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Review

A Flying Reign of Terror? The Who, Where, When, What, and How of Non-state Actors and Armed Drones

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Abstract: Over the last five years, violent non-state actors have acquired armed unmanned aerial vehicles (UAVs) and have been using them extensively. This paper presents the main non-state actors involved and the areas in which they have used this tool, as well as how UAVs are used and procured. To date, armed UAVs have mainly been used by non-state actors in the Middle East and Central Asia. They have also been used in the conflict zones of Ukraine, Myanmar, Mexico, and Ecuador. While this is worrisome, limited evidence suggests that violent non-state actors use armed UAVs intentionally in areas where mostly civilians are present. The paper details the state of UAV usage by non-state actors and develops a thesis of cyclic adaptation between state and non-state actors. Not only do non-state actors learn from state actors, so does state and state-backed actors learn from non-state actors in conflict zones.

This process have been visible on the battlefield in Ukraine, where state-backed actors on both sides have incorporated smaller consumer style UAVs into their repertoire. As the use of armed UAVs developed substantially following Hezbollah's early UAV operations in 2004 and spread to many regions of the world, the adaptation of non-state cleverness and ingenuity can be harnessed by state actors in times of poor or limited access to weaponry and support systems.

Keywords: actors; drones; militants; non-state; UAVs

1. Introduction

Nation-states have air superiority over their non-state counterparts, within and outside conflict areas. While the difference between the first's and latter's air capabilities remains substantial, during the last decade, non-state actors have taken advantage of the increased availability of consumer-style drones to take some of their fight to the skies. Armed unmanned aerial vehicles (UAVs) in the hands of state actors have long been debated, and there are concerns regarding legal issues, technological constraints, and operational efficiency [1]. Now, in the hands of non-state actors, armed UAVs have forced

security forces to also keep a keen eye on the skies while fighting on the ground.

Access to UAVs has raised the concerns of national security professionals about terrorist attacks in Western countries and outside of conflict zones [2,3] and those of intelligence services and security forces [4]. One such concern is a number of or, even worse, a swarm of armed UAVs approaching a civilian-populated area, targeting them. A swarm of UAVs, as opposed to merely multiple UAVs, is defined by their ability to communicate and coordinate their positions and actions to accomplish a shared goal [5]. To date, no non-state actor has used a UAV swarm to attack civilian or military targets.

However, a Russian base in Syria was attacked on several occasions by multiple armed UAVs. In one incident, up to 13 armed UAVs engaged the Russian base [6]. Importantly, no evidence of communication and coordination between the UAVs was found.

Another critical scenario is if those UAVs have autonomous capabilities. In the near-future short movie “Slaughterbots,” terrifying scenes showed how flying robots autonomously select and engage human targets. The movie made the headlines in 2017 and later again in 2021. However, those following the UAV and lethal autonomous weapons system (LAWS) field were closely aware that something similar had already happened in real life. A UN report from 2021 describes an incident from March 2020 in Libya, where a Kargu loitering munition UAV apparently identified and engaged a target on its own. If the news is factual, this is the first publicly known incident where aerial LAWS acted on its own and inflicted potentially lethal violence upon humans [7].

The question arises: What if that autonomous UAV was launched by a non-state actor, such as a militant or terrorist group, toward a crowded area with civilians gathered? It is a terrifying thought with a possibly horrific outcome in terms of human loss. This then begs the question: How likely are these scenarios, especially the ones describing mass attacks against civilians? The future is unknown, and no crystal ball has been invented to foresee it yet. Therefore, our best chance of predicting future developments is by looking at what we already know under the current circumstances and applying that knowledge to future scenarios. So, what do we know about non-state actors and armed UAVs? Who has used them in what region of the world and when and against what kinds of targets? Furthermore, how have non-state actors procured armed UAVs?

Past research has focused, among other things, on the technological development of UAVs by violent non-state actors [8,9], tactical use and human harm [10–12], UAVs as a means to communicate and present violent non-state actors as sovereign legitimate actors [13], and on the proliferation of UAVs [14]. However, none of these covered or aimed to cover, more broadly, the field of violent non-state actors and

armed UAVs. Using prior case studies, scholarly writing, and reports, this article seeks to summarize and present what we know now (as of late-2022). This research is relevant for both civilian governments in or close to areas where non-state actors have used armed UAVs to help them plan and maintain contingency plans and security policies and prepare themselves and their citizens for the possibility of a violent non-state actor’s UAV attack. The research is also relevant for intelligence and security services, as it maps out relevant actors and their historical capabilities in taking their fights to the skies.

