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**FROM TARGETED TO TARGETERS: THE FUTURE OF UNMANNED
AERIAL SYSTEM (UAS) PROLIFERATION BY TERRORIST GROUPS**

by

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NIU Class 2021

Submitted to the faculty of the
National Intelligence University
in partial fulfillment of the requirements for the degree of
Master of Science of Strategic Intelligence

July 17, 2021

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From Targeted to Targeters: The Future of Unmanned Aerial System (UAS)
Proliferation by Terrorist Groups

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ABSTRACT

TITLE OF THESIS: From Targeted to Targeters: The Future of Unmanned Aerial System (UAS) Proliferation by Terrorist Groups

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CLASS NUMBER: NIU 2021 **DATE:** July 17, 2021

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Current literature characterizes the future threat of unmanned aerial systems (UAS) operations by terrorist groups as limited. This study argues the contrary. It asserts that the use of UAS technology by terrorist groups is currently a niche threat. However, evidence shows the threat will become mainstream within the next five years. This study uses quantitative research via the case study methodology to prove the research question. The dependent variable is the terrorists' use of complex UAS operations. The independent variables are simplicity, supply, and scale. The research assesses three terrorist groups: the Kurdistan Workers' Party, Hayat Tahrir al-Sham, and Boko Haram. Findings indicate that acquiring UAS technology is easy but expanding operations is difficult due to technological limitations. Furthermore, it identifies gaps in current literature and research that need to be addressed, such as how groups acquire said technology and raise funds to develop programs. It also highlights progress made by the United States and international community in addressing the UAS threat while exposing stark gaps in legislation and regulations. The implications of the research show the United States and its allies are behind in defending against the threat.

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ACKNOWLEDGEMENTS

First, I would like to express my gratitude for my family. Without the love, support, and sacrifices of my parents, (b) (6), I would not be where I am today. Thank you, Mom and Dad. To my younger sister, (b) (6) thank you for being my best friend and sounding board as we navigate adulthood together. I also cannot fail to mention the unwavering love and support from my grandparents: (b) (6). Your love and motivation gave me the push I needed to hurdle obstacles throughout life, including furthering my education. To my boyfriend, (b) (6) thank you for being an incredible partner and for helping me to grow. You are my rock, and your selflessness has helped me to get through some big changes. I love all of you to the moon and beyond.

Additionally, I would like to thank my thesis committee: (b)(3), (b)(6). Thank you for your patience as I navigated through this project and for lending your time and expertise to assist me. I was extremely honored and grateful when both of you agreed to be a part of my committee, and I can only hope that I go on to do great things with my career like you two. I appreciate you for pushing me to do my best work. Thank you again.

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CHAPTER 1

Introduction and Research Background

Conventional wisdom held by U.S. scholars says that terrorists' use of unmanned aerial system (UAS) technology will not reach large complex operations in the future due to more effective alternatives. In the context of UAS operations, complex operations entail either the simultaneous use of UASs on the battlefield, remote split operations, swarming, or using UASs as a tool for tasking, processing, exploiting, and disseminating intelligence. This thesis contradicts said perspective and demonstrates how conventional wisdom is misguided. Scholars in the United States are stuck in dispositions of old thinking, thus hindering progress in preventing the threat. The following research gives insight as to why U.S. scholars are not theorizing more into this pressing national security issue.

The United States has a history of being reactionary to unforeseen or misunderstood national security threats. Recently, the United States was caught off guard yet again by terrorist groups' ability to adapt their tactics on the battlefield and cause bloodshed in new and surprising ways. These groups are infringing on a battlespace long dominated by the U.S. military: the air domain. The recent incorporation of unmanned aerial systems (UASs), commonly referred to as "drones," into the tactics and techniques of terrorist operations is forcing the United States to reassess its policies and defense measures to protect its employed military forces. The United States is playing catch-up to its adversaries. Current U.S. policies and doctrine are insufficient. The U.S. intelligence community (USIC) is puzzled because of a lack of imagination, an area where terrorists consistently succeed and permits them to gain the upper hand. This pitfall prevents the

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U.S. from gaining the foresight it needs to predict future threats and adapt to them before they occur. The adoption of UAS technology by terrorist groups is the natural next step in the evolution of warfare. These groups are taking back their power over the same technology that targeted their members for decades. More attention needs to be paid to the threat as it evolves, or the United States will continue to be plagued by surprises on the battlefield.

The U.S. military's success with UAS technology throughout the Global War on Terror (GWOT) should have indicated that terrorist groups would become interested in obtaining it themselves. The United States is a trailblazer in creating revolutionary battlefield technology. The MQ-9 Reaper, for example, removes the risk of putting a pilot's life in harm's way during missions, provides superior intelligence, and can conduct lethal action against targets without the need for soldiers on the front line.¹ A decrease in the loss of life of U.S. soldiers gives the United States an edge over its adversaries.

U.S. drone strikes are effective. During President Barack Obama's tenure in the White House, approximately 3,300 al-Qaeda, Taliban, and other jihadists, including 50 senior leaders, were killed in Pakistan and Yemen alone by U.S. drones.² Retaliation for the strikes was unmatched due to a lack of similar technology possessed by the targeted groups. The United States historically ruled the sky and struck fear into terrorists from above. Today, the tables are turning. The United States' success contributed directly to a new threat. Terrorists are looking to UAS technology to fight back. This technology

¹ US Air Force, *MQ-9 Reaper*, September 23, 2015, <https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104470/mq-9-reaper/>.

² Daniel L. Byman, "Why Drones Work: The Case for Washington's Weapon of Choice," June 17, 2013, <https://www.brookings.edu/articles/why-drones-work-the-case-for-washingtons-weapon-of-choice/>.

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appeals to terrorists due to its affordability, lethality, and effectiveness in keeping fighters out of harm's way when conducting operations. The purpose of this study is to raise awareness of the urgency of the threat and to provide insight to U.S. policymakers and national security officials as to how terrorist groups will approach developing successful UAS programs. This thesis argues that terrorists will develop UAS programs if they have the minimally sufficient conditions to do so. It establishes a mechanism to predict why and how these programs will develop. The result is for the USIC to gain a predictive model for terrorists' use of emerging technology.

This research seeks to answer the question, "Will the use of UAS technology by terrorist groups grow from a niche threat within the next five years?" To the present, only a handful of terrorist groups were successful in using UAS technology. There is reason to believe, however, that other groups will seek to follow their lead to create their own programs. The scope of the issue will be much larger in the future and preparation needs to begin now to prevent the United States from being caught further off guard.

The current stance of scholars conveys UAS technology as a niche threat that will be sidelined by terrorist groups for more lethal offensive alternatives. This thesis challenges said viewpoint and argues that terrorist groups will in fact move into advanced stages of UAS warfare as a function of three independent variables: simplicity, supply, and scale.

The dependent variable is the terrorists' use of UASs. This is measured on a horizontal scale. On the lower end of the scale is the use of UASs strictly for observation. The midpoint of the scale represents advancement to the use of armed UASs or swarms.

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The high end of the scale is the development and use of complex operations by terrorist groups.

The three independent variables moderate the outcomes of the dependent variable. They are assessed and scored in the analysis of each of the selected terrorist groups within the following case studies. The amalgamation of the scores for the independent variables will then determine how far along terrorist groups are on the horizontal scale of the dependent variable. Terrorist groups will essentially have to master all three variables to successfully achieve complex operations and develop robust UAS programs.

State of the Literature

Current literature on the use of UASs by terrorist groups is limited. One fact derived from literature is that the interest of terrorist groups in using UASs in operations is not new. The following literature review is broken down into three distinct categories. First, it covers research conducted on the threat from its inception until the present. Then, it analyzes what scholars surmise the threat will look like in the future. Finally, it assesses the current defensive state of the international community against the threat.

Historical Context of the Threat

In his research, Robert Bunker outlined 24 different instances in which groups used, or attempted to use, UASs between the summer of 1994 and March 2015.³ All of the events, except for two, were conducted by radical jihadist groups in the Middle East.

³ Robert J. Bunker, *Terrorist and Insurgent Unmanned Aerial Vehicles: Use, Potentials, and Military Implications* (Carlisle, PA: The Strategic Studies Institute and U.S. Army War College Press, 2015), 13-15.

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One-quarter of the incidents were committed by Al-Qaeda and other prominent groups including Hamas, Hizbollah, and, more recently, the Islamic State of Iraq and ash-Sham (ISIS) beginning in the fall of 2014.⁴ Bunker's data supports this study by suggesting that the interest in UAS technology is largely prominent in groups that were historically targeted by the United States in the global war on terror (GWOT). Prior to ISIS' nineteen recorded uses of UASs, only one operation – a reconnaissance mission by Hizbollah – had a successful outcome. The other plots were either foiled by authorities or never attempted.⁵ The lack of success by groups in the past is likely why the discussion about terrorist groups adopting UAS technology was not prioritized.

It is not difficult to imagine how the United States' use of drones in the Middle East contributes to more individuals joining the ranks of terrorist groups. In his book, *The Thistle and the Drone*, Dr. Akbar Ahmed provided the Pakistani victim's view. From his perspective, drones do not just target terrorists, but also Muslim tribal groups in Pakistan, Yemen, Somalia, and Afghanistan.⁶ He believes that the targeted killings in the name of defeating al-Qaeda during the GWOT was a guise. Al-Qaeda only had a few thousand members at its height and the scope of attacks widened because the United States failed to understand tribal society nor could identify where al-Qaeda influence ended and tribes began.⁷ The rate of attacks created fear among populations. Under

⁴ Ibid.

⁵ Ibid.

⁶ Akbar Ahmad, *The Thistle and the Drone*, (Washington, D.C.: Brookings Institution Press, 2013), 1.

⁷ Ibid., 9-10.

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President Barack Obama, drone strikes were occurring in Waziristan on average once every four days.⁸ Such frequency and uncertainty likely contributed to widespread psychological distress.

U.S. drone strikes are also seen as “dishonorable” from the Muslim perspective because they kill from above and cause significant collateral damage via killing innocent civilians.⁹ This alone is enough to spark resentment against the United States, Dr. Ahmad asserts. He claims the United States and its allied national governments are a “global terror network involving drones, rendition, and comprehensive initiatives to shore up central governments [in the region].”¹⁰ The highlighted features of the United States’ drone campaign in the Middle East all seem to echo grievances by terrorist groups in the region, and people acting out of fear could feel the need to resort to joining said groups in the hopes of fending off death from above. While Dr. Ahmed’s argument can be seen as radical, it supports the idea of this study that the United States’ drone campaign continues to motivate individuals in targeted regions to retaliate.

The alarming aspect of the threat is displayed through empirical evidence gathered and analyzed by Havard Haugstvedt and Jan Otto Jacobsen. Their research sought to fill the evidence gaps in scholarly literature. The authors collected data from the Global Terrorism Database (GTD) of the National Consortium for the Study of Terrorism and Responses to Terrorism (START), Google alert string searches, incidents reported on LiveUAMap, and weekly searches for relevant news reports and articles, as well as

⁸ Ibid., 81.

⁹ Ibid., 86.

¹⁰ Ibid., 274.

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access to Bellingcat analyst Nick Waters' collection of ISIS' UAS attacks.¹¹ Their data collection was diverse and thorough. They identified 440 cases in which UASs were used in attacks, 98.9% of which occurred between August 2016 and March 2020.¹² This indicates that approximately 435 attacks occurred within the past four years. Compared to Bunker's research, Haugstvedt and Jacobsen's empirical evidence shows that attacks involving UASs have increased by 1,712.5%. These statistics are a harbinger of the rapidity with which terrorist groups are adapting. More interesting is the geographical concentration of the attacks. The Middle East accounted for ninety-eight percent (98%) of the attacks.¹³ Targets were also overwhelmingly proportional to two types. Fifty-seven percent (57%) of attacks targeted military while the second most common target was private citizens and property at 10.5%.¹⁴ It is not only military personnel that is at risk. Hard targets attracted 314 attacks, while soft targets yielded 92 attacks.¹⁵ The issue goes beyond the battlefield.

Combining the statistics with the geographical location in which the attacks are concentrated solidifies the threat to U.S. personnel and assets operating in the region – and the threat will likely continue to increase. Additionally, although targets were historically military, the statistics regarding attacks on civilians should not be discounted

¹¹ Havard Haugstvedt and Jan Otto Jacobsen, "Taking Fourth-Generation Warfare to the Skies? An Empirical Exploration of Non-State Actors' Use of Weaponized Unmanned Aerial Vehicles (UAVs – 'Drones')," *Perspectives on Terrorism* 14, no. 5 (October 2020): 29, <https://www.universiteitleiden.nl/perspectives-on-terrorism/archives/2020#volume-xiv-issue-5>.

¹² *Ibid.*

¹³ *Ibid.*, 30.

¹⁴ *Ibid.*, 31.

¹⁵ *Ibid.*

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as priorities for terrorist groups could shift. Two groups are primarily responsible for the attacks. ISIS and the Houthi/Ansar Allah movement in Yemen are responsible for 80.7% of attacks.¹⁶ Interest by other groups appears to be stirring. 11 other groups have committed at least one attack involving UASs.¹⁷ Much of this interest can be contributed to the success of one group.

The ISIS phenomenon changed the battlefield complexion. ISIS members' remote locations forced the United States to increase its drone capabilities. The United States needed to address the ISIS threat, but without the politically unpalatable "boots-on-ground." According to a report by Don Rassler, ISIS escalated the threat and achieved two grave milestones never seen before on the battlefield. First, a terrorist group conducted a successful offensive, lethal attack with a UAS. Second, a terrorist group broadcasted propaganda of accurate, explosive rigged UASs.¹⁸ These milestones set a new standard for UAS operations by terrorists.

