chosen this type of UAV deployment in order to be able to play off its own strength in artillery systems, which can thus remain on its own soil, against Ukrainian forces. In turn, Russia could consider a Ukrainian artillery or air force setback on Russian territory unlikely; on the one hand because this would represent open aggression by Ukraine against Russia and would also play into Russian narratives, and on the other hand because the military attempt would already be associated with great risks.

UAVs on the Ukrainian side can shake this momentum on the Russian side. On the one hand, effective strikes against armoured formations and air defence systems are possible with UAVs. On the other hand, the concealment of such an attack with modified systems has been proven, which in turn could challenge the legitimacy of a clear counter-reaction.

More recent developments show that the tactical use of these systems is still ongoing.[12] In the near future, however, intensification of the conflict in this area is to be expected since, on the Ukrainian side, in-house developments (e.g. Sokil-300), external procurements (e.g. Bayraktar TB2), and the defence against UAVs (e.g. 35D6M radar) are gaining in importance.[13] On the Russian side,

7 Council on Foreign Relations, 'Conflict in Ukraine'.
8 Headquarters Department of the Army, 'FM 100-2-1 The Soviet Army – Operations and Tactics'.
9 Zwijnenburg, 'Donbas: A Ticking Toxic Time Bomb'.
10 Malyasov, 'Ukrainian Soldiers Shoot Down Unidentified Drone Over the Combat Zone'.
11 Grytsenko, 'Remembering the shelling: "We saw a glow, they were burned alive"'.
12 Malyasov, 'Ukraine Army receives first Bayraktar armed UAVs from Turkey'.
13 Jones, 'Ukraine reportedly looks to buy 48 Turkish Bayraktar TB2 armed drones'.

however, the Kavkaz-2020 manoeuvre showed that the Russian Federation is also capable of deploying its UAVs in a larger group and, above all, that the precision of the artillery systems behind them is capable of escalation.[14] It is also to be expected that the Russian Federation will gradually reduce its dependence on UAVs of Israeli origin (e.g. Fortpost ISR [aka IAI Searcher]), as the supply of such systems and the corresponding spare parts could quickly dry up in the event of sanctions.[15] In addition, Russia is currently working on MALE UAVs capable of performing multiple roles at the same time (e.g. Orion-E MALE).[16]

The conflict in Ukraine has demonstrated both an escalative and a de-escalative character through the use of UAVs by different parties to the conflict. The use of the systems has increased the uncertainty on both sides of the conflict with regard to the air situation. This was tragically illustrated by the shooting down of a Malaysian Airlines Boeing 777, operating as flight MH17. Furthermore, this is underlined by the procurement of new radar systems for countering drone use, but also the expansion of the UAV arsenal on the Ukrainian and Russian side. The conflict-dynamic relevance of these events has recently become apparent, among other things, through a public Russian note to Turkey on this matter, warning Turkey against an active drone-based armament of Ukraine.[17] The two direct parties to the conflict are also expanding their capability portfolios in the use of UAVs and with regard to the variations in their use. Even if classic deployment patterns still dominate at present, an increased spectrum of use of the systems in the conflict can be expected in the event of a renewed escalation. On the de-escalation side, the deployment of the Camcopter S-100 system in the conflict zone by the OSCE since 2018 should be mentioned as well. This deployment is intended to help neutral conflict observers assess the situation and monitor the agreements between the parties to the conflict.[18]

14 Hambling, 'Russia Uses "Swarm Of Drones" In Military Exercise For The First Time'.
15 Cooper, 'The Nagorno-Karabakh war: a spur to Moscow's UAV efforts?'.
16 Asian Military Review, 'Russia unveils its Orion-E MALE drone in attack configuration'.
17 Ahval News, *Russia warns Turkey over drone deliveries to Ukraine.*
18 OSCE, 'SMM long-range unmanned aerial vehicles resume monitoring of security situation in eastern Ukraine'.