2. Methodology

This article relies on a snowball procedure to identify relevant sources, both academic and gray literature, as proposed by Wohlin [15]. This approach has, in contrast to a traditional systematic or scoping review, its point of departure in several publications on the current topic and not keyword searches in academic databases. The reason for having a broader, yet less systematic, approach is to capture the wide range of publications from among other NGOs and high-quality journalism often left out of rigorous systematic reviews. It also transparently utilizes important publications and their references. Moreover, while the database searching systematic review approach with its published research protocols and search strings is highly valued as a means to synthesize extant research [16], few studies have addressed the reliability of systematic literature studies [15]. Peer-reviewed academic work is also, in this study, considered a main target for snowball searching. However, leaving out reports and publications from research institutions, NGOs, and high-quality journalism will leave the study with a less up-to-date overview of the UAV field. Inclusion criteria, relating to both academic and non-academic publications, are that the publication provides either detail, general insights, or analysis on general non-state actors and UAVs, specific non-state actors, or geographical regions or issues related to violent non-state actors and UAVs. The publications used as starting points in this process are presented in Table 1 below.

Table 1. Initial publications.

Author(s)	Title	Publication and date
Bunker [8]	Terrorist and insurgent unmanned aerial vehicles: Use, potentials, and military applications.	Strategic Studies Institute; 2015
Kallenborn & Bleek [5]	Swarming destruction: Drone swarms and chemical, biological, radiological, and nuclear weapons.	Nonproliferation Review. 2018 Sep 2;25(5–6):523–43.
Rassler [17]	The Islamic State and drones. Supply, scale and future threats.	New York: Combating Terrorism Center at West Point. United States Military Academy; 2018.
Archambault & Veilleux-Lepage [13]	Drone imagery in Islamic State propaganda: flying like a state.	International Affairs. 2020 Mar 30;1-19.
Haugstvedt & Jacobsen [10]	Taking fourth-generation warfare to the skies? An empirical exploration of non-state actors’ use of weaponised unmanned aerial vehicles (UAVs – ‘drones’).	Perspectives on Terrorism. 2020;14(5):26–40.
Doctor & Walsh [11]	The coercive logic of militant drone use.	Parameters. 2021 May 18;51(2).

The snowballing search for literature departs from these publications and produce, either via direct reference or through yet another publication, several relevant scholarly/grey literature and other relevant sources. This process involves both forward and backward snowballing, indicating that papers cited by the selected publications and papers citing the selected publications are explored for relevance. Moreover, the study will include news reports on incidents where necessary, as these are rarely directly cited in academic work.

This research relies solely on sources in the English language, thereby leaving out potential sources in other languages. This limitation has implications for the breadth of sources, potentially skewing the focus toward a Western-centric approach. Furthermore, the research has a state-centric position, which is in line with traditional terrorism and conflict studies traditions. Such a research position often revolves around understanding a potential threat from violent non-state actors, the consequences of terror attacks, and how nation-states can prepare and respond to such threats [18]. While there is increased concern from critical terrorism scholars that this position may fail to recognize the potentially normative and state problem-solving consequences of its position and methodologies [19], such criticism can be found within more traditionally oriented terrorism scholars as well [20]. The state-centric position, as well as the language, timeframe, and type of publications, should be recognized by those reading this paper.

3. Results

Including the six publications used as starting points, a total of 21 publications were identified in the first step of data collection, either directly in the references section of the selected starting publications or through secondary reference sections. Furthermore, 20 publications reporting on actual UAV attacks from different regions of the world, as well as several from the author's own extensive collection of such sources, are included in the base of this article.

4. Who?

UAVs, both armed and unarmed, have been a part of Hezbollah's and Hamas' repertoire for over 15 years [21]. Supplied or otherwise supported by Iran, these two non-state actors pioneered what we in recent years have seen in Iraq, Syria, Yemen, Saudi Arabia, and Afghanistan. In Iraq and Syria, both the so-called Islamic State of Iraq and al-Sham (ISIS) and Hayat Tahrir al-Sham (HTS) have inflicted attacks on local government and US-led forces using locally developed UAVs as well as modified quadcopter UAVs with grenade dropping capabilities [22,23]. In Yemen and Saudi Arabia, the Houthis are fighting both Yemen's legitimate government and a Saudi-led coalition backing them using a vast repertoire of missiles and armed UAVs [24,25].