ISIS's UAS program differs from the groups before it in that it is complex and robust. The group established designated factories to manufacture its UASs, developed an extensive international acquisition network that included 16 different companies across seven different countries to obtain supplies, created schools for cadre to teach pilots how to successfully operate UASs, and conducted pre- and post-flight UAS

¹⁶ Ibid., 32.

¹⁷ Ibid., 33.

¹⁸ Don Rassler, *The Islamic State and Drones: Supply, Scale, and Future Threats*, (West Point, NY: Combating Terrorism Center at West Point, July 2018), iv, accessed July 8, 2020, <https://ctc.usma.edu/app/uploads/2018/07/Islamic-State-and-Drones-Release-Version.pdf>.

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checks and after-action reviews of operations.¹⁹ ISIS' program essentially mirrors programs of conventional forces, such as the United States' program. It transformed the group into a formidable and technologically advanced force on the battlefield.

Rassler identified that the variables of simplicity, supply, and scale were key to the success of ISIS' UAS program. However, his research stopped with ISIS. The independent variables for this study were derived from Rassler's original research and applies them to other terrorist groups that have demonstrated interest in developing their own UAS programs. In doing so, the research will expand insight on the future of the threat.

UAS technology acquisition made up another tranche of the terrorists' UAS literature. Using ISIS as an example, acquisition networks can be quite sophisticated. Two Bangladeshi brothers, Siful Haque Sujon and Ataul Haque Sobuj, established a network through information technology front companies to move UASs, money, and dual-use components.²⁰ The network spanned across multiple countries. The main front companies were based in Bangladesh, the United Kingdom (U.K.), and Spain with branches in the United States, Australia, and Denmark.²¹ These overt activities went undetected by the United States. Deception was key to operating unimpeded. Sujon, for example, used fake Western names to conceal his nefarious activities.²² Adaptability was another key factor for the survival of the network. After Sujon died in a drone strike in

¹⁹ Ibid., 5-17.

²⁰ Rassler, *The Islamic State*, iv, 7.

²¹ Ibid.

²² Rassler, *The Islamic State*, 10.

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2015, Sobuj took over and used the pre-established network to continue operations.²³

The network took another hit in 2017. Coordinated arrests removed Sobuj and his partners from operations.²⁴ It is unclear if the network survived the brother's demise.

However, Ressler's study again demonstrates just how advanced, intricate, and creative terrorist organizations' acquisition networks may be.

ISIS' success gained attention around the globe. Since 2016, terrorist groups beyond the Middle East, including those in Africa, Asia, and Eurasia, have begun using UASs in operations, both lethal and non-lethal, according to Serkan Balkan.²⁵ ISIS' influence spread across continents and significantly expanded the scope of the threat. Future expansion is possible and underscores the importance of understanding the threat in the Present before it grows to a scale in which the United States will be unable to defend itself against in a timely manner. The scale and urgency of the threat is finally starting to be noticed by U.S. officials. A statement given before the Senate Homeland Security and Governmental Affairs Committee in June of 2018 by Scott Brunner, the Deputy Assistant Director of the Federal Bureau of Investigation's (FBI) Critical Incident Response Group at the time, raised the seriousness of the imminent threat to the American people and how UASs could threaten U.S. citizens in a number of ways, to include: illicit surveillance, attacks utilizing weapons of mass destruction (WMD),

²³ Ressler, *The Islamic State*, 8 and 13.

²⁴ Ressler, *The Islamic State*, 14.

²⁵ Serkan Balkan, *A Global Battlefield? Rising Drone Capabilities of Non-State Armed Groups and Terrorist Organizations*, (Turkey: SETA Publications, 2019), 39-48, accessed June 2, 2020, <https://setav.org/en/assets/uploads/2019/12/R146En.pdf>.

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kinetic attacks on soft targets, or attacks targeting government personnel and buildings.²⁶

Both Balkan and Brunner added to the urgency that this study promotes by identifying that the threat to the United States may not be restricted to environments overseas.

Much research exists as to why groups are drawn to UAS technology. According to Nicholas Grossman's book, *Drones and Terrorism*, a prime reason is that the technology permits a group to conduct operations, such as surveillance or attacks, without putting personnel in harm's way.²⁷ This is significant because members of a group were previously relied upon for physical surveillance and early warning in operations. Now, members can remain safely at a distance while conducting surveillance from the air. *Drones in Society* sums up some additional key attractive attributes in "the five A's:" agility, accessibility, affordability, adaptability, and anonymity.²⁸ Affordability and availability are perhaps the greatest benefits that permit the spread of UAS technology to terrorist groups. Kelly Sayler noted that UASs typically used by hobbyists are adopted as the UAS of choice by terrorist groups because of how cheap and readily available they are versus traditional conventional drones possessed by state militaries.²⁹ Grossman and Sayler solidify the theme this study argues: the threat of off-the-shelf (OTS) UAS technology is expected to grow and become increasingly popular to civilians and terrorist groups alike.

²⁶ US Federal Bureau of Investigation, Critical Incident Response Group, *Statement Before the Senate Homeland Security and Governmental Affairs Committee*, by Scott Brunner, June 6, 2018, <https://www.fbi.gov/news/testimony/countering-malicious-drones>.

²⁷ Nicholas Grossman, *Drones and Terrorism* (New York, NY: I.B. Tauris & Co. Ltd, 2018), 94.

²⁸ Ron Bartsch, James Coyne, and Katherine Gray, *Drones in Society* (New York, NY: Routledge, 2017), 3.

²⁹ Kelley Sayler, "A World of Proliferated Drones," *Center for a New American Security*, (June 2015): 11-12, <https://www.jstor.org/stable/resrep06394>.

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The Future of the Threat

There is a paucity of literature regarding the future threat. As Kerry Chavez and Dr. Ori Swed articulate, scholars have neglected or amalgamated the commercial threat with military-grade platforms, thus narrowing the scope of studies to only three terrorist groups in the Middle East – Hizballah, Hamas, and the Houthis.³⁰ Such a narrow scope fails to consider the whole picture of the problem. With the commercial OTS threat included, there are 40 separate groups that could pose a threat across all continents except Antarctica.³¹ Scholars need to broaden the scope of future studies, and this study seeks to provide a starting point.

Several authors support conventional wisdom and argue that the threat of UASs is not significant. The authors of one report, Brian Jackson et al., infer that the threat from UASs is a “niche threat” due to the fact that there are “simpler alternatives” available with superior capabilities, such as vehicle-borne improvised explosive devices (VBIEDs), and that UASs are unlikely to be major elements in groups’ operational planning in the near future.³² Improvised explosive devices (IEDs) and VBIEDs are just as complex and niche as UASs, and the authors fail to consider previously mentioned uses for UASs that provide for highly valuable advantages in operations. Don Rassler, in another report, concluded that this point-of-view was hard to argue against; additionally, he cited that the lack of the successful employment of UASs by terrorists prevented the

³⁰ Chavez and Swed, “Off the Shelf,” 30.

³¹ Ibid.

³² Brian A. Jackson, David R. Frelinger, Michael A. Lostumbo, Robert W. Button, "Evaluating Novel Threats to the Homeland: Unmanned Aerial Vehicles and Cruise Missiles," Santa Monica, CA: RAND Corporation, 2008, xvi and 72, <https://www.rand.org/pubs/monographs/MG626.html>.

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threat from being widespread and argued that a terror attack using UASs will unlikely be strategic.³³ The threat is also not recognized by some in the robotics industry. A survey conducted by the Association of Unmanned Aerial Vehicles and Systems of the 25 top stakeholders in the robotics field identified that 60 percent of the participants did not foresee “any social, ethical, or moral problems that the continued development of unmanned systems might bring.”³⁴ Others take a more radical standpoint. David Hambling believes that it is “impossible” to predict what future battlefields will look like or to what extent humans will be involved other than as “warm targets.”³⁵ Herein lies the issue of a lack of imagination.

Intelligence professionals will not be able to assess the future of the threat with absolute certainty but, through the insight provided in this study, they can at least begin brainstorming and assessing trends and patterns as a starting point. One only needs to look back in history to see that this type of threat was long overdue. The probability of the threat will only increase in likelihood as UAS sales continue to rise. Currently, over 90 nations and non-state groups operate UASs, including at least 30 countries which are either developing, or already developed, armed UASs.³⁶ These figures will continue to grow.

³³ Don Rassler, *Remotely Piloted Innovation: Terrorism, Drones and Supportive Technology*, (West Point, NY: Combating Terrorism Center at West Point, October 2016), 47-48, accessed April 14, 2019, <https://ctc.usma.edu/app/uploads/2016/10/Drones-Report.pdf>.

³⁴ P.W. Singer, “The Ethics of Killer Applications: Why Is It So Hard to Talk About Morality When It Comes to New Military Technology?” *Journal of Military Ethics* 9, no. 4 (2010): 301, https://www.brookings.edu/wp-content/uploads/2016/06/12_robotics_ethics_singer.pdf.

³⁵ David Hambling, *Swarm Troopers*, (Archangel Ink, 2015), 77.

³⁶ Sayler, “A World of Proliferated Drones,” 5.

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It is evident that the popularity of such technology spreads well beyond the U.S. military. The sales of UASs increased significantly in recent years. Last year, the global consumer market for UASs was \$2.47 billion; this number is expected to drop because of coronavirus to \$2.33 billion.³⁷ Despite the drop in sales, the market is expected to rebound. By 2023, the market is expected to reach \$3.27 billion.³⁸ The sales are significant for U.S. national security. The U.S. Federal Aviation Administration (FAA) noted there were 1.1 million UASs in the United States as of 2016 and expects this number to triple by 2021 to 3.5 million.³⁹ These statistics bolster the argument in this paper by demonstrating the sheer scale of UASs expected to be flying in U.S. airspace. These numbers will present a unique challenge for both the U.S. government (USG) and its citizens when it comes to being able to discern hostile UASs from friendly UASs. The technology is here to stay, and threat needs to be recognized before it is too late. The Global Megatrends of 2030 developed by the U.S. intelligence community recognizes the use of UASs by terrorist groups as a “possible” future issue.⁴⁰ The inclusion of the threat in the report indicates that it is more than just a niche threat.

Literature also hinted at some potentially creative ways in which UASs can be altered to optimize lethality. David Hambling wrote about the threat of swarming UASs,

³⁷ “Worldwide Consumer (Recreational) Drones Industry to 2030 – Key Drivers and Restraints,” Markets Insider, Business Insider, July 3, 2020, <https://markets.businessinsider.com/news/stocks/worldwide-consumer-recreational-drones-industry-to-2030-key-drivers-and-restraints-1029365592#>.

³⁸ Ibid.

³⁹ Ibid.

⁴⁰ US National Intelligence Council, *Global Trends 2030: Alternative Worlds*, National Intelligence Council, December 2012, ii, <https://www.dni.gov/index.php/who-we-are/organizations/mission-integration/nic/nic-related-menus/nic-related-content/global-trends-2030>.

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those working together as a team, with “unblinking resistance” that could act as flying IEDs and overwhelm victims with sheer numbers.⁴¹ The rapid evolution of artificial intelligence makes this type of threat simple to fathom. In fact, ISIS demonstrated such tactics already. In May 2017, during the battle for Mosul, the head of Special Operations Command identified as many as 70 ISIS UASs in the air within a span of 24 hours, with approximately 12 of them dropping 40mm bombs.⁴² The shock and awe of such a feat had a major impact. In fact, the United States admitted to a lapse in tactical superiority of the airspace.⁴³ It is unlikely the United States felt tactically inferior via the air in decades. This should have caused alarm and begs the question as to why solutions were not addressed sooner. The threat could be much larger. Swarms could fly into the engines of commercial aircrafts full of passengers to down them.⁴⁴ Multiple recorded instances of close calls occurred using this tactic. In Ohio, UASs nearly collided with aircraft on 117 occasions over a five-year period and near miss incidents also occurred in the U.K. and Abu Dhabi.⁴⁵ Some UASs find their target. In one instance, a UAS collided with a passenger Boeing 737 over Mexico resulting in an emergency landing.⁴⁶ The results of such an attack being successful could be both catastrophic and tragic.

⁴¹ Hambling, *Swarm Troopers*, 182-183.

⁴² Ressler, *The Islamic State*, 23.

⁴³ Kerry Chavez and Dr. Ori Swed, “Off the Shelf: The Violent Nonstate Actor Drone Threat,” *Air & Space Power Journal*, (Fall 2020): 29, https://www.airuniversity.af.edu/Portals/10/ASPJ/journals/Volume-34_Issue-3/F-Chavez_Swed.pdf.

⁴⁴ David Hastings Dunn, “Drones: Disembodied Aerial Warfare and the Unarticulated Threat,” *International Affairs* 89, no. 5 (September 2013): 1,245, <https://www.jstor.org/stable/24538306>.

⁴⁵ Chavez and Swed, “Off the Shelf,” 38.

⁴⁶ *Ibid.*

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Another possibility is larger payloads. Outside of pre-assembled quadcopters, a kit aircraft built at a terrorist's home could be outfitted with 150-300 pounds of payload.⁴⁷ A payload of such a size could cause significant damage and casualties. Hobbyists can provide a wide spectrum of ideas to terrorists searching on the internet for new ideas. One teenager in Connecticut successfully attached a handgun to a UAS and fired it in 2015 and did the same thing with a flamethrower six months later.⁴⁸ Modifications created for harmless fun could be used for more sinister operations. A swarm of UASs with flamethrower attachments could also cause unparalleled damage to infrastructure and human lives. These instances support this study by illuminating how creative terrorists can, and will, be with OTS technology.