Syria

Since 2011, Syria has been facing two mixed fronts that have been fighting each other, causing severe damage to the country and, above all, harm to its civilian population. The Syrian government, represented by President Assad and supported by the Russian Federation and the Islamic Republic of Iran, stands in stark contrast to the variety of government-opposition groups that embody a cacophony of streams and ideologies. These are mainly (selectively) supported by the United States, Saudi Arabia, and Turkey. The terrorist organization Daesh (aka ISIS) has established itself as a third force, in addition to an international coalition set up to fight against it, which has included Iraqi-Syrian cronies. Israel in particular intervenes in the conflict when it sees its security interests being threatened by Syria and/or Iranian forces in the region.[19]

Use of UAVs

The use of UAVs in the conflict in Syria is multifaceted, as both classic high-altitude reconnaissance support systems such as the American RQ-4 Global Hawk have been used, and bulging MALE and TUAV systems have been deployed by a greater variety of actors.

The loss of an MQ-9 Reaper revealed that the US is deploying this system on the ground in Syria. The same applies to MQ-9s of the British Armed Forces (Royal Air Force [RAF]), which are also being deployed, as revealed by the Ministry of Defence following a request by the organization "Drone Wars UK".[20] Due to its sensor-effector combination, the MQ-9 is suitable for a wide range of operations and is considered one of the most powerful MALE UAVs in the world. Basically, it is used for ISR as well as strike operations.

Turkey's role in the use of UAVs in Syria is of interest for several reasons. Firstly, Turkey (as well as Israel) used them in suppression of enemy air defences (SEAD) operations (especially during Operation Spring Shield) on the ground. Their UAVs (Bayraktar TB2 and Ankar-S) were used against Syrian air defence positions (primarily of Russian origin: S-300; S-400;[21] Pantir, Buk-M1) and in a combination of EW operations (conducted by Ankar-S and ground-based indigenous systems), as well as the Bayraktar TB2 UAV-based weapons deployment. In addition to the aforementioned SEAD, the range of UAV operations also included ISR/TA and strike operations, for example, against hundreds of armoured vehicles, dozens of artillery systems and several hundred soldiers of the Syrian Armed Forces.[22] The casualty rate among the deployed Turkish UAVs does not appear to have exceeded ten in this operation, which is remarkably low.

With regard to any Russian Federation activity in Syria, photographic evidence suggests that Russian forces are using UAVs on the ground. Systems of the same type (Orlan-10) have also been used in the context of the Ukraine conflict, as well as in corresponding manoeuvres by the Russian armed forces such as the above-mentioned Kavkaz-2020. The evidence presented seems credible at this point, and the use of the systems for ISR and TA purposes seems plausible.[23]

The various non-state armed groups, such as Daesh, have also used UAVs in this conflict. The systems used range from tactical UAVs to very basic recreational and hobbyist systems. The first reported use of a UAV in Syria by Daesh was against Turkish forces and involved an unspecified UAV from which an explosive payload (likely an RPG7 warhead) was dropped.[24] In addition to the

19 Gross, 'Syria says Israel massively bombs area with large Iranian presence'.
20 Cole, 'Drone Wars UK'.
21 This system is also operated by Turkey itself and was procured by the Russian Federation in recent years under appropriate US protest.
22 Crino & Dreby, 'Turkey's Drone War in Syria – A Red Team View'.
23 Malyasov, 'Syrian rebels claim shooting down of Russian drone over Zawiya Mountain'.
24 Balkan, *Daesh´s Drone Strategy – Technology and the rise of innovative terrorism.*

kinetic effect, however, it seems that at this point it was primarily the propagandistically useful value of these operations that was of interest to this actor, as suggested by the conveniently published video recordings of such attacks.

The example of the Syrian conflict and the various actors involved in it illustrates that UAVs can be successfully used for SEAD against air defence systems of varying maturity (also in different altitude bands) in conjunction with electronic warfare/combat management measures. This results in massive tactical as well as strategic advantages for the coordinated force. A look at non-state actors in the conflict, some of which are terrorists (e.g. Daesh), reveals that UAVs have already found favour as a preferred means for their specific purposes (primarily psychological operations [PSYOP] but also strikes). Thus, an intensification of these efforts in this area is to be expected.