The Taliban has, like many other non-state actors, used unarmed UAVs to conduct surveillance of security forces

for at least six years [26,27]. However, Taliban forces in 2020, while still fighting Afghan security forces and international forces, did drop grenades or mortar shells from quadcopter-style UAVs on some occasions [28]. These attacks resemble how ISIS used armed UAVs in Iraq and Syria in 2016 and 2017. The Kurdistan Workers' Party (PKK) has used armed drones against Turkish forces in a similar manner [29], and later, the same has been observed by researchers following anti-government forces against Myanmar's military [30].

5. Where?

The examples above are by far gathered mostly from the Middle East (Iraq, Syria, and Yemen) and Central Asia (Afghanistan). Armed non-state actors in the Sahel and East Africa have also used UAVs for reconnaissance and media purposes, much like similar groups in the areas mentioned above. However, UAV attacks conducted by non-state actors in the Sahel and East Africa are yet to happen according to open sources [31]. In addition to these areas and Myanmar, armed UAVs have, to a lesser extent, been used in other regions by non-state actors. In South and North America, armed UAVs have been used by criminal cartels in Mexico to attack police forces [32], an Ecuadorian prison [33], and President Maduro of Venezuela [34]. Moreover, a UAV fitted with a copper wire was apparently used to target a US power station in Pennsylvania [35]. Armed UAVs have also been used by non-state actors on both sides of the conflict in Ukraine, whereby armed groups loyal to Ukraine for several years have engaged pro-Russian militants [36].

6. What?

There are two main types of UAVs used by both state and non-state actors: the fixed wing UAV with a vertically positioned rotor and the quadcopter-type UAV with four or more rotors positioned horizontally [37]. The Houthis in Yemen present a good example of dual use, depending on the range to target. When the Houthis engage targets inside Saudi Arabia, they appear to mostly use fixed-wing UAVs with explosives that either detonate on targets or close to them. In combat against government-supported forces in Yemen, examples of both fixed-wing UAVs and quadcopter-style UAVs have been found [38]. This is similar to how ISIS used armed UAVs in 2016 and 2017, by dropping explosives or placing explosives in rigged UAVs on the ground [17,39,40]. The quadcopter-style UAV is also used by groups fighting government forces in Myanmar, by the Taliban in 2020, by PKK fighting Turkish forces, and by criminal cartels in Mexico and Ecuador, as well as by pro-Russian militia in eastern Ukraine. While the fixed-wing UAV in general has a greater range, the quadcopter UAV possesses the characteristic advantage of being able to hover over a designated target area [41] before dropping grenades or other explosives on its below target.

7. When?

In terms of when non-state actors have used armed UAVs, with a few exemptions, most incidents have occurred from 2016 until the end of 2021. Prior to that, Hezbollah was recorded to use them with a few flights into Israel in 2004 [42] and attacks in 2006 and 2014 [31]. ISIS developed and used its armed UAV program extensively in 2016 and 2017. As seen above, ISIS's creative use of consumer quadcopters modified to drop grenades may have inspired the Mexican cartels, Taliban, PKK, and anti-government forces in Myanmar to do the same in the following years. Needless to say, UAVs have become more easily available, less expensive, and more well-known to the public than they were at the onset of Hezbollah's development of UAVs over 15 years ago.

8. How?

The question of how is divided into two sections: one about how non-state actors use armed UAVs, such as target selection, and the second about how they procure UAVs to the extent that it is known.