Innovation will be incorporated in the development of UAS technology as well. Groups may not need an extensive acquisition network to obtain UAS parts. 3-D printing and additive manufacturing are successful alternatives. Corporations and students alike manage to 3-D print UASs at a fraction of the cost and in as little as 24 hours.⁴⁹ There is an entire online movement promoting this form of manufacturing. A "Drones at Home" blog offers a step-by-step guide for producing a UAS in a 3-D printer, and the Maker Movement is a community that shares designs to make UASs in said printers.⁵⁰ Further instruction is available. A Spanish company, CATUAV, offers a

⁴⁷ Ibid.

⁴⁸ Ressler, *The Islamic State*, 56-58.

⁴⁹ Hambling, *Swarm Troopers*, 108.

⁵⁰ Ibid.

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one-week course on developing UASs in 3-D printers.⁵¹ Additionally, the affordability of 3-D printing should raise another concern. Researchers in England printed a prototype UAS that costs merely \$9 per copy.⁵² Additive manufacturing could be useful for printing deadly munitions. Terrorists could print “explosively formed penetrators” (EFPs).⁵³ These types of munitions are known to pierce armor and have devastating effects on troops in the wake of blasts.

Another issue could be the use of friendly forces’ technology. A raid in May 2012 on a Taliban base revealed the threat of terrorists scavenging, reverse-engineering, and utilizing military-grade UASs when what appeared to be a smaller North Atlantic Treaty Organization (NATO) platform was found.⁵⁴ Hambling and Tam et al., concur that more attention needs to be paid to alternative means by which terrorists can obtain UAS technology. Simply going after the manufacturers of such technology will not be enough.

The Current State of International Defensive Measures

Literature on UAS countermeasures is scarce. The Army publicly touts its success in defending against the threat on the battlefield. It stated that U.S. forces had “overwhelming success” in countering UASs from 2016-2018, resulting in zero deaths

⁵¹ Ibid.

⁵² Gabriel Tham, Edward Wong, and Kelvin Kuo Kai Ming, “Technologies in Hybrid Warfare: Challenge and Opportunities,” *Pointer Journal of the Singapore Armed Forces* 43, no. 1 (2017): 13, <https://www.mindef.gov.sg/oms/safti/pointer/documents/pdf/V43N1.pdf#page=18>.

⁵³ Ibid., 14.

⁵⁴ Chavez and Swed, “Off the Shelf,” 31.

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for U.S. troops.⁵⁵ Another vocal element is the Asymmetric Warfare Group (AWG). It assisted the U.S. Army in “consistently out-innovating” ISIS’ UAS program and attributed its success to identifying the threat “years before American forces encountered enemy small UASs on the battlefield.”⁵⁶ This declaration of success is not only inaccurate, but premature. If this were in fact the case, then why would the commander of Special Operations at the time paint a vastly different picture of happenings on the battlefield? Additionally, if allies of the U.S. were killed, could that really be considered a success? ISIS is inspiring other groups to this day which suggests that the United States failed to smother the threat. Lastly, the Army is deactivating the AWG in 2021, thus shelving the Army’s proponent for counter-UAS operations.⁵⁷ Focus on the threat is waning yet again.

The commander of U.S. Central Command (CENTCOM), General Kenneth McKenzie, reinforced concern while speaking to the public on April 22, 2021. He confirmed the first attack on U.S. forces with an explosive laden UAS in Erbil, Iraq occurred just days earlier on April 14.⁵⁸ In this instance, there were no casualties. The commander went on to say that “the UAS threat is probably what concerns me the most...the smaller drone is a problem, and the smaller drone is the future of

⁵⁵ T.S. Allen, Kyle Brown, and Jonathan Askonas, “How the Army Out-Innovated the Islamic State’s Drones,” *War on the Rocks*, December 21, 2020, <https://warontherocks.com/2020/12/how-the-army-out-innovated-the-islamic-states-drones/>.

⁵⁶ *Ibid.*

⁵⁷ Devon Suits, “Army to discontinue AWG, REF efforts,” *Army News Service* October 2, 2020.

⁵⁸ Bridget Johnson, “CENTCOM Commander: Drones Dropping Explosives ‘Probably Concerns Me the Most,’” *Homeland Security Today*, April 26, 2021, <https://www.hstoday.us/subject-matter-areas/airport-aviation-security/centcom-commander-drones-dropping-explosives-probably-concerns-me-the-most/>.

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warfare...we need to get ahead of that right now.”⁵⁹ His concern stems from the inability of current air defense systems to defend against such small targets. The important takeaway from this source is that this alleged “success” by the United States is limited and should not be an excuse for complacency. The United States should not let the priority of the threat slip and must maintain pressure on terrorist groups interested in the technology. U.S. troops are now targets and protecting their lives is of utmost importance.

Additionally, current countermeasures have many gaps that need to be filled before the United States can truly declare success. The Department of the Army’s Technique Publication (ATP) 3-01.81 *Counter-Unmanned Aircraft System Techniques* provides how to counter small UASs on the battlefield when encountered by maneuver units. The proposed defensive measures are largely passive and includes tactics such as reporting encounters, operating at night, practicing good operational security, and using cover and concealment to avoid detection.⁶⁰ Specifics on how to actively counter UASs on the battlefield is lacking. Doing so is left to the “commander’s discretion,” and there is only one feasible offensive option – concentrating all gunfire onto an airborne UAS.⁶¹ The ATP does not provide real, tangible solutions for soldiers on the frontlines other than reporting and hiding, and it removes the ability for troops to regain the offensive on the battlefield against hostile UASs. Major General Cedric Wins’ article, “CCDC’s road

⁵⁹ Ibid.

⁶⁰ US Department of the Army, *ATP 3-01.81 Counter-Unmanned Aircraft System Techniques*, (Washington, D.C.: Headquarters, Department of the Army, April 2017), 2-4 and 2-5, https://rdl.train.army.mil/catalog-ws/view/100.ATSC/9B8B46D7-719C-4E15-A8FE-9F2C1E278B88-1492434973380/atp3_01x81.pdf.

⁶¹ Ibid., 1-6 and A-4.

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map to modernizing the Army: Air and missile defense,” displays how the Army is still attempting to adapt to the newer UAS threat in terms of organic technology. The Ballistic Low Altitude Drone Engagement (BLADE) system is a kinetic solution to counter UASs that offers more precision for soldiers than simply firing their weapons in the air, however it is only a prototype which suggests that soldiers are still vulnerable on the battlefield to date.⁶² The article does not indicate how the system may be affected in different environments, such as how the jamming and firing capabilities could impact civilians in an urban environment. Ryan Wallace provided more potential defensive tactics in his article. He noted that prevention and denial are the most effective layers of protection against UAS threats. The denial layer of defense entails how the environment, including trees and “high structures,” can enhance security against UAS threats.⁶³ This implies that cities may naturally help hinder attacks by UASs, but the report lacks evidence of this proposal. The prevention layer is the responsibility largely of the USIC in identifying threats in advance.⁶⁴ Furthermore, many options are being researched by the USG. The Pentagon launched a \$700 million crash program to develop tactics and technology to counter the threat: these countermeasures include net guns, UAS-hunting eagles, lasers, and electronic and cyber weapons.⁶⁵ However, there is minimal evidence

⁶² Major General Cedric T. Wins, “CCDC’s Road Map to Modernizing the Army: Air and Missile Defense,” *Army L&T Magazine*, (Fall 2019): 4-5, <https://asc.army.mil/web/news-alt-ond19-ccdc-road-map-to-modernizing-the-army-air-and-missile-defense/>.

⁶³ Ryan J. Wallace, “Examining Unmanned Aerial System Threats & Defenses: A Conceptual Analysis,” *International Journal of Aviation, Aeronautics, and Aerospace* 2, no. 4 (October 2015): 15, <https://doi.org/10.15394/ijaaa.2015.1084>.

⁶⁴ *Ibid.*, 13.

⁶⁵ Ressler, *The Islamic State*, 18.

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as to the effectiveness of these options in the field and raises the question of if such funding is being wasted. Multiple munitions are cited as “being in development” for use against undersea UASs and swarms as well.⁶⁶ These munitions are not identified and provide further evidence that there are few measures at the present that can protect U.S. personnel. Additionally, many of the current funded countermeasures, such as the eagles, net guns, and jamming weapons, would be useless against autonomous swarms.⁶⁷ So far one weapon, Lockheed Martin’s directed energy weapon (DEW) called “Athena,” is allegedly successful. It uses a laser to shoot at UASs and each shot costs less than \$1.⁶⁸ Athena is an example of progress, but more research needs to be conducted for protection against this type of threat.

Another issue that makes the United States and international community vulnerable to attacks is loose guidelines, or a lack thereof, to regulate UASs. Arthur Sosa identified the issue in a report published in 1998 where he stated that, “non-proliferation of unmanned aerial vehicle (UAV) technology is clearly a national security issue for the United States.”⁶⁹ He goes on to make an important policy recommendation. The U.S. should monitor the development and sale of UASs and related technology worldwide.⁷⁰ He expands on this by highlighting a two-fold challenge facing the United States. The

⁶⁶ Michael T. Klare, “The Challenges of Emerging Technologies,” *Arms Control Today* 48, no. 10 (December 2018), 12-13, <https://www.jstor.org/stable/10.2307/90026587>.

⁶⁷ Tham, Wong, and Ming, “Hybrid Warfare,” 15.

⁶⁸ *Ibid.*

⁶⁹ Arthur J. Sosa, “UNMANNED AERIAL VEHICLES: PROMISES AND POTENTIAL,” Strategic Studies Institute, (1998): 66, <http://www.jstor.com/stable/resrep11935.7>.

⁷⁰ *Ibid.*, 67.

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country needed to prepare for preventing rogue nations from gaining delivery means for WMDs and to devise countermeasures for “highly maneuverable, stealthy enemy UAV aircraft.”⁷¹ The foresight was there, but not enough people paid attention.

As it stands now, the international community is not much better off than it was in 1998. There seems to be concurrence among literature that the United States is poorly suited to handle the domestic threat. Commander Sean J. O’Brien, focusing on the national capital region, stated the United States is not capable of protection against the threat because of nonexistent policy and that complexity and ambiguity “pervades the institutional seams” that composes its homeland security enterprise.⁷² Both the United States and international community have made some advancements with policy. The FAA currently requires that UASs be registered to fly in the United States and Australia, New Zealand, Japan, Brazil, Mexico, Sweden, France, Indonesia, and the Czech Republic have developed regulations.⁷³ There is no guarantee, though, that terrorists will abide by a given country’s laws. Thus, legislation can be obsolete.

It is at least recognized that the use of UASs needs to be regulated for safety purposes. Some countries have yet to develop regulations, such as Canada or the U.K.⁷⁴ The lack of regulations, or insufficient regulations, presents a significant gap in defensive measures that could be exploited by terrorists. This is likely because the threat

⁷¹ Ibid., 70.

⁷² Commander Sean J. O’Brien, “Countering Unmanned Aircraft Systems in the National Capital Region,” U.S. Army War College, 2018, <https://publications.armywarcollege.edu/pubs/3589.pdf>.

⁷³ Bartsch, Coyne, and Gray, *Drones in Society*, 44-47.

⁷⁴ Ibid., 46.

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was overlooked. Additionally, one of the greater challenges has to do with civil liberties. Much of the OTS platforms involve dual-use technology. The implementations of regulations must be able to balance the transit and use of UAS products for civil purposes while preventing their use for nefarious activities.⁷⁵ This will be no easy feat.

Compliance poses another challenge. Many manufacturers and retailers are not privy to arms control agreements or national regulations; some businesses continue to operate out of ignorance while others may seek loopholes to get around regulations due to compliance costs.⁷⁶ Technical-use controls are a potential plausible approach. Manufacturers can integrate such controls into autopilot or ground control system (GCS) software; such controls can prevent flight in designated no-fly zone (i.e., near airports).⁷⁷ This seems promising, but terrorist groups will likely find a way to re-configure systems to get around such restrictions. If they can potentially reverse-engineer a UAS, their ability to re-configure one to infiltrate no-fly zones is only a matter of time. Terrorists do not abide by nation-state laws.

Literature on the UAS threat has significant ground to cover. Most studies are generally repetitive and cover information that is already known. Major gaps exist. Defensive measures seem to lack practice and little is known as to their effectiveness. Regulations and policy are minimal at best on the international level. Research regarding

⁷⁵ Larry Friese, N.R. Jenzen-Jones, and Michael Smallwood, "Emerging Unmanned Threats: The Use of Commercially-Available UAVs by Armed Non-state Actors," *ARES Special Report*, no. 2 (February 2016): 52, https://www.academia.edu/37605935/Emerging_Unmanned_Threats_The_use_of_commercially_available_UAVs_by_armed_non_state_actors.

⁷⁶ Ibid.

⁷⁷ Ibid., 53.

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acquisition measures taken by terrorist groups is needed. Studies overwhelmingly hone in on four groups, ISIS, Hizbollah, Hamas, and the Houthis, with little attention being paid to others. Counterintelligence and cyber functions of UASs through the advancement of artificial intelligence is mostly unexplored. Future implications and threats are unimaginative and narrow in scope, focusing mostly on swarming. Research on the domestic threat also leaves much to be desired. The United States is seemingly lost as to how to approach a threat that loomed for decades.

Theory

This work theorizes that terrorist groups will achieve complex UAS operations over the next five years via the development of robust UAS programs. This outcome is linked to three variables. First, the use of UAS technology becoming simple. If operation, use, precision, and lethal retrofitting become accessible, we can expect increased usage by terrorists. Second, the proliferation of UAS technology. If the growth of commercial OTS technology remains at its current pace and continues to be widely available, we expect the use of UASs by terrorists to increase. Third, is the terrorist UAS program scalable? This suggests the effort to produce armed UASs decreases while production increases, making the venture cost effective. If these three variables, simplicity, supply, and scale, are present at the same time, the terrorists' UAS programs will accelerate. The lack of any one variable will slow, though not stop, the march forward of lethal UASs.