Depending on the actor, the use of UAVs in the Syrian conflict covers a wide range of mission types and intended purposes. High-intensity SEAD operations to protect one's own forces (especially one's own manned systems, e.g. in the run-up to air strikes) as well as operations to combat mobile ground targets by state actors can be highlighted, for example. In this context, the use of UAVs helps hybrid actors to keep their own cost-benefit calculations positive, and enables them to make use of the limiting, primarily military effect. In this way, the footprint in the conflict itself can be kept light and the impact within the bounds of what is necessary. Non-state actors, such as Daesh, focus primarily on the media benefits enabled by UAVs. This aspect seems to be the easiest for these actors to exploit and also seems to generate the greatest possible added value according to their reasoning. Even though the dropping of explosives by these actors was reported, no indications of a sustainable and tactically relevant change in this approach to dealing with UAVs could subsequently be identified. The Syrian example illustrates that UAVs have become the means of choice in hybrid conflicts when the aim is to participate in a conflict while externalizing the costs of it as far as possible.

Libya

In Libya, two competing organizations have been opposing each other since 2011 – the Government of National Accordance (GNA), based in Tripoli and supported by the United Nations, and the government led by General Haftar's Libyan National Army (LNA), based in Tobruk. The GNA is mainly supported by Turkey, France, Italy and Qatar. Turkey supports the GNA on the one hand with military advisors (among other things, to carry out UAV operations), and on the other hand with mercenaries from the so-called Sultan Murad Division, who primarily come from Syria, which also supplies a wide variety of equipment. The LNA, however, is backed by the Russian Federation (mainly by mercenaries from the Wagner Group and the Moran Security Group). It is also supported from within the region by forces such as some Sudanese mercenaries and the United Arab Emirates (UAE).[25] The situation on the ground is complicated by numerous tribal, regional, political, as well as religious motivations and territorial claims. The country's abundance of raw materials and the absence of clear-cut power relations and loyalties explain the degree of discernible international interference in this conflict and inevitably lead to its continued stimulation.[26]

Use of UAVs

The GNA is primarily supported by Turkey and twelve Bayraktar TB2 systems. Bases in Misrata and Mitiga are used for this purpose. These systems are led by Turkish forces via LOS. This limits their operational range to approximately 150 kilometres, even though there are reports that this operational range can be extended in some cases via relay stations (e.g. through Stations in Tripoli, Misrata and Jurfa), and this circumstance inhibits the deployment of the systems on the ground. The Bayraktar TB2 is used for reconnaissance and attack operations on the ground, also targeting the UAV infrastructure (ground control stations) of the LNA.[27, 28]

The LNA is supported by the UAE and uses six to eight Chinese Wing Long I and, where appropriate, Wing Long II systems. These systems have been deployed by the UAE and are conducting combat operations (mainly within the framework of close air support operations) in Tripoli and Misrata. Furthermore, two Austrian Schiebel Camcopter S-100 as well as Iranian Mohajer-2 UAV are used by these LNA forces. These systems are supposed to be stationed at the al-Khadim airbase.[29]

The UN estimated 900 UAV deployments in Libya in the six months to November 2019 (600 LNA to 300 GNA). These were mainly ISR missions, but also strike missions, for example against two IL-76 transport aircraft used by the LNA, which were also noted. Italy also uses UAVs on the ground, namely MQ-9 Reapers, as evidenced by their firing by LNA forces near Tarhuna (south of Tripoli).[30]

The conflict and the use of UAVs depicted in it also repeatedly led to notable civilian casualties. This is partly attributed to the use of UAVs in close air support (CAS) operations, some of which take place in urban areas. The distinction between combatants and non-combatants is difficult even for UAV operators and subsequently leads to these casualties.