8.1. *How Armed UAVs are Used by Non-state Actors*

Armed UAVs have the potential to overwhelm a civilian area, inflict distress, and cause severe injuries [43,44]. However, research on non-state actors shows that they do not select targets randomly and tend to focus on hard targets, such as armed forces or security forces, rather than soft targets where unprepared civilians are present. They also do not cause mass casualties or mass injuries [10], and in a comparison with US UAV attacks, non-state actors' UAV attacks were found to be less lethal than US UAV attacks, but they caused slightly greater injuries to civilians [12]. This finding should however be revised following investigative journalism by the New York Times, which uncovered thousands of civilian deaths from US drone strikes compared to what was formerly known [45]. Two separate studies have also examined the extent to which non-state actors use armed UAVs as a tool to conduct strategic bombing according to available data. Both studies failed to find evidence to support this. Rather, non-state actors use armed UAVs tactically against armed forces [10,11] and for theatrical and media purposes [11,13]. However, some important exceptions to these patterns are well known, such as the Houthi attacks on Saudi airports [46]. Other examples are the UAV attacks against Iraqi Prime Minister al-Kadhimi in late 2021 [47] or Venezuelan President Maduro in 2018 [34].

8.2. *Procurement of UAVs*

Non-state actors procure armed UAVs in different ways. In the case of Hezbollah, which was responsible for pioneering this tool for non-state actors, evidence suggests that support was provided by Iran, as both the Ayoub and Shahed

model UAVs were reportedly used by Hezbollah [42,48,49]. Additionally, consumer-grade quadcopter UAVs, such as the DJI Phantom, have also been used by Hezbollah, indicating procurement through commercial channels via third parties [50]. Hamas has also used several versions of the Iranian Ababil UAV model, which gave them a platform to conduct reconnaissance and carry out attacks [51]. Hamas' UAV capabilities are also linked to the work of an in-house Tunisian UAV engineer. Since he was killed in a 2016 assassination [52], Hamas' UAVs, such as balloons and kites, have clearly been far less sophisticated [53]. Notably, a recent development, albeit beyond the non-state sphere, is that Iran is supplying Russia with various types of armed UAVs that are used in attacks against civilian-populated areas, such as Kyiv in Ukraine [54]. While this does not constitute terrorism in the traditional sense, Russia is inflicting fear, uncertainty, and terror upon Ukraine's civilians as well as harming Ukraine's energy infrastructure through the use of such UAVs [55].

ISIS's procurement of armed UAVs has been extensively researched by both scholars and journalists [17,56,57]. A Danish investigation effort by a collective of journalists and researchers found that a Danish–Lebanese engineer played a key role in procuring ISIS drone parts through an intricate network spanning from Denmark to Syria [57]. However, ISIS also had other supply routes, as there was no overlap between retailers used to buy drones in the case mentioned above and findings from another investigation of ISIS drone procurement [17].

In addition to Hezbollah, Hamas, and ISIS, the Houthis in Yemen have frequently used armed UAVs against targets in Yemen and Saudi Arabia [10]. Research into Houthi UAVs has found that important components are similar to those used in improvised explosive devices by other non-state actors in Yemen and Bahrain. Others are similar to those in Iranian UAVs [25].

After Hezbollah pioneered this field, many others followed suit. ISIS has had a massive influence on the use of commercial-grade UAVs among non-state actors, and their modification of easily obtainable models such as the DJI Phantom has inspired others to mimic their operations. Parallel to ISIS's loss of land, Mexican cartels started using quadcopter UAVs with explosives, following their example [58]. Researchers following Mexican criminal cartels have observed this repeatedly after 2017 [32,59]. The Taliban's use of armed UAVs is also similar to that of ISIS's use of quadcopters [28]. A similar use can be found among the People's Defense Force in Myanmar, in combat with the government's forces [30].

Violent non-state actors operating within and outside active conflict zones are typically less technologically sophisticated compared to their government-led counterparts [60]. Past research has shown that non-state actors learn from and adopt tools and tactics from their state counterparts and that they evolve and adapt because they believe that something can be gained by the innovation [61]. An important development in the use of UAVs in 2022 is how

Ukrainian forces, supported financially and logistically by other nations, organizations, and private individuals, have used UAVs in the same manner as non-state actors have been doing in conflict zones. Imagery provided by ISIS, the Houthis, and militants fighting in Myanmar, to name a few, has shown how commercially available quadcopter UAVs are re-designed and fitted with various munitions, such as modified grenades and mortar shells. Images of the same have been coming from the Ukrainian battlefield for several months in 2022: a UAV hovering over a Russian armored vehicle and dropping explosives on the target [62]. In the summer of 2022, these images also featured larger UAVs, such as the DJI Matrice, dropping up to eight explosives on their target below.