The standard of success set by ISIS coupled with the vulnerability of the United States, whom many terrorist groups consider to be an enemy, is enough to inspire other groups to initiate the development of programs. Copycats' success can be influenced by

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the United States and its allies if the appropriate actions are taken. Currently, there are minimal restrictions and regulations on UAS technology, as demonstrated in the literature review. The threat is more than just a “niche” threat. It is already significant enough to change warfare as we know it.

Scope

UASs are generally grouped into five different categories, per the U.S. Army’s ranking system. Group I represents small hobbyist UASs and Group V represents extraordinarily complex military-grade UASs, such as the previously mentioned Predator.⁷⁸ This study focuses on hobbyist UASs, or OTS technology, represented in Group I. It does not focus on Groups II-V because abundant literature already exists on terrorist groups in possession of military-grade UAS technology provided by state sponsors. Group I UASs are readily available for purchase by the public, with a cost of generally less than a few thousand dollars, and do not require formal training or infrastructure to operate.⁷⁹ This study starts with the identification of the use of hobbyist UASs in 2015 by ISIS and ends in 2021, bounding the research window. Additionally, the study includes both lethal and non-lethal instances in which UASs are used. Non-lethal events could be a precipitator to future lethal actions. Finally, this study focuses on the use of UASs by terrorist groups. It does not analyze the use of said technology by criminal transnational groups, such as drug cartels, who adopted the technology in recent

⁷⁸ Ressler, *Remotely Piloted*, 7-8.

⁷⁹ *Ibid.*, 7.

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years. It also does not focus on the possibility of the lone wolf threat that could exist in the United States.

Relevance to the U.S. Intelligence Community

The topic is relevant to the intelligence community because of the security threat terrorist UASs present to U.S. troops and interests, both at home and abroad. The topic is especially relevant to the Department of Defense (DoD), the Federal Bureau of Investigation (FBI), and national security policymakers at home. Soldiers will be facing hostile UASs on the battlefield and will need to know what to expect during encounters. Intelligence personnel in the DoD will need to know why groups are interested in developing programs pertaining to this technology, who will develop said technology, and in what capacity the technology will be used on the battlefield to appropriately prepare military commanders in the decision-making process. Additionally, the threat posed by malicious UASs should also not be ruled out at home. U.S. citizens can be at risk if a terrorist group decides to conduct a terrorist attack on U.S. soil utilizing UAS technology.

Plan of Thesis

The plan of this thesis is to build a framework to analyze the future development of UAS programs by terrorist groups and to provide insight to the USIC on the threat. This study challenges current wisdom via evidence provided in the analysis of three case studies. The case studies will analyze the Kurdistan Worker's Party (PKK)/Syrian Kurdish Democratic Union Party (YPG), Hayat Tahrir al-Sham (HTS), and Boko

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Haram, respectively. In these case studies, each group will have their UAS programs scored against the three independent variables and will identify their respective statuses on the trajectory towards complex operations. If organizations score high in all three independent variables, then they will develop sound UAS programs and achieve complex UAS operations. The USIC will have to identify these organizations to inform military commanders of formidable threats on the battlefield. If organizations score low in any of the variables, then more development will be required in specific areas, which the USIC can use to its advantage. Analysts can focus on how to prevent groups from resolving the weaknesses in their programs and prevent more groups from developing robust UAS programs.

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CHAPTER 2

Research Framework and Methodology

The key variables identified will be tested via the collective case study methodology. Essentially, the study builds on Don Rassler's research of ISIS by testing the validity and application of the independent variables against other terrorist groups. The selected case studies may reveal other variables that could also be relevant over the next five years. From there, analysis will permit the most significant variables to be identified. The study will conclude with a summation of the significant points gleaned from the case studies. It will also provide insight and recommendations to national security policymakers in addition to identifying areas for further research.

Key Questions

The following key questions drive this research. First, what are the largest obstacles that groups face when attempting to obtain UAS technology? Second, why do some groups succeed in developing UAS programs while others fail? Last, what do groups hope to achieve by developing robust UAS programs?

Research Approach, Design, and Methodology

The research takes a qualitative approach to answer the research questions. The qualitative approach was ideal because of its purposes. There are four identified purposes for qualitative research: description, interpretation, verification, and

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evaluation.⁸⁰ The primary purposes of this study are verification and interpretation. Through interpretation, the research focuses on understanding the phenomenon of terrorist groups and the development of their interest in UAS technology over a period of time. It seeks to provide insight into why their interests manifested and where it will lead in terms of the shaping and growth of terrorist UAS programs in the future. Additionally, it seeks to verify the validity of previous claims regarding the effectiveness of ISIS' UAS program and other groups in their attempts to follow its example.

The collective case study research design allows for the analysis of multiple cases, versus a single case study, which is necessary in understanding the adoption of UAS technology by terrorists. The collective case studies are useful as they can show how the means of proliferation and the outcomes may differ across different groups. Analyzing multiple groups will provide for a more holistic understanding of the phenomenon. Analysis of the selected case studies will involve comparing the approaches of different terrorist groups in acquiring and adopting UAS technology and identifying why groups either succeeded or failed. At this time, the terrorist groups that will be the focus of the case studies are the Kurdistan Worker's Party (PKK) / Syrian Kurdish Democratic Union Party (PYD), Hayat Tahrir al-Sham (HTS), and Boko Haram. The selection of these groups was deliberate because they are examples of those that mirrored ISIS' example in adopting UAS technology and required more analysis.⁸¹ In comparing the case studies, the research is geared towards evaluating and analyzing

⁸⁰ Paul D. Leedy and Jeanne Ellis Ormrod, *Practical Research*, 9th ed. (New Jersey: Pearson Education Inc., 2010), 136-137.

⁸¹ Balkan, *A Global Battlefield*, 25, 35, and 41.

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the inferred independent variables and their contribution to the development of their UAS programs. In addition, it may potentially identify some unexpected independent variables that impact the outcomes of UAS programs. It may also reveal that some of the independent variables are not as essential to the development of programs as expected or highlight other variables that require further analysis. Ultimately, the research will highlight the most essential variables required for terrorist groups to be successful. Case studies are beneficial because they provide context surrounding scenarios and will assist other researchers later in drawing conclusions about the extent to which the findings in this study can be generalized to other situations.⁸² The intent of this design is to provide a baseline for members of the intelligence community and national security officials on what to expect as UAS technology gains more traction among terrorist groups. The intent will need to be refined as more groups get involved with UASs and provide additional data to study. The methodology for the case studies is reliant on data analysis. Case studies encompass several characteristics of qualitative research as defined by Creswell and Creswell; they involve multiple sources of data, inductive and deductive analysis of the data, and seeks to develop a holistic account of the issue at hand.⁸³ A wider variety of sources and the effort to look at the threat in terms of a bigger picture will allow for more robust and complete conclusions to be drawn.

⁸² Leedy and Ormrod, *Practical Research*, 137-138.

⁸³ John W. Creswell and J. David Creswell, *Research Design*, 5th ed. (Los Angeles: Sage Publications, Inc., 2018), 181-182.

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Definitions

Unmanned Aerial System (UAS): Small and pilotless aerial vehicles, commonly referred to as “drones,” that are widely available to the public commercially and off-the-shelf.

Unmanned Aerial System (UAS) Program: A formalized, operational entity within a terrorist group dedicated strictly to conducting the training, development, and facilitation of operations using UAS technology.

Terrorist Group: An extremist group seeking to achieve their political, ideological, or religious goals through means of violence, coercion, and/or fear.

Complex Operations: Operations that involve the simultaneous use of UASs on the battlefield, remote split operations, swarming, and/or using UASs as a tool for tasking, processing, exploiting, and disseminating intelligence.

Limitations

Some limitations of the study include time, availability of information, and the number of variables being analyzed. Due to the rapid nature by which technology is evolving today, the study is restricted to five years to recognize that the significance of the independent variables identified in the study may be affected by the progression of time. The independent variables will likely require future attention and need to be re-assessed beyond the established timeframe. Additionally, information available to contribute to the study is another limiting factor. This is largely due to guidelines

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restricting access to facilities where classified information may be accessed because of COVID-19. Finally, the number of variables identified as the most significant in their influence on success will be limited to no more than six. The three that were already identified in ISIS's program by Don Rassler and used in this study are worth re-assessing, but any new factors that are identified during analysis need to be taken into consideration.

Data Collection Strategy

The collection method for this qualitative study included document collection. Documents are the primary sources behind the research. The internet was the main tool utilized in gathering sources due to the abundance and variety of unclassified sources that it contains. Document collection included sources such as journals, books, government publications, reports, and other academic papers. Due to the COVID-19 pandemic, research of classified information is restricted.

Analytic Strategy

The case study approach involved sequential tactics with data analysis, namely data was collected first and then analyzed. The analysis followed a process like that outlined in Leedy and Ormrod's book. The first step involved gathering all details and facts pertaining to the cases and organizing them logically.⁸⁴ In this study, the data is organized chronologically to establish the progression of the proliferation of UAS

⁸⁴ Ibid., 138.

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technology by each group over time. The second step categorized the data.⁸⁵ The data is organized based on the level of effectiveness in relation to the dependent variable. It is broken down into data that has a positive impact, negative impact, or no impact. This assisted in identifying where on the spectrum the selected groups are in the process of developing UAS programs. The third step involved interpreting single instances by examining them for specific meanings in relation to the case.⁸⁶ Different operations performed by each group involving UASs were studied as well as how the outcomes affected either the progression of UAS programs or the status of already developed UAS programs. Next, patterns were identified.⁸⁷ The common themes across the cases helped to identify in more general terms what will and will not work for terrorist groups who intend to develop programs. It also provides for the ability of a broader application of the research to other terrorist groups worldwide in the future versus restricting the scope of the application to groups in the Middle East alone. The final step synthesized the information to establish conclusions.⁸⁸ The conclusions will hopefully provide insight into the phenomenon as well as identify areas that may require further research to gain a better understanding of an ever-evolving technological threat.

⁸⁵ Ibid.

⁸⁶ Ibid.

⁸⁷ Ibid.

⁸⁸ Ibid.

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The Second Drone Age

Scholars' application of the word "niche" to the threat implies that its impact is minute or limited in scope. Why should the United States be concerned with a threat that is perceived to be restricted to a small number of people? Why should resources be allocated to fortify the country? The answer is because terrorist attacks previously crippled the United States due a failure of the intelligence community to piece together seemingly minute red-flags into a bigger picture. The attacks by al-Qaeda on September 11, 2001, is the most well-known and infamous example. Technology has come a long way since that fateful day. Coordination and recruitment via social media, for example, significantly amplified the power of terrorists. Social media was critical as a recruitment mechanism for ISIS.⁸⁹ The worldwide reach of social media permitted the group to influence a global audience – a scale much larger than one achieved by word-of-mouth. ISIS was successful in harnessing social media because the abundance of imagery and ideology normalized extremist concepts like jihad and martyrdom.⁹⁰ They created appeal that could draw in recruits. Perhaps even more important was their ability to make their targeted audience members feel a sense of inclusion by creating virtual groups of like-minded individuals.⁹¹ These virtual groups were safe spaces for extremist views to fester and terrorist plots to manifest. ISIS' online footprint was large. In 2016 alone, Twitter suspended 125,000 ISIS-affiliated accounts.⁹² Another useful social media site is

⁸⁹ Robyn Torok, "ISIS and the Institution of Online Terrorist Recruitment," *Middle East Institute*, January 29, 2015, <https://www.mei.edu/publications/isis-and-institution-online-terrorist-recruitment>.

⁹⁰ Ibid.

⁹¹ Ibid.

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Telegram. That same year, ISIS had telegram channels in Pashto, Persian, and Turkish, of which the former two commanded over 4,000 followers.⁹³ Once individuals become radicalized, the risk of them mobilizing for the cause they believe in increases. A 2018 article indicated that ISIS mobilized 40,000 foreign fighters via social media to join their cause from 110 different countries worldwide.⁹⁴ Other groups are likely to follow ISIS' example to amass followers using social media. Social media is a proven force multiplier.

The reason why some scholars write off the threat as a niche threat can be explained by the Chaos Theory. This theory argues that a recognizable and predictable pattern of change in a system (order) can suddenly shift into a turbulent, unrecognizable pattern (chaos).⁹⁵ The system is society. The fact that terrorist groups would adopt UAS technology was predicted by scholars decades ago. It was not a sudden surprise so there is no sentiment by scholars that chaos will occur. This explains there appears to be a false sense of security among literature. Our system is in a state of order as the country believes it is ahead of the threat. The state of the universe swings like a pendulum between order and chaos.⁹⁶ The problem, then, is that this false sense of security inhibits

⁹² Sarah Ponder and Jonathan Matusitz, "Examining ISIS Online Recruitment through Relational Development Theory," *Connections: The Quarterly Journal* 16, no. 4 (2017): 41, https://it4sec.org/system/files/16.4.02_isis_online_recruitment.pdf.

⁹³ Antonia Ward, "ISIS's Use of Social Media Still Poses a Threat to Stability in the Middle East and Africa," RAND Corporation, December 11, 2018, <https://www.rand.org/blog/2018/12/isiss-use-of-social-media-still-poses-a-threat-to-stability.html>.

⁹⁴ Ibid.

⁹⁵ Linda Groff, "Models of Change: A Foresight Tool to Aid Policymakers," *World Affairs: The Journal of International Issues* 15, no. 4 (October – December 2011): 32, <https://www.jstor.org/stable/10.2307/48505079>.

⁹⁶ Ibid.