In general, both factionalized sides in the conflict currently seem to be striving for the introduction and deployment of more potent air defence systems due to the ongoing threat situation from the air.[31] Whether this project will be crowned with success for one side or the other remains doubtful at this point, in view of the experiences from

25 Klingert, 'Im Land der Söldner und der Glücksritter'.
26 Council on Foreign Relations, 'Civil War Libya'.
27 Gady, 'Useful, but not decisive: UAVs in Libya's civil war'.
28 Borsari, *The Middle East´s Game of Drones.*
29 Gady, 'Useful, but not decisive'.
30 Borsari, *The Middle East´s Game of Drones.*
31 Gady, *Useful, but not decisive: UAVs in Libya's civil war.*

other UAV-SEAD operations (especially Syria, Nagorno-Karabakh). More decisive for the situation on the ground will be the change in the control of the systems; if increasing control by means of BLOS becomes possible, conflict management could be further intensified, since the UAV-operating personnel and their ground control stations would no longer have to be kept on site and logistically supplied, but could be stationed in the respective home countries.[32] Only the technical personnel necessary for the maintenance of the aircraft and the effectors and sensors as well as their protection would then have to be kept on site. For the deployment and intensity of the use of UAVs in this conflict, a long-lasting deployment tendency on the ground is thus emerging. This will depend primarily on the technical BLOS capabilities of the systems provided by third parties on the ground.

The conflict in Libya is characterized by the very active and prominent appearance of external actors. In contrast to Syria, in addition to the actual parties to the conflict, various substitutes are being used to drive the conflict in one direction or the other. First and foremost are the various mercenary groups that are provided by the supporting nations in the background of the formal conflict parties, and that are intended to prevent direct involvement with their own troops. The second major element affecting the conflict is the use of MALE UAV systems. These systems are either left to the factions of the conflict parties or operated for them (with limited personnel of their own on site). The active use of Chinese products by the LNA and its supporters makes it clear that a deliberate proliferation of equipment, spare parts and replacement systems seems to be in the background here as well, and thus Beijing's endorsement of the Russian Federation at this point can also be understood as a strategic decision. In comparison to the conflicts in Syria and Ukraine, it is striking that a comparable engagement of China in these conflict zones is not discernible.

Thus, in Libya, all elements across the spectrum from hard, soft to smart power approaches are combined with each other, by different actors on the ground. The conflict in the North African state is becoming an experimental laboratory for hybrid, remote proxy conflicts of a newer kind. With the expected introduction or expansion of the use of UAVs suitable for BLOS, it can be assumed that the intensity of the conflict on site will not necessarily increase, but will lead to a technology-based stalemate situation, which can be described as a frozen conflict controlled by third parties. These hybrid, technology-focused attrition conflicts will remain sustained and thus frozen as long as the strategic calculus of the proxy conflict parties in the background and their resource-based replenishment can be guaranteed.

32 Borsari, *The Middle East´s Game of Drones.*

Yemen

The most recent conflict in Yemen's history began in 2014 with the uprising carried out by Houthi rebels (aka Ansar Allah), who are of the Shia faith and who rose up in arms against the Sunni-led government. In the process, this conflict party, backed by the Islamic Republic of Iran, captured the capital Sana'a.

After failed negotiations between Ansar Allah and the government, the presidential palace was captured in 2015 and the incumbent President Abd-Rabbu Mansour Hadi was removed from office. In March 2015, this entailed an economic and a military intervention by a coalition consisting of Saudi Arabia and the UAE, which continues to this day. This operation is led by Saudi Arabia, and is supported by the US, which contributes to the course of the conflict with logistical and intelligence support.[33]

The conflict is characterized above all by its strong geopolitical dimension, namely due to the fact that the Shiite-Sunni conflict takes on a territorial dimension on the Arabian Peninsula, and due to the three geo-economic choke points (the Strait of Hormuz; the Abqaiq Oil Processing Facility; and the Suez Canal) relatively nearby, which can be influenced by this conflict.[34] These constellations can in turn lead to global consequences (e.g. rising oil prices) and thus make the conflict an ideal, hybrid-scalable means of power projection for the competing regional powers behind it. This circumstance, in turn, considerably diminishes hopes for a quick resolution of the conflict.