Armed UAVs are, as this paper has shown, not only being used in the Middle East but also in South and North America, Central Asia, and South East Asia. This development—now going from non-state actors to state actors—indicates a cyclic adaptation of new tools and tactics. In this cyclic adaptation, both actors appear open to the idea of incorporating the success of their counterparts' trials and errors. This may be particularly relevant in conflict zones where state actors, much like non-state actors, may struggle at times with gaining access to their preferred weaponry and support systems for military operations. Their counterparts' ability to adapt and their overall creativity and cleverness may therefore be harnessed if propaganda videos are actively gathered and researched by intelligence and research communities.

9. What Does All this Tell us About Future UAV Threats from Non-state Actors?

The previous sections inform us of the following: Armed UAVs are mostly used in the Middle East and Central Asia by violent non-state actors engaged in conflict zones. Non-state actors mainly targeted government security forces or their international allies, with some exceptions. Given the development until now, this is likely to continue to some degree. However, as the modification of commercially available UAVs continues in Mexico, Ecuador, Afghanistan, Yemen, and Myanmar following ISIS's example from 2016 and 2017, such inspiration and transfer of tools and tactics are also likely to continue. This spread may exponentially increase the risk of non-state actors or lone actors using armed UAVs against civilians.

As Iran is identified as a provider and supporter of the Houthis in Yemen—often through shipments [63]—continued control of naval traffic in the region is of great importance. Further, as commercially available quadcopters are and will continue to be accessible in the open market, their role in the actions of more non-state actors will most likely become greater than what it is currently. In line with the development of 3D-printed gun or gun parts [64], it is also possible that 3D printing will be used more extensively to produce parts essential to modifying off-the-shelf commercial quadcopters with mechanisms to drop or place explosives on

targets. In addition to UAV parts, such as the UAV's body, rotors, or release mechanisms, 3D-printed weapons can also be fitted onto a UAV. In the early days of 3D-printed guns, they were assessed and discussed as unreliable [64]. However, 3D-printed guns have evolved, and more reliable, fully homemade, semi-automatic rifles are now well known [65]. There is no reason to believe that the future will not see a merger of partially modified UAVs and partially or fully homemade 3D-printed weapons fitted onto them.

These potential developments, possibly advanced locally developed or modified UAVs, are worrisome. Considering the potential of autonomous capabilities, the possible scenarios appear even worse. Fortunately, to date, there is no indication of non-state actors having launched UAVs with autonomous capabilities. However, artificial intelligence (AI) is no longer an exclusive resource for nation-states. It is less expensive and more available than it was merely a few years ago [66]. Like commercial UAVs and 3D printing, it is likely that AI will assist non-state actors in future actions. However, at present, if lethal autonomous weapon systems are launched and used, a nation-state is likelier responsible. As disturbing as that is, it is slightly more encouraging as a nation-state has to answer for their actions to a larger extent than a non-state actor and may be subjected to sanctions from the international community.

10. Concluding Remarks

This research utilized a snowballing procedure to identify relevant academic and non-academic literature on non-state actors and armed UAVs. In doing so, it has a state-centric position, aimed at establishing an overview of the presence and threat of armed UAVs in non-state actors' hands. Over 15 years ago, Hezbollah pioneered non-state actors' use of UAVs and armed UAVs. Recent years have shown that many and vastly different non-state actors have adopted the "ISIS version" of modified armed commercial UAVs. As the use of armed UAVs spreads through social media in particular [67,68], it is likely that the spread of technology and know-how will continue. This may inspire new and emerging players in the field to adopt armed UAVs in their repertoire. As recommended in past scholarly work [69], intelligence and security services should pay attention to violent non-state actors showing interest in and procurement of UAV parts or bodies, particularly those who have members with aviation and/or engineering expertise. Research and reporting on violent non-state actors' use of armed UAVs from the last decade have shown that the development, to some extent, has come full circle in the sense that state actors or state-backed actors are using commercial UAVs in the same manner as violent non-state actors have been for several years. Presently and to the best of the authors' knowledge, this can be seen in the Ukrainian forces. However, with trade agreements and sanctions limiting the sale of more advanced UAVs to some states, commercial tools developed by non-state actors may also be more broadly used by other state actors in the future.

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