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leaders to anticipate the potential for chaos if the international community is not better prepared against terrorist UASs. Scholars need to look beyond the order to create contingencies to prevent any future chaos.

Unfortunately, events have already transpired that indicate that chaos is beginning to bear down on the international community. Dr. James Rogers calls the adoption of UAS technology by terrorist groups “the second drone age.” The first being the era in which the United States monopolized the use of military UASs.⁹⁷ The commencement of a new era of warfare could not be initiated by just a niche threat. The eye of the storm is coming and is represented by terrorist groups establishing advanced UAS operations. As the United States does with an actual hurricane, it needs to brace itself and anticipate ways to minimize the damage caused by terrorist groups when they do realize complex operations. The United States, unsurprisingly, will be a primary target. Deployed U.S. forces are at risk and there is the potential for homegrown threats as well.

The United States’ approach to terroristic UAS technology must be an integral part to its most recent military offset strategy. The first offset strategy involved the United States maintaining its significant technological advantage to offset Soviet Union’s strength and geographical advantage during the 1950s under President Eisenhower.⁹⁸ Note that the United States was already in possession of advanced

⁹⁷ James Rogers, “Future Threats: Military UAS, Terrorist Drones, and the Dangers of the Second Drone Age,” in *A Comprehensive Approach to Countering Unmanned Aircraft Systems*, (Germany: The Joint Air Power Competence Centre), 481-482, <https://www.japcc.org/c-uas-future-threats-military-uas-terrorist-drones-and-the-dangers-of-the-second-drone-age/>.

⁹⁸ U.S. Department of Defense, “The Third Offset Strategy and its Implications for Partners and its Allies,” speech by Deputy Secretary of Defense Bob Work, January 28, 2015,

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technology. The second strategy was dedicated to offsetting the Soviet Union in the 1970s through the development of “assault breaker technology” that would successfully counter deep Soviet penetration behind the U.S. forward line of troops.⁹⁹ In recent history, the United States has not necessarily had the monopoly over technology. According to Deputy Secretary of Defense Bob Work, the advantages of both strategies in today’s battlefield are eroding.¹⁰⁰ This brings us to the third and latest offset strategy. This strategy differs from the first two in that the threat is no longer a definitive, conventional force such as the Soviet Union.¹⁰¹ The United States faces a hybrid threat when it comes to transnational groups, some of which that are supported by state actors. A second difference is that today’s technology – to include robotics, autonomous systems, big data, and additive manufacturing – is being driven by the commercial sector instead of the military sector.¹⁰² The UAS systems that terrorist groups obtain are coming from the commercial sector. The United States must focus then on developing a strategy that integrates its commercial sector into its countermeasures. The third offset strategy focuses on maintaining the competitive advantage of the United States and its military allies.¹⁰³ Doing so will not be possible if the United States Government does not recognize and neutralize the threat of terrorist UASs on the battlefield. The approach of

<https://www.defense.gov/Newsroom/Speeches/Speech/Article/606641/the-third-us-offset-strategy-and-its-implications-for-partners-and-allies/>.

⁹⁹ Ibid.

¹⁰⁰ Ibid.

¹⁰¹ Ibid.

¹⁰² Ibid.

¹⁰³ Ibid.

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the following research can help to serve as a starting point by identifying vulnerabilities in the adoption of UAS technology by terrorist groups. The vulnerabilities can then be exploited to help maintain the United States' competitive edge.

The Trajectory to Complex Operations

The path that terrorists must take to develop their own UAS programs and embark on complex operations is not complicated. Terrorist groups seeking to develop strong programs will have to master three characteristics: simplicity, supply, and scale. All three variables must work in concert with one another. If a group can only attain one or two, then complex operations will not be realized. This does not mean that groups who do so should be discounted from mastering all three variables in the future.

Simplicity

Simplicity as a characteristic of a successful UAS program is not about oversimplifying technology. It is about the marrying of high technology and low technology. The high technology comes from the increasingly advanced OTS UAS systems, and the low technology could be add-on materials.¹⁰⁴ Differentiations between the types of add-ons will be important in assessing the status of groups in the pursuit of complex operations. Add-ons can be nonlethal, such as cameras, or they can be lethal, such as the homemade grenades ISIS rigged to UASs. The key is that the components are easy to replicate.¹⁰⁵ Ease of replication will contribute to the mastery of the other two variables.

¹⁰⁴ Ressler, *The Islamic State*, iv.

¹⁰⁵ Ibid.

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Supply

ISIS' program involved a complex and extensive acquisition network across several countries. This study expands analysis of supply to encompass groups with more limited capabilities. For other terrorist groups that perhaps have less status, resources, and reach, the supply network will not need to be as layered or complex. While it may not be necessary for acquisition networks of interested terrorist groups to be as complex as ISIS' network, they may follow a similar process broken down into phases.

The first phase being the acquisition of counter-surveillance technology.¹⁰⁶ In regions like the Middle East where Western UAS operations are active in targeting groups, terrorists will need said technology to prevent their operations from being discovered. Denial and deception will be particularly important for this variable. Terrorists will need to protect the infrastructure used to facilitate UAS operations as well as the specialists who will be involved in the UAS programs.

Phase two involves the acquisition network of the UASs and other components.¹⁰⁷ ISIS used numerous front companies and cover identities to purchase parts and systems. Other groups, thanks to technological advancements since 2015, will not have to go to such lengths. Additive manufacturing via 3D-printing will be a game-changer. It is an incredibly cheap alternative and could rapidly cut down the time to obtain UAS technologies as demonstrated in the literature review. The most expensive aspect would be purchasing a 3-D printer, but even then, the average price of a printer is

¹⁰⁶ Ibid., 10.

¹⁰⁷ Ibid., 13.

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much smaller in comparison to other acquisition methods. Printers can be purchased from Amazon under the price of one-thousand U.S. Dollars (USD).¹⁰⁸ Amazon also sells all other components needed for additive manufacturing. Larger industrial printers are more costly, up to four-million USD, but prices are falling.¹⁰⁹ The ability to conduct additive manufacturing requires only three components. These are the printer, the materials for the object to be printed (in this case metal powder), and a digital build file that contains all the information that the printer needs to print the UAS.¹¹⁰ Additive manufacturing would remove the need for terrorists to purchase their components through third parties, such as internet retailers. This will minimize the potential for digital footprints being discovered as a result that could compromise acquisition operations. Accessibility will also improve as the ability to print UASs removes the obstacle of government sanctions and restrictions, and terrorists will likely be able to find printable designs off the internet.¹¹¹ The fate that met ISIS' acquisition network could be avoided.

This research diverges from Ressler's in that it argues a required third phase. Terrorist groups will need a supply of personnel to fill various roles to maintain and facilitate UAS operations. UAS programs will require leaders, trainers, operators, manufacturers, and logisticians. While it is possible any member of a group could

¹⁰⁸ "Best Sellers in 3D Printers," Amazon, accessed January 22, 2021, <https://www.amazon.com/Best-Sellers-Industrial-Scientific-3D-Printers/zgbs/industrial/6066127011>.

¹⁰⁹ Marco Fey, "3D Printing and International Security," Peace Research Institute Frankfurt, 2017, 8, <http://www.jstor.com/stable/resrep14453.4>.

¹¹⁰ *Ibid.*, 3.

¹¹¹ Trevor Johnston, Troy D. Smith, and J. Luke Irwin, "Additive Manufacturing in 2040," RAND Corporation, 2018, 2-13, <http://www.jstor.com/stable/resrep19917>.

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operate OTS technology, these positions will likely be required to maintain efficiency in operations.

Scale

Achieving this variable is the most time-consuming of the three. For ISIS, the scale-up took a minimum of one year.¹¹² If other groups learn from ISIS, the process will likely decrease in time as methods of improving efficiency are discovered. Terrorist groups will need manufacturing capabilities to create weapons to increase the scale of their programs.¹¹³ In regions where law and order is lax, access to these items will likely be unimpeded. Terrorist groups will be able to share what they learn with one another, thanks to the internet, and learn from each other's mistakes. ISIS, for example, was careful in keeping records of pre- and post-flight check lists as well as after action reports on UAS operations.¹¹⁴ These notes could be useful to other groups that are just starting off in their program development. Another factor for increasing scale that proved effective for ISIS is the standardization of the manufacture of weapons.¹¹⁵ This could apply to manufacturing UASs. Another factor, that can augment supply at the same time, would be indicators of program expansion. This could be a noticeable expansion in the number of UASs a group possesses, calls for personnel or equipment, and potentially the addition of leadership dedicated to developing UAS programs.

¹¹² Ressler, *The Islamic State*, 18.

¹¹³ *Ibid.*, 5.

¹¹⁴ *Ibid.*

¹¹⁵ *Ibid.*

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The UAS Complex Operations Continuum

The following case studies will provide background on the selected terrorist groups as well as an evaluation on the state of their respective UAS programs through their capability to conduct varying degrees of operations. Analysis will involve scoring each group against the three weighted independent variables as shown below. Based on the total of the scores, each group will be placed on the continuum accordingly. It is possible that groups do not have UAS programs and those will be reflected with a score of zero at the far-left end of the continuum. Once groups adopt UAS technology, they will begin with *simple operations* as represented with a score of one. These operations are impromptu and nonlethal, such as surveillance. *Hybrid operations* are indicated at the mid-point with a score of five. Operations in this stage are both lethal and nonlethal. UAS programs will be developing but likely still contain several gaps and weaknesses. At the far-right end of the continuum is *complex operations*. Complex operations are multi-faceted, synchronized, and require extensive planning. As previously stated, complex operations will likely manifest as swarming, remote split operations, and involve the simultaneous use of multiple UASs. Successful terrorist groups will have established and robust UAS programs at this point, and they will be able to evolve with said technology and anticipate how to adapt to any countermeasures implemented by the United States or its allies. Complex operations are represented by a score of ten.

The important take-aways from the visuals will be the identified gaps that groups need to fill to progress toward the far-right end of the continuum and successfully complete their UAS programs. It is possible that some groups may not wish to advance beyond simple operations. However, this possibility should not be a reason to

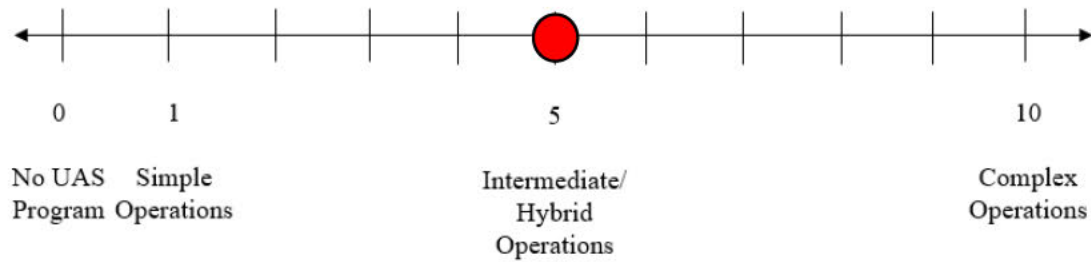
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discontinue the monitoring of groups in the future as intentions could change at any time for any reason.

SIMPLICITY (4 POINTS)	SUPPLY (3 POINTS)	SCALE (3 POINTS)
Combined technology = 1 point	Counter-surveillance technology = 1 point	Indicators of program expansion = 1 point
Nonlethal add-on = 1 point	Acquisition network for UAS technology/components = 1 point	Manufacturing capabilities = 1 point
Lethal add-on = 1 point	Personnel = 1 point	Standardization = 1 point
Replicability = 1 point		

The Complex Operations Continuum



 = Terrorist Group X

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CHAPTER 3

The Kurdistan Worker's Party (PKK) Case Study

Introduction

This chapter is the first of the empirical chapters. The purpose is to substantiate the theory with empirical data. This case involves the Kurdistan Worker's Party (PKK). It relays the story of the armed group's resistance and terrorist actions using UAS technology. It demonstrates how progression and advancement in simplicity, supply, and scale allowed the PKK to use technology to pursue complex UAS missions. This chapter proceeds in four parts. First, it gives a short background of the PKK. Second, it evaluates the PKK using the three explanatory variables. Third, based upon the scoring of the explanatory variables, it weighs the case against the dependent variables. Fourth, it concludes.

Background

The PKK is a terrorist group operating from a region known as Kurdistan. Kurdistan is a geographical area that borders many states, including Syria, Turkey, Iraq, and Iran. The PKK is focused exclusively on the Kurdish region in Turkey. This includes, though to a lesser extent, the Turkey-Syria, Turkey-Iraq, and Turkey-Iran loci.

The PKK originated in the 1960s. It adopted the ideology of Marxism-Leninism.¹¹⁶ A decades-long conflict between the PKK and the Turkish government ensued. It racked up a death toll of tens of thousands of people.¹¹⁷ It is not clear when

¹¹⁶ Kyle Orton, "The Secular Foreign Fighters of the West in Syria," *Insight Turkey* 20, no. 3 (Summer 2018): 157, <https://www.jstor.org/stable/10.2307/26469849>.

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the conflict will come to an end. Additionally, the PKK established branches in multiple states. There is the Kurdistan Democratic Solution Party (PCDK) in Iraq, the Democratic Union Party (PYD) and the People's Protection Unit (YPG) in Syria, and the Kurdistan Free Life Party (PJAK) in Iran.¹¹⁸ Furthermore, the PKK has a parent organization. It falls under the transnational umbrella organization called the Kurdistan Communities' Union (KCK), which is led by Abdullah Ocalan from the Qandil Mountains in Northern Iraq.¹¹⁹ Ocalan was also the founder of the PKK. These branches are important to understand the group. Sometimes the names can be used interchangeably. The purpose of the different names and branches is to conceal the reality that PKK leadership in Qandil retains "direct command and control."¹²⁰ Qandil is the central hub of the PKK.