Use of UAVs

In the context of this specific conflict, different means of action mentioned in the introduction appear in combination. To a certain extent, this characterizes the conflict, as the UAV, in the context of its specific strengths and weaknesses, is used primarily by Ansar Allah against Saudi Arabia and Abu Dhabi. Ansar Allah first used a COTS UAV of the DJI Phantom type, a conventional quadcopter, in December 2015 for ISR missions of a very basic nature in Yemen.[35] This system, which was stolen from a local TV station, was still used in ISR missions in 2016 before it was shot down in December of the same year. In 2017, it was replaced by a Skywalker X-8. This system is also a COTS conventional and freely available UAV system with limited ISR capabilities. Even though Ansar Allah claimed to have developed this system itself, the claim appears to be bogus. As early as November 2016, the discovery of unassembled Iranian Qasef-1 UAVs by UAE forces aroused the suspicions of the group's successive professionalization in terms of its UAV deployment intentions. In January 2018, a UN expert group reported that Ansar Allah appeared to be in possession of systems almost identical to Iranian Ababil UAVs. A year later, in January 2019, the first strike operation by Ansar Allah in Yemen was successfully carried out against a senior member of the Yemeni military at al-Anad airbase.[36]

Finally, on 14 September 2019, a combined attack was launched against Saudi Arabia's main oil processing facility (Abqaiq Oil Processing Facility), ostensibly intended to have an economic effect on the country's oil production. The Abqaiq Facility processes two-thirds of Saudi crude oil production and thus has a strategic relevance for the country and the global oil economy. The plant can be depicted as one of three geopolitically choke points relevant for the region and for geopolitical stability.[37] The attack hit 17 out of 19 designated targets, proving that Ansar Allah (and its allies) had the necessary capabilities, willingness and technical-

33 Council on Foreign Relations, 'Yemen'.
34 Foreign Policy, 'The List: The Five Top Global Choke Points'.
35 Muhsin, 'Houthi use of drones delivers potent message in Yemen War'.
36 Ibid.
37 Foreign Policy, 'The List'.

operational capacities to realize such a complex operational task.[38]

The attack targeted Saudi Arabia's economic strength and international reputation as a respected oil-producing nation. In view of the initial public offering (IPO) of the state oil company Saudi Aramco planned for December 2019, the attack primarily served PSYOP and strategic communication purposes and took place at a well-timed moment. Some sources claim that the systems used were 3D-printed solutions of Iranian design, which were deployed in a swarm (around 10 systems are assumed) and overcame a three-member phalanx of air defence systems, an (American) Patriot, a (French) Shashine and a (Swiss) Oerlikon.[39] As a further consequence, there have been repeated attacks on infrastructure-relevant facilities such as airports in Saudi Arabia (e.g. in Najaran and Abha International) as well as in the United Arab Emirates (Abu Dhabi Airport in July 2018).

Recent oil installations in Saudi Arabia (Jeddah, Ras Tanura, Asir and Jazan) have again been attacked with a mix of ballistic missiles (Zulfiqar), cruise missiles (Quds-2 and Quds-1) and loitering-capable munitions on UAV platforms (Samad-3; Qasef-2K).[40]

However, the coalition side in this conflict also relies on UAVs as part of its reconnaissance and strike capability. Saudi Arabia uses the Saker and Saker-1C systems; in addition, a co-production of the Cai Hong 4B (CH series) was realized together with the People's Republic of China (PRC). The UAE developed the Yabhon system and probably also used it locally.[41] Current construction projects off the coast of Yemen may indicate that the UAE and/or Saudi Arabia are also looking to increase their drone deployment on the ground more permanently.[42]

Looking at the ongoing heated situation between the conflicting parties and its motivational basis, the development of further indigenous Iranian multi-role UAVs such as the Ababil-3T; Mohjaer-4B/G variants, the Shahed-129 and Mohajer-6; as well as the work on strategic BLOS solutions and synthetic-aperture radar (SAR) components is rather sobering.[43]

The Islamic Revolutionary Guards Corps (IRGC) have positioned their first military satellite to achieve this BLOS guidance goal, which could, for example, provide such a solution in geostationary orbit for systems suited to it.[44] From the perspective of a hybrid actor, there are thus numerous possibilities for experimentation and application in order to try out their own tactical-operational procedures. This would lead to this conflict becoming a real laboratory for the unconventional and combined use of remotely controlled systems of a cheap design, and could thus develop a tendency to have international appeal for other conflicts and actors (cf. the latest skirmish between Hamas and Israel).[45]