People continue to travel to the region to support the group's cause. Westerners from Europe and the United States are joining the struggle.¹²¹ Human capital is not the only commodity provided by the West. Its supporters in Europe provide up to one-million USD each year.¹²² These factors elevated the PKK as a national security priority for the West. Since 2018, the USG worked with Turkey to capture senior PKK leaders and push YPG members out of "safe zones" in the Turkey-Syria border.¹²³ The United

¹¹⁷ Nodirbek Soliev, "The Terrorist Threat in Turkey: A Dangerous New Phase," *Counter Terrorist Trends and Analyses* 9, no. 4 (April 2017): 26.

¹¹⁸ Orton, "Secular Foreign Fighters," 159.

¹¹⁹ *Ibid.*

¹²⁰ *Ibid.*, 159-160.

¹²¹ *Ibid.*, 162.

¹²² *Ibid.*, 168.

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States arguably complicated the situation. From 2014 to 2018, the United States provided support in Syria to combat ISIS.¹²⁴ More specifically, it supported the YPG. In 2017, the United States directly armed the YPG ahead of the campaign to seize Raqqa and promised it would reclaim the weapons after ISIS' defeat.¹²⁵ This is not unlike the instance where the United States provided support to the Mujahideen when the Soviet Union invaded Afghanistan; the support backfired when the weapons were later used against the United States. Evidently, the United States did not learn from its past mistakes.

Many individuals enter the YPG for three primary reasons. Some individuals seek personal gain.¹²⁶ This could be money, infamy, or perhaps a sense of belonging to a greater cause. Others, such as "drifters and lunatics," join for the excuse to kill people.¹²⁷ In this case, the allure is not necessarily the cause but the lawlessness of the environment. Finally, there are some people who simply seek adventure.¹²⁸ Many Western countries hold a similar perspective of the Kurds. They agree an independent Kurdistan, which the PKK fights for, is a bad idea.¹²⁹ The Turkish government is unrelenting in its position to address Kurdish demands. In doing so, the government

¹²³ "Turkey, the PKK, and U.S. Involvement: A Chronology," Congressional Research Service, December 5, 2019, <https://crsreports.congress.gov/product/pdf/IF/IF11380>.

¹²⁴ Ibid.

¹²⁵ Ibid.

¹²⁶ Orton, "Secular Foreign Fighters," 163.

¹²⁷ Ibid.

¹²⁸ Ibid.

¹²⁹ Aliza Marcus, "Turkey's PKK: Rise, Fall, Rise Again?" *World Policy Journal* 24, no. 1 (Spring 2007): 76, <https://www.jstor.org/stable/40210079>.

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keeps the Kurdish problem alive.¹³⁰ In recent years, however, another major player has entered the arena of conflict.

ISIS exacerbates tensions in the country by taking advantage of the anti-Kurdish sentiments. Interestingly, the Turkish government facilitated these tensions. It regarded ISIS as an effective tool against President Bashar al-Assad's ground troops in Syria and in preventing the establishment of a "Kurdish Belt" across Iraq and Syria.¹³¹ The development that Turkey is essentially supporting ISIS as a proxy added fuel to the fire. Moreover, the Syrian conflict bled into Turkey beginning in 2015. ISIS started attacking the Kurds and pro-Kurdish targets in the country in retaliation for the territorial gains of Syrian Kurds in the Northern regions of Iraq and Syria.¹³² Turkey eventually turned its back on ISIS. Ironically, the Turkish government believed ISIS conducted too many attacks against the Kurds, thus prompting a change of heart, and began pre-emptive assaults against ISIS.¹³³ This move brought terrorism, particularly from ISIS to Turkey's doorstep. Now, both ISIS and the PKK continue to conduct acts of terrorism against Turkish authorities within Turkey.¹³⁴ As the conflict continues, technology is increasing the lethality of the PKK.

¹³⁰ Ibid., 75.

¹³¹ Soliev, "Terrorist Threat," 25.

¹³² Ibid.

¹³³ Ibid., 26.

¹³⁴ Ibid., 24.

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Current Operations

The PKK are one of the first terrorist groups inspired by ISIS' tactics. Its program originates in February 2016, when the Turkish military captured a weapons cache containing weaponized UASs.¹³⁵ The earliest recorded use of UASs in actual operations by the group occurred in 2017.¹³⁶ The construct of the UASs was simple. The group simply mounted bombs to Chinese-made systems.¹³⁷ Not much effort went into these devices since they were pre-made. The first identified armed PKK UAS was captured in July 2017 in Sirnak on the Iraqi border, and it was a quadcopter-style system.¹³⁸ UAS attacks increased. The PKK continued to target Turkish military forces over the next couple of years.¹³⁹ By 2019, a notable shift occurred in the PKK's operations. The group began combining UAS parts with plastic explosives and escalated to swarm attacks.¹⁴⁰ The first incident of swarming occurred towards the end of 2018. During the "November 10 Ataturk Remembrance Day," the PKK conducted a swarm attack using nine UASs.¹⁴¹ The group no longer relied on pre-made UAS systems. In

¹³⁵ David Hambling, "Kurdish PKK Militants Step Up Improvised Drone Bomb Attacks in Turkey," *Forbes*, August 27, 2020, <https://www.forbes.com/sites/davidhambling/2020/08/27/pkk-terror-group-steps-up-improvised-drone-bomb-attacks/?sh=566db6a16a3e>.

¹³⁶ Osman San and Huseyin Akarslan, "Terrorist Use of Unmanned Aerial Vehicles: Turkey's Example," *Defence Against Terrorism Review* 13, (2020): 71, https://www.tmmm.tsk.tr/publication/datr/volumes/Datr_Vol.13.pdf.

¹³⁷ Ibid.

¹³⁸ Hambling, "PKK Militants."

¹³⁹ San and Akarslan, "Turkey's Example," 71.

¹⁴⁰ Ibid.

¹⁴¹ Ibid., 68-70.

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fact, the new platforms were custom-made, composed of Styrofoam, and had no landing equipment.¹⁴² The custom design made for a cost-effective alternative. Styrofoam is a cheap material and likely contributes to the PKK's capability to increase its fleet of UASs. The absence of landing gear and the presence of explosives suggests that these UASs are used strictly for suicide-type bombing purposes. Furthermore, the group attempted to find ways to make the UASs more lethal. The plastic explosives utilized electric detonators, and nails were also included in the bombs to increase lethality.¹⁴³ What is more interesting is the PKK's attempted deception in the operation. The group camouflaged its UASs with paint to make them difficult to spot by their victims.¹⁴⁴ Although the composition of the UASs was simple, the technology was still superior. Members of the group flew the UASs to their targets by entering coordinates into the UAS systems.¹⁴⁵ The significance here is that the UASs are autonomous, and a pilot is not required. This keeps PKK members out of harm's way. No Turkish lives were lost in the attack and seven of the UASs either crashed or were downed.¹⁴⁶ While the attack could be considered a failure by the group because it did not achieve its goal of killing victims, another important event occurred following the incident. The remaining two UASs flew back to Iraq.¹⁴⁷ The PKK could recycle these systems to use in other attacks.

¹⁴² Ibid., 70.

¹⁴³ Ibid.

¹⁴⁴ Serkan Balkan, "How Cheap Drones Became Assets for Terrorist Organizations," *Politics Today*, January 17, 2019, <https://politicstoday.org/how-cheap-drones-became-assets-for-terrorist-organizations/>.

¹⁴⁵ San and Akarslan, "Turkey's Example," 70.

¹⁴⁶ Ibid., 70-71.

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The PKK uses another tactic of recycling. It uses ready-to-attack UASs outfitted with improvised explosive devices (IEDs) seized from ISIS in warzones.¹⁴⁸ The PKK clearly values efficiency and being resourceful. Another attack occurred in the same month. This time, seven Turkish soldiers died in an explosion at Semdinli, which the PKK later claimed was caused by a UAS.¹⁴⁹ Next, a UAS attack occurred on the first day of 2019. Three UASs reinforced by C4 explosives and nails targeted the Martyr Ecrument Turkmen Barracks in Silopi and the District Gendarmerie Command in Cizre.¹⁵⁰ This was not another swarm-style attack, but it did present a high level of sophistication in which multiple targets in multiple towns were attacked at the same time. Additionally, the counter-UAS techniques used by Turkish soldiers were subpar. They attempted to neutralize the UASs by direct fire and only destroyed one.¹⁵¹ This is the same tactic cited in the U.S. Army's counter-UAS field manual, which is disconcerting. Luckily, the other two UASs crashed into the ground, and no one was hurt.¹⁵² It should not be forgotten that Turkish troops were left vulnerable on the ground with nothing to protect themselves with other than their own bullets. Had the UAS systems been more precise, damage to Turkish troops would have been significant. Current counter-UAS technology may not be enough to protect troops either. The pre-programmed, autonomous style of

¹⁴⁷ Ibid., 70

¹⁴⁸ Balkan, *A Global Battlefield*, 35.

¹⁴⁹ Hambling "PKK Militants."

¹⁵⁰ Balkan, *A Global Battlefield*, 37.

¹⁵¹ Ibid.

¹⁵² Ibid.

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UASs used in the November 2018 may evade jamming technology.¹⁵³ This further leaves troops vulnerable to attacks. The most recent attack occurred in August 2020. PKK UASs carrying explosives attacked a Turkish army outpost in Seladize to “punish invading Turkish soldiers.”¹⁵⁴ The attacks will continue as allied troops remain vulnerable.

Outside of Turkey, the PKK maintained operations in Syria. There, it captured ISIS workshops that are useful in sustaining UAS operations.¹⁵⁵ These workshops could contain materials for building platforms or weapons and operation manuals left by ISIS. They could also provide a pre-established space where UAS operations can be facilitated from. It is likely the PKK will continue similar attacks in the future seeing as the Turkish government still clashes with the Kurdish populations and ISIS continues to ramp up attacks. Furthermore, the group allegedly possesses captured Israeli technology. Israel spotted two of its Heron UASs collecting intelligence for the PKK. The platforms were identifying locations to establish bases in northern Syria meant for confronting Turkish troops.¹⁵⁶ The successful flight of more complex military-grade platforms proves the group has technological expertise. What is also concerning is the potential support group members are receiving from U.S. allies. PKK member Kenan Yildizbakan, for example, visited Israel on numerous occasions prior to conducting an attack on a Turkish naval

¹⁵³ Ibid., 38.

¹⁵⁴ Hambling, “PKK Militants.”

¹⁵⁵ Balkan, *A Global Battlefield*, 38.

¹⁵⁶ Oren Kessler, “PKK Using Israeli drones to attack Turkish troops,” *The Jerusalem Post*, January 18, 2012, <https://www.jpost.com/Middle-East/PKK-using-Israeli-drones-to-attack-Turkish-troops>.

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base in 2010; an incident like this raises the suspicion of the organization's ties to the state of Israel.¹⁵⁷ Halting the operations of the PKK will be more challenging and convoluted than dealing with the group alone. The United States will have to reason with the involved allies as well.

Scoring Current Operations

Simplicity (4 points): The PKK received full points in this category. It demonstrated the combination of high-technology with low-technology through attaching lethal bombs to styrofoam frames. The systems are also autonomous and are difficult to counter. The cheap style is easily replicable. The PKK skipped nonlethal uses initially and went straight to lethal attacks. It later used nonlethal operations for strategic purposes.

Supply (2 points): It is evident there are members within the PKK's ranks that are savvy enough to understand how to operate the systems, including autonomous platforms. Personnel is not an issue. There are also individuals capable of attaching weapons to the aircrafts, even with only rudimentary supplies such as duct tape. Information could not be located regarding how the group acquires its components to make its platforms. The use of the Chinese UAS platforms indicates they were likely obtained online, but this could not be confirmed. Additionally, the supplies reflected in the composition of the PKK's current platforms are rudimentary. It is likely that items like Styrofoam can be salvaged within the state. However, this is still an information gap that needs to be filled. Little information was available as to the PKK's counter-surveillance technology. The

¹⁵⁷ Ibid.

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painting of its UASs in camouflage was a form of counter-surveillance. This is an indicator the PKK is developing counter-surveillance technology or tactics but is another area that needs refining.

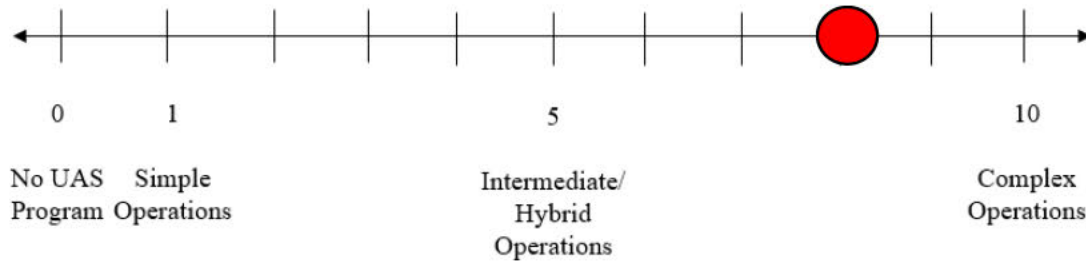
Scale (2 points): The PKK demonstrated its ability to assemble its own UAS systems, but it is not likely to have the capabilities to manufacture them in greater numbers. The scale of UASs in recent attacks remains relatively small. Additionally, the composition of the current platforms show they are likely assembled by hand, which takes both time and energy. Assembly of such platforms appear to be standardized. The PKK noticeably expanded its program once it transitioned from Chinese platforms to its own manufactured brand. Swarming attacks became possible after the transition. The PKK is continuously expanding its ranks, so a supply of people to be trained on UAS operations is not limited. The PKK forcibly recruits child soldiers and women while also trying to influence individuals around the world to join.¹⁵⁸ This is where it differs from other terrorist groups. The PKK does not need popularity to expand its numbers, therefore it can use or harm the civilian populations as it pleases and turn against its host countries without repercussions and still expand in numbers.