The conflict in Yemen is the prototypical multi-dimensional and cross-dimensional hybrid proxy conflict, as it is reflected at religious, cultural, economic as well as political levels. UAVs, in combination with other means of action, become the weapon of choice in this conflict, as they serve both the interests and purposes of the immediate parties to the conflict (e.g. media attention), as well as the interests of those who are fighting a regional conflict for supremacy and spheres of influence in physical and transcendental spheres in the background. It is worth highlighting the reciprocal upgrading to UAV production, on the side of Ansar Allah by the Islamic Republic of Iran, and on the Saudi Arabia and UAE coalition side through the production support of the People's Republic of China.

The operational-strategic escalation potential that can be recognized in this conflict in the hybrid use of UAVs (and other means of action) illustrates the geopolitical dimension of the conflict. The successful attacks with UAVs from Yemen on Saudi territory make it clear that an anti-access/area denial (A2/AD) approach can be broken through

38 Noël, 'Saudi oil under attack'.
39 Hallinan, 'The bloody truth about drones'.
40 Wright & Barrie, 'Ansarullah's missile and munitions launches flex Saudi responses'.
41 Borsari, *The Middle East´s Game of Drones*.
42 Gambrell, 'Mysterious air base being built on volcanic island off Yemen'.
43 Borsari, *The Middle East´s Game of Drones*.
44 Ibid.
45 Kershner, 'Israel and Hamas Begin Cease-Fire in Gaza Conflict'.

UAVs, and that virtual (politico-media) as well as factual (military) claims to power can be undermined. In this hybrid conflict, the UAV becomes the geostrategic sword of Damocles of a regional power struggle, the basic conflict dynamics of which cannot be resolved at present.

The UAV thus becomes an intensifying means of action at the various interfaces of the conflict (including war/peace, civil/military, open/covert, etc.). Due to the presumed ease of use of these systems, which are largely free of damage, there is a tendency towards mutually escalating use – especially for those actors who believe they can achieve a momentary operational advantage through their offensive deployment.

Nagorno-Karabakh

The regional dispute over the territory around the region of Nagorno-Karabakh, between Armenia and Azerbaijan and their different ethnic affiliations, which has been frozen for over a decade, escalated again on 22 September 2020, leading to a brief but fierce military confrontation between the two states and their respective protecting powers. The Russian Federation had promised appropriate protection on Armenia's side, and Azerbaijan was supported by Turkey and, weapons-wise, also by Israel. Although a ceasefire was negotiated in the end (with the help of the Russian Federation, France and the US), the balance of the conflict is strongly negative, especially on the Armenian side.[46]

Use of UAVs

The use of UAVs was shown to be effective in a very clear way in this conflict. Above all, it became apparent that closing the 'sensor-to-shooter gap'[47] was critical to success, and that the side with the least UAV support was at a clear disadvantage.

With the outbreak of hostilities towards the end of September 2020, the UAV strikes, mostly by Bayraktar TB2 UAVs armed with MAM-C, MAM-L and Bozok, originally Turkish-developed effectors, as well as an ISR platform, focused on those Armenian forces located behind the frontline as well as on their lines of communication. Thus, a progressive A2/AD function was achieved against the Armenian forces through the use of UAVs, which increased their deployment and effect in space.[48]

In addition to the Bayraktar TB2s, Israeli Harop and Orbiter-1K systems from the family of loiter-capable munitions were used as well. Azerbaijan also used a converted version of the An-2 transport aircraft, which was used as a remote-controlled system, and dropped FAB 250 kg free-fall bombs. However, due to the design, seven of these converted An-2 were shot down by an Armenian man-portable air-defence system. Furthermore, Azerbaijan's attack helicopters as well as Armenia's air force were not activated in the conflict.[49]

During the conflict, a large number of protected combat vehicles consisting of a variety of main battle tanks, artillery systems, ballistic missile systems, unprotected vehicles and specific air defence systems (including four S-300HP) were taken out by the UAVs.[50] This was possible because the Turkish-led UAVs were deployed together with EW measures, and the data fusion within the Turkish Armed Forces, comparable to the American Joint All-Domain Command & Control (JADC2) concept, enabled real-time data synchronization.[51, 52] This enables sensor and effector capabilities to be transported and processed within a digital network. Thus, in the conflict on the side of Azerbaijan, the effect could be positioned on the target where it was needed, and hence the surprise effect as well as the relative defencelessness of the air defence systems, which were partly still on the march or under preparation for deployment, could be exploited.[53]

Armenia, in contrast, was able to inflict only relatively minor material losses on Azerbaijan.[54] The losses among the UAVs et al. varied and included seven Harop, one Orbiter 1K and at least one Bayraktar TB2.

Thus, in the context of this military campaign, ISR, TA, EW, SEAD, Strike, CAS as well as PSYOP procedures came into play in the use of UAVs. Even if the geographical framework conditions as well as

46 Council on Foreign Relations 2021.
47 This refers to the time gap between detecting and striking the target.
48 Roblin, 'What Open Source Evidence Tells Us About The Nagorno-Karabahh War'.
49 Ibid.
50 Ibid.
51 Ringler, 'Turkey's New Joint Operational Concepts Foreshadow the Future of Armed Conflict'.
52 Kasapoglu, 'Drone War – Lessons learned from Nagorno-Karabakh and Syrian battle-space'.
53 Ibid.
54 22 main battle tanks (T-72A and T-90S); 17 BMP-1, -2 and -3, as well as 5 BTRA-82A wheeled tanks. Cf. Roblin, 'What Open Source Evidence Tells Us'.

possible operational shortcomings on the part of the Armenian military may have led to a disadvantage, the effectiveness of the Turkish-Azerbaijani approach must be emphasized.

In summary, with regard to the short and intensive combat between Armenia and Azerbaijan, Azerbaijan's use of UAVs in combination with EW measures and a functioning network-centred communication approach led to the achievement of a critical advantage over the forces of Armenia, despite Russian support.

The conflict over the Nagorno-Karabakh region shows that UAVs can be deployed in multiple roles and can enable decisive military success. This was particularly evident against air defence systems and armoured transport and combat vehicles. Thus, they are able to quickly turn the cost-benefit calculation around through the sustainable and relatively cheap use of sensor-effector combinations. High-quality combat systems costing millions of euros can be rendered incapable of fighting or even completely destroyed with material costing only a few tens of thousands of euros. In addition, high-resolution videos that can be exploited by the media for digital PSYOP and strategic communication purposes can be produced, and even broadcast live to the whole world to showcase one's own power and any powerlessness of the enemy. However, the systems used also reflect the strategic dependencies entered into, which are based on converging interests. Should it not be possible to maintain this consensus between the cooperating parties, a corresponding planning of forces and means will leave a strategic gap behind. To a certain extent, a comparison can be made here with nuclear deterrence: If possible, nuclear weapon systems should not be deployed, whereas UAVs only contribute to deterrence through their operational deployment, which will always be associated with a corresponding degree of uncertainty and dependency.

Conclusions

The analysis of five quite different conflicts has demonstrated that UAVs play a key role in each of them, even if these roles differ from one another, sometimes in a nuanced way, sometimes markedly.

The main findings are that the proliferation of UAVs must be recognized as a fact and that, thanks to them, successive actors are being massively upgraded in their operational and, in some cases, strategic performance and capability spectrum, and thus in their actor quality per se compared to previous conditions. Ansar Allah in Yemen, Daesh in Syria and Iraq, or the GNA and LNA in Libya are examples of this.

This upgrading can also lead to technological autonomy or even self-sufficiency if a system is not only provided and integrated, managed and operated by external personnel, but can actually be produced (e.g. with the help of computer-aided design and 3D printing processes) and used independently. In terms of highly portable and location-independent production systems, this can lead to a fluid threat situation.