¹⁵⁸ “Kurdistan Workers Party,” Counter Extremism Project, 4-5, accessed March 15, 2021, https://www.counterextremism.com/sites/default/files/threat_pdf/Kurdistan%20Workers%27%20Party%20%28PKK%29-02242021.pdf.

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The PKK's Complex Operations Continuum



Assessment

The PKK scored a total of eight points across the independent variables. In the context of the dependent variable, this indicates it is in the earlier stages of complex operations. The PKK attempted both a swarming attack and an attack with multiple UASs simultaneously in different geographic locations. This aligns with the definition of complex operations for this study. The attempts are notable, but the failed to achieve its goals in either operation. Said failures resulted from remaining gaps in the PKK's UAS program. These vulnerabilities include a lack of advanced counter-surveillance technology and manufacturing equipment. These factors prevent the PKK from the widescale production of UAS platforms and from protecting itself. If the PKK can obtain such capabilities, the scale of the program will expand rapidly, and swarming operations could increase in complexity and lethality. A lingering information gap is how the group acquires pre-made platforms or the materials for its hand-made platforms.

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Conclusion

The PKK is continuously adapting its UAS systems to increase efficiency and lethality. The effort put into expanding operations shows the group's intent to establish a well-rounded UAS program. It is just shy of doing so. Completion of the PKK's program requires more advanced counter-surveillance technology to protect its UAS assets and manufacturing capabilities to expand its production. In addition to the information gap regarding the PKK's acquisition network, another would be where it is obtaining and assembling its platforms. The PKK's tactics will excel as technology advances. Its program will have room to advance should Turkey's status quo of instability remain. The Turkish government will have to work with the Kurdish population to reduce tensions if it hopes to hinder the PKK's progress.

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CHAPTER 4

Hayat Tahrir al-Sham (HTS) Case Study

Background

HTS operates primarily in Syria. The group formed in January 2017 after it splintered from al-Qaeda (AQ).¹⁵⁹ AQ denounced HTS after the split. HTS is a Salafi-jihadist organization located predominantly in Syria's Idlib province as well as the Damascus, Dera'a, and Quneitra provinces.¹⁶⁰ Its dynamics are complex. HTS is a semi-clandestine organization seeking a unified, hegemonic order in Syria.¹⁶¹ Its aim is not clear. Rhetorically, it is committed to installing Islamic rule in Syria and protecting the Sunnis.¹⁶² HTS' military leader, Abu Muhammad al-Jolani, has a different intent. He announced that HTS intends to commit transnational jihad.¹⁶³ The group uses violence to promote unrest in the region. Turkey further complicated the situation. When Turkish forces entered Northwestern Syria in October 2017 to establish a "de-escalation zone," they coordinated with HTS.¹⁶⁴ The support did not stop there. Turkish media praised HTS while treating it as a political reality.¹⁶⁵ Turkey is perpetuating

¹⁵⁹ Seth G. Jones, Charles Vallee, and Maxwell B. Markusen, "The Creation of Hay'at Tahrir al-Sham," Center for Strategic and International Studies (CSIS), 2018, 10, <http://www.jstor.com/stable/resrep22441.6>.

¹⁶⁰ Ibid., 11.

¹⁶¹ Sam Heller, "The Strategic Logic of Hayat Tahrir al-Sham," *Perspectives on Terrorism* 11, no. 6 (December 2017): 139 and 144, <https://www.jstor.org/stable/26295963>.

¹⁶² Ibid., 145.

¹⁶³ Ibid.

¹⁶⁴ Ibid., 146.

¹⁶⁵ Ibid.

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violence through its enduring support of terrorist groups in pursuit of its own foreign policy objectives.

Turkey's actions bolstered HTS' position in Syria. Syrian offensives recently threatened HTS' position. As of December 2019, a shift in power dynamics around Idlib led to HTS losing influence with Turkey.¹⁶⁶ This pressured HTS to ensure its survival. It began cracking down on other groups supporting AQ, namely Tanzim Hurras al-Din (HaD), to align itself with Turkey's actions as it increasingly depended on Ankara.¹⁶⁷ Turkey is a lifeforce for HTS.

Several factors will impact HTS' future. They include how leadership decisions align with the base of the group; its relationship with the local populace; and the future of Northwest Syria and the role of Turkey in the area.¹⁶⁸ HTS' current dynamics are volatile. Leadership's decision to align with Turkey causes internal friction, the group's relationship with local populaces is strained at best, and the future of Syria is uncertain.¹⁶⁹ HTS will likely do what it can to cling to power. For example, HTS continues to undermine established ceasefires to break down any attempts at stability.¹⁷⁰ Consequently, Syria will counter HTS' actions to prevent it from establishing footholds and gaining territory. It is expected that Turkey will have a prominent role in negotiating with HTS.¹⁷¹ This connection complicates relations for the United

¹⁶⁶ Silva Carezzi, "A Downward Scale Shift? The Case of Hay'at Tahrir al-Sham," *Perspectives on Terrorism* 14, no. 6 (December 2020): 98, <https://www.jstor.org/stable/10.2307/26964728>.

¹⁶⁷ *Ibid.*, 98.

¹⁶⁸ *Ibid.*

¹⁶⁹ *Ibid.*

¹⁷⁰ Lars Hauch, "Outlook and Policy Recommendations," Clingendael Institute, 2020, 26, <https://www.jstor.org/stable/resrep25694.8>.

¹⁷¹ *Ibid.*

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States, as Turkey is a longtime ally. The United States is outspoken in its opposition of state sponsors of terrorism, such as Iran. Turkey is now sponsoring terrorism with its recent support of HTS and the United States' continued relations with Turkey under such circumstances make its policies appear hypocritical and contradictory.

Current Operations

The first known instance of HTS using UASs in operations occurred in 2014. HTS used a UAS for reconnaissance purposes to break the Mahila siege.¹⁷² The group advanced its operations by 2017. It organized attacks with UASs carrying IEDs in its initial lethal operations.¹⁷³ HTS is another group mirroring ISIS' UAS tactics. On December 31, the group conducted its first comprehensive attack targeting Khmeimim Air Base and Tartus Naval Base.¹⁷⁴ By early 2018, HTS made yet another change. In one attack on January 5, it used 13 UASs against Russian troops.¹⁷⁵ This suggests HTS is trying to refine swarming techniques. No casualties were recorded during the attack because the Russians managed to down all UASs.¹⁷⁶ Despite a lack of casualties, the complexity of the attacks are concerning.

The Russians provided analysis on the downed UASs. HTS' UASs were innovative. Like ISIS' systems, the UASs were launched via catapult and had fixed wings that were fashioned

¹⁷² Balkan, *A Global Battlefield*, 25.

¹⁷³ Ibid.

¹⁷⁴ Ibid.

¹⁷⁵ Ibid.

¹⁷⁶ Ibid.

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together with tape.¹⁷⁷ The configuration of the wings was deliberate. The taped-on pieces of the wings decreased friction in the air, thus saving fuel.¹⁷⁸ HTS prioritized efficiency in building the platforms. Additionally, fuel tanks installed on the bodies of the UASs extended their range.¹⁷⁹ Each UAS had the capability to carry ten IEDs that could be released simultaneously.¹⁸⁰ This configuration differs from the PKK's in that the UASs are not apparently used in kamikaze-style attacks, but rather in a shock-and-awe strafing manner. The UASs also lacked landing gear, suggesting that they were not meant to return to their home-station.¹⁸¹ This was likely a deliberate move to conceal the locations of HTS members that sent the UASs to their targets. The UASs did not have cameras suggesting that propaganda was not a priority for the attacks.¹⁸² That is not to say HTS does not conduct such operations. Furthermore, the UASs had GPS-systems that allowed for autonomous flight.¹⁸³ This technology makes it more difficult for the UASs to be jammed. In January 2018, HTS broadcasted propaganda showing one of its UASs providing overwatch to members engaging ISIS fighters in East Hama.¹⁸⁴ The use of UASs for overwatch minimizes the risk of life to fighters who previously conducted reconnaissance themselves on the ground. In July of the same year, the Russians were again attacked at

¹⁷⁷ Ibid., 26.

¹⁷⁸ Ibid.

¹⁷⁹ Ibid.

¹⁸⁰ Ibid.

¹⁸¹ Ibid., 27.

¹⁸² Ibid.

¹⁸³ Ibid.

¹⁸⁴ Ibid., 29.

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Khmeimim Air Base with 45 IEDs dropped from HTS UASs.¹⁸⁵ The scale of firepower adds a definite psychological factor to the attacks despite no casualties being recorded.

Another unique use that HTS developed for their UASs involves using them as vectors for suicide vehicle borne IEDs (SVBIEDs). HTS uses the UASs to guide the SVBIEDs to their targets on the ground.¹⁸⁶ HTS mimics ISIS in its SVBIED operations as well. The SVBIEDs are outfitted with armor to make them more difficult to neutralize.¹⁸⁷ HTS makes one significant, distinct alteration to their operations from ISIS. Whereas ISIS used UAS operators to transmit live information to the SVBIED operator via radio, HTS outfitted its SVBIED with tablets that allows SVBIED operators to livestream the assisting UAS feed.¹⁸⁸ The added technology permits attackers to guide the SVBIED to its target with much greater precision than seen in ISIS' tactics.

HTS UASs also augment indirect fires operations. Group members will use UASs to vector mortars to their targets.¹⁸⁹ This is another HTS innovation that increases precision and lethality in attacks. HTS' success was evident in the battle of Aleppo. The precision provided by the UASs caused more casualties of Shia militia members and Syrian regime forces.¹⁹⁰ These lethal attacks forced Syrian troops to take the threat of HTS seriously.

¹⁸⁵ Ibid., 28.

¹⁸⁶ Ibid.

¹⁸⁷ Ibid.

¹⁸⁸ Ibid.

¹⁸⁹ Ibid., 29.

¹⁹⁰ Ibid.

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The modifications that HTS made to its UASs provide important insight into its program. First, the innovative techniques used to enhance the capabilities of the assets demonstrates that the group possesses members with great technical knowledge of UAS systems.¹⁹¹ HTS is also consistently finding means of increasing efficiency in its systems. It took the basics of ISIS' UAS program and used modifications to enhance lethality and precision in attacks. HTS will likely continue to modify UASs as technology advances to strengthen its foothold in Syria.

Scoring Current Operations

Simplicity (4 points): HTS' use of UASs for both surveillance and propaganda alongside lethal operations, such as SVBIED and bombing attacks, show it is on its way to achieving hybrid warfare. The systems combine high- and low-technology through the simple taped airframes and GPS systems. The basic composition of the UASs is easily replicable.

Supply (1 point): HTS demonstrated it has access to, and the ability to create, its own UAS technology. Specialists among its ranks appear to be fluent enough in technology to master UAS platforms. Evidence indicated the group is seeking to expand the number of specialists within its hierarchy. HTS posted a job announcement via Telegram seeking surveillance UAS operators with the qualifications listed as "being able to read and write, concentrate and memorize information, and having passed religious and military training."¹⁹² By expanding its human

¹⁹¹ Ibid., 30.

¹⁹² "Hayat Tahrir al-Sham Posts Job Openings for Heavy Equipment, Drone Operators," Homeland Security Today, November 16, 2018, <https://www.hstoday.us/subject-matter-areas/counterterrorism/hayat-tahrir-al-sham-posts-job-openings-for-heavy-equipment-drone-operators/>.

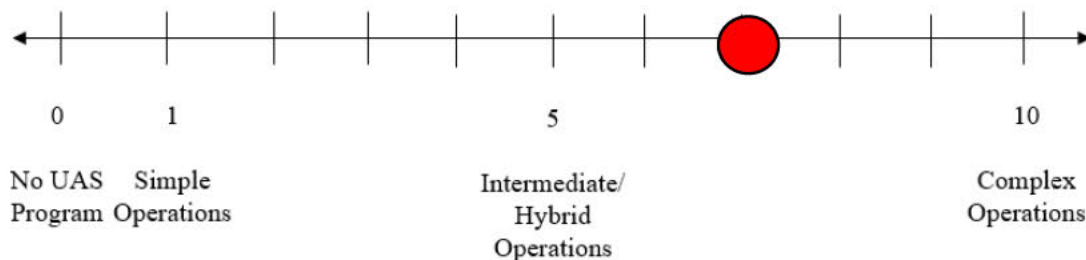
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capital, HTS is consequently expanding its UAS program. It is not evident that HTS has any counter-surveillance technology. The primary intelligence gap is how the group acquires its UAS components.

Scale (2 points): It is unlikely HTS is in possession of manufacturing equipment at this time based on the elementary composition of the UAS airframes. The composition of the platforms appears to be standardized. As mentioned in supply, the job postings for UAS personnel are a clear indicator that HTS is expanding its program.

HTS' Complex Operations Continuum



Assessment

HTS scored a total of seven points across the independent variables. It is a group in the advanced stages of hybrid operations. HTS shares the vulnerabilities of the PKK in which it lacks manufacturing capabilities and counter-surveillance technology. Where it differs from the PKK is its concentrated active efforts to specifically expand its UAS program. Job

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announcements are targeted specifically at UAS operators and suggests HTS has ambitious aims for the future of its program. HTS demonstrated just how useful UASs can be when augmenting a range of different operations on the battlefield, to include SVBIED attacks, indirect fires attacks, and complex attacks.