The vulnerability or detection-side impotence of conventional air defence systems in the face of these threats from a combination of UAVs, cruise missiles, ballistic missiles and loitering munitions illustrates that these assets can quickly become overwhelmed or saturated.

Improving electro-magnetic (especially EW) as well as direct energy defence system combinations can be part of the answer. Another part of the answer lies in the yet to be developed resilient handling of operational procedures, tactics and the corresponding mindset of the personnel with appropriate education and training concepts. This means that not only the technical level, but also the human factor must be given greater consideration in training procedures and established leadership principles in the future, when dealing with a sensor- and effector-infested digital and multispectral environment. This may mean that the more centralized and immediate the data fusion of these UAV systems and others in combination with further C4ISR (Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance) network elements is, the more decentralized the response must be.

The use of semi-autonomous systems, as seen in the numerous cases of strikes against Saudi oil infrastructures, can be understood as a foretaste of what can be expected with fully autonomous systems and the use of strong AI in the near future. A high-intensity military confrontation with more technically sophisticated HALE-class combat-focused UAVs (UCAVs) in an A2/AD environment, and those derivatives that in turn follow them, will strongly challenge common ways of thinking, planning and operating.

The use of UAVs shows that there is no vacuum in international politics. The American and Israeli highly mature technical solutions are bound by restrictions on distribution. This has led to the emergence of a market for Chinese derivatives on the one hand and for regional initiatives on the other. This circumstance runs counter to the establishment of any universally applicable limitations and standards. Therefore, an effective ban on or prohibition of such systems is not to be expected in the near future. The violations against and erosion of international agreements on limitation, non-proliferation or the banning of individual classes of warfare agents has proved the ineffectiveness of these treaties. This is a further reason why one's own resilience to such systems will have to be shaped and one must be able to protect oneself against them both technically and conceptually.[55]

It should also be noted that the dependencies created by deployment and proliferation will not continue ad infinitum. In hybrid conflict contexts in particular, this should be understood as an inadmissible focus on one aspect of the whole much wider spectrum of hybrid vectors. UAVs are

55 Cf. Gady, 'Krieg um Berg-Karabach 2020: Implikationen für Streitkräftestruktur und Fähigkeiten der Bundeswehr'.

becoming the means of choice, as they can perform in multiple domains with pinpoint accuracy in a hybrid-led confrontation of varying intensity, and can thus support the actions of a hybrid actor in the best possible way. The price to be paid for the use of UAVs by third parties (those actors who rely on support from UAV providers and operators) is their strategic autonomy. The transfer of UAV systems and the commitment through the use of specific personnel to their maintenance and operation will only be crowned with success as long as no effective countermeasures against these systems are brought into the field. Furthermore, these relations and operational capabilities can only be maintained as long as the other aspects of hybrid warfare and conflict management (e.g. with regard to financial and economic stability) do not hinder such a UAV solution, causing actors to fall into a situation where they are no longer in a position to provide or deploy the system for the respective party. This strategic relationship duly has serious consequences and dependencies for both sides (provider and user).

The renaissance of the current mercenary system also suggests that it will only be a matter of time before private, commercial organizations offer their paying clientele comparably complex UAV operations, as has been possible in the international framework on the basis of the outlined conflicts. Experiences with companies such as Executive Outcomes, Blackwater/ Academi or others should be cautionary examples of the possible repeatability of history. The possible use of such mercenary actors in combination with such powerful UAV capabilities in the context of false flag attacks or proxy attacks can appear attractive to hybrid threat actors, rogue states/organizations/ companies and criminal organizations for many reasons.[56]

UAVs are a means of power projection. They save blood, sweat and tears on one's own side in the broadest sense, since as a surrogate they seem to reduce the involvement of military personnel in combat operations. At the same time, however, they encourage non-state armed groups to increase violence against civilian targets and even offer them a suitable means to do so. UAVs are weapons of our time, and humanity will have to find a way to deal with them in the struggle against and with hybrid threat actors.

56 Singer, *Corporate Warriors: The Rise of the Privatized Military Industry*.

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