Conclusion

It is highly likely that HTS will continue to expand and refine its UAS program. The group proved its innovation and success in augmenting the lethality of its attacks with UASs. Increasing the scale of HTS' program will likely not be difficult as materials used to build its platforms are cheap. Syria continues to provide an unstable environment with little law and order. This will make acquiring materials to build UASs much easier. The group shares vulnerabilities of the PKK. A primary intelligence gap is how HTS is acquiring its materials to assemble its platforms and weapons. With a few minor tweaks, HTS will likely reach complex UAS operations within the next five years.

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CHAPTER 5

Boko Haram Case Study

Background

Boko Haram is Africa-based jihadist organization. Mohammed Yusuf founded the group in 2002 and adopted a radical Islamist ideology.¹⁹³ Boko Haram's objectives echo those of other jihadist organizations. It seeks to establish an Islamic caliphate, impose sharia law in Nigeria, and do away with corrupt Western principles and culture.¹⁹⁴ Its activities took a violent turn in 2009. Yusuf was killed and crackdowns by police forces provoked the group into killing thousands of people and displacing millions through suicide bombings, assassinations, kidnappings, and bombings.¹⁹⁵ Boko Haram's activities created significant economic impacts. It derailed economic growth, created a large humanitarian crisis, and the government's military does not have the willpower or strength to defeat it.¹⁹⁶ The government enables the activities to continue. Corruption is the leading cause of complacency in response to Boko Haram, followed by inadequate supplies and fuel needed for security forces to fight back.¹⁹⁷ Priorities need to be re-assessed in the country before real progress can be made against the terrorists.

Boko Haram expanded after its founder was killed. It established relations with other transnational Islamist groups in Africa such as Ansar Dine and al-Qaeda in the

¹⁹³ Adesoji O. Adelaja, Abdullahi Labo, and Eva Penar, "Public Opinion on the Root Causes of Terrorism and Objectives of Terrorists: A Boko Haram Case Study," *Perspectives on Terrorism* 12, no. 3 (June 2018): 36, <https://www.jstor.org/stable/26453134>.

¹⁹⁴ Ibid.

¹⁹⁵ Ibid.

¹⁹⁶ Ibid., 36-37.

¹⁹⁷ Ibid., 37.

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Islamic Maghreb (AQIM).¹⁹⁸ Boko Haram externalized its conflict as a survival strategy. Working alongside other groups allowed the group to learn and adapt successfully. One of Boko Haram's more significant allies is ISIS. Boko Haram pledged its allegiance in ISIS' November 2014 issue of its magazine, *Dabiq*.¹⁹⁹ External assistance permits Boko Haram to advance its UAS program. Assistance is provided in the form of funding, fighters, weapons, and the technical know-how to build their own weapons.²⁰⁰ Boko Haram's operations improved since receiving support from ISIS. The quality of its digital media productions significantly improved suggesting that ISIS is providing valuable educational information to Boko Haram.²⁰¹ The growing support for Boko Haram provides for a strong foundation in Africa. Unfortunately, despite the efforts made by the Nigerian military to weaken the group, it still has the capacity to grow and remains a significant threat to Nigeria's stability.²⁰² It is likely Boko Haram will continue appealing to fighters that wish to join its cause. In Nigeria, high unemployment rates, illiteracy, and the absence of basic amenities attributes to the country being a fertile recruiting ground.²⁰³ People who are not provided basic amenities to live

¹⁹⁸ Ahmed S. Hashim, Gregoire Patte, and Nathan Cohen, "'Western Ways Are Evil:' The Emergence and Evolution of Boko Haram," *Counter Terrorist Trends and Analyses* 4, no. 7 (July 2012): 6, <https://www.jstor.org/stable/10.2307/26351071>.

¹⁹⁹ Jennifer Ogbogu, "Analysing the Threat of Boko Haram and the ISIS Alliance in Nigeria," *Counter Terrorist Trends and Analyses* 7, no. 8 (September 2015): 17, <https://www.jstor.org/stable/10.2307/26351381>.

²⁰⁰ James Adewunmi Falode, "The Nature of Nigeria's Boko Haram War, 2010-2015: A Strategic Analysis," *Perspectives on Terrorism* 10, no. 1 (February 2016): 45, <https://www.jstor.org/stable/26297518>.

²⁰¹ *Ibid.*, 46.

²⁰² Mustapha Kulungu, "Does Boko Haram Pose a Threat to the US?" *Counter Terrorist Trends and Analyses* 11, no. 2 (February 2019), 7, <https://www.jstor.org/stable/10.2307/26627975>.

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comfortably are forced to look elsewhere for survival. That can lead to individuals joining terrorist groups.

Boko Haram's leadership continues to look for new ways to evolve and advance operations. It is leaps and bounds ahead of where it began in terms of tactics. Prior to 2010, Boko Haram had no apparent strategy in Northern Nigeria.²⁰⁴ Its rudimentary capabilities were evident. Hit-and-runs were common, and weapons included locally made guns, swords, knives, Molotov cocktails, and clubs.²⁰⁵ After 2010, Boko Haram became more strategic in its targets. It began using bombs and IEDs on specific locations.²⁰⁶ Since then, the group's arsenal is much more advanced. Fighters use AK-47s, grenades and rocket-propelled grenades, surface-to-air missiles, vehicle-mounted machine guns with anti-aircraft visors, T-55 tanks, and Semtex explosives.²⁰⁷ These weapons increase Boko Haram's lethality and make it more difficult to counter. Furthermore, the group favors using VBIEDs.²⁰⁸ According to the University of Maryland's Study of Terrorism and Responses to Terrorism (START) database, Boko Haram conducted over 1,728 attacks across multiple African countries between 2015-2019.²⁰⁹ Private citizens and property as well as military targets are the most abundant

²⁰³ Ogbogu, "ISIS Alliance in Nigeria," 18.

²⁰⁴ Falode, "Boko Haram War," 43.

²⁰⁵ Ibid.

²⁰⁶ Ibid.

²⁰⁷ Ibid., 44.

²⁰⁸ Ibid.

²⁰⁹ National Consortium for the Study of Terrorism and Responses to Terrorism (START), University of Maryland. (2019), The Global Terrorism Database (GTD), accessed June 2, 2021, <https://www.start.umd.edu/gtd>.

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victims. From July 2009 through 2014, Boko Haram had 1,311 attacks recorded in the START database.²¹⁰ Its rate of attack increased by more than 75% since it received support from ISIS. Boko Haram's increasing notoriety is attributed to the internet. YouTube is the popular platform for uploading propaganda videos.²¹¹ The internet is a proven, powerful recruitment tool. Presently, Boko Haram is mentioned under the umbrella of jihadist conflicts that are among the top security threats to Africa in 2021.²¹² The ranking of the threat amplifies its significance. Groups motivated by jihad are second only to the covid-19 pandemic.²¹³ The threat includes Boko Haram's use of UASs.

Current Operations

Boko Haram mimicked ISIS in its use of UASs. The earliest use of UASs was recorded by a newspaper on September 4, 2017.²¹⁴ This was not long after ISIS demonstrated success in using UASs. Boko Haram is currently using UASs for reconnaissance and surveillance in Cameroon and Nigeria as a means of monitoring security forces.²¹⁵ Much of the footage from the UASs is uploaded to the internet as

²¹⁰ Ibid.

²¹¹ Falode, "Boko Haram War," 44.

²¹² Matthias Basedau and Jann Lay, "Ten Things to Watch in Africa in 2021," *German Institute of Global and Area Studies (GIGA)*, January 2021, <https://www.jstor.org/stable/resrep28520>.

²¹³ Ibid.

²¹⁴ Balkan, *A Global Battlefield*, 41.

²¹⁵ Ibid.

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propaganda. Boko Haram still looks to ISIS for its tactics.²¹⁶ Subsequently, to understand Boko Haram's shifts in tactics analysts must also focus on ISIS as well. Boko Haram has no established acquisition network, such that as seen under ISIS, to import UAS technology.²¹⁷ Boko Haram also has yet to carry out kinetic, or lethal, attacks using UASs. It is predicted that the group will be capable of adopting aerial IED attacks and vectoring SVBIEDs using UASs as tactics soon.²¹⁸ Boko Haram is known to use pre-made Chinese platforms.

DJI Phantoms are Boko Haram's platform of choice. Several images of downed or captured Boko Haram UASs depict this specific airframe.²¹⁹ The reason for this may be the group does not yet have the knowledge to build its own platforms. Phantoms are pre-made white platforms with four rotors and skid landing gear.²²⁰ These pre-made systems save Boko Haram time versus creating its own airframes. The average cost of one Phantom is \$1,199.²²¹ This is pricier than the cheap composition of handmade assets seen under other groups. The combination of the landing gear and the high cost indicates it is likely that the group would not use Phantoms in kamikaze-style operations. Boko

²¹⁶ Ibid., 42.

²¹⁷ Thomas Braun, "Miniature Menace: The Threat of Weaponized Drone Use by Violent Non-State Actors," *Wild Blue Yonder*, September 14, 2020, <https://www.airuniversity.af.edu/Wild-Blue-Yonder/Article-Display/Article/2344151/miniature-menace-the-threat-of-weaponized-drone-use-by-violent-non-state-actors/>.

²¹⁸ Balkan, *A Global Battlefield*, 42.

²¹⁹ Scott Crino and Andre Dreby, "Drone Technology Proliferation in Small Wars," *Small Wars Journal*, October 2, 2019, <https://smallwarsjournal.com/jrnl/art/drone-technology-proliferation-small-wars>.

²²⁰ Dan Gettinger, "Drones Operating in Syria and Iraq," *Center for the Study of the Drone*, December 2016, 4, <https://dronecenter.bard.edu/files/2016/12/Drones-in-Iraq-and-Syria-CSD.pdf>.

²²¹ Ibid.

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Haram could follow ISIS' lethal tactics by simply dropping bombs from these assets. Furthermore, Phantoms are lightweight (1.36 kg), can fly at speeds of 72 km/h, and have an endurance of 20 minutes.²²² The shorter endurance suggests that Boko Haram UAS operators must be precise with routes to targets as 20 minutes does not provide ample time to mitigate errors.

It is likely Boko Haram's preference for violence will translate to its UAS program. It is nicknamed "the deadliest terror group in the world."²²³ It kills indiscriminately. In 2014, Boko Haram killed more people than ISIS and quadrupled its killings from the previous year.²²⁴ It is taking steps to acquire equipment to defend itself and sustain its deadly operations. The North Atlantic Treaty Organization (NATO) unintentionally contributed weaponry to the group. A 2012 United Nations (UN) report warned that equipment from the UN's war on Libya was smuggled into the Sahel region, to include light anti-aircraft artillery and likely advanced surface-to-air missiles and man-portable air-defense systems (MANPADS).²²⁵ Technology such as MANPADS can be used as counter-UAS technology against Western assets. The violence continues. As of April 5, 2021, Boko Haram ravaged Northern Cameroon and killed at least 80 civilians.²²⁶ Members ensure their victims suffer. A suicide bomber blew up fleeing

²²² Ibid.

²²³ Dan Glazebrook, "Deadliest Terror in the World – The West's Latest Gift to Africa," *The Thinker* 67, (2016): 74, <https://ujcontent.uj.ac.za/vital/access/services/Download/uj:41847/SOURCE1>.

²²⁴ Ibid.

²²⁵ Ibid.

²²⁶ "Cameroon: Boko Haram Attacks Escalate in Far North," Human Rights Watch, April 5, 2021, <https://www.hrw.org/news/2021/04/05/cameroon-boko-haram-attacks-escalate-far-north#>.

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civilians while others were killed with machetes or assassinated while family members were forced to watch.²²⁷ Boko Haram is able to operate without much resistance.

Scoring Current Operations

Simplicity (2 points): Boko Haram's platform of choice, the DJI Phantom, combines simplicity with high technology. Boko Haram solely uses its UASs for nonlethal operations. This does not mean the group will not pursue lethal operations. The DJI Phantom is not easily replicable. Boko Haram could not likely build such a platform on its own which is why it spends a larger amount of money to purchase them pre-made. There is no evidence that Boko Haram succeeded in building its own platforms.

Supply (1 point): Boko Haram does not likely have counter-surveillance technology which is evident in images of downed platforms. The significant quantities of anti-air equipment that has made its way into the region could be acquired by Boko Haram. However, there is no evidence that such assets are being employed. Additionally, Boko Haram likely acquires its DJI Phantom platforms online, but information could not be located confirming a formal acquisition network. It is evident Boko Haram has individuals capable of flying the Phantom platforms, however they are not likely highly skilled in doing so. There is a lack of evidence that operators are skilled in evasive flying techniques based on the evidence of downed UASs.

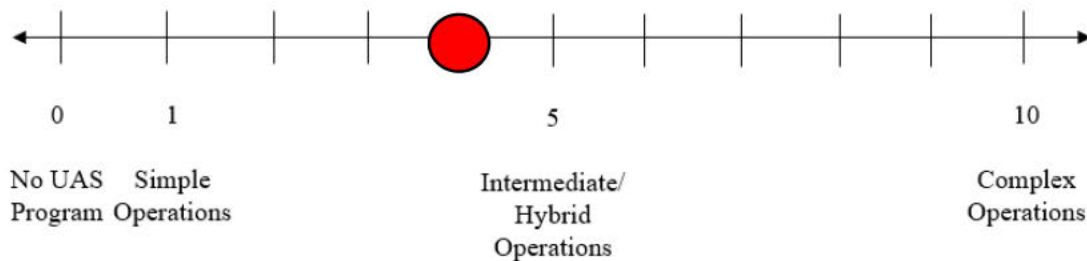
²²⁷ Ibid.

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Scale (1 point): No indicators could be found indicating Boko Haram is looking into expanding its program. This does not mean the group is not intending to do so. Boko Haram does not have manufacturing capabilities based on its need to purchase pre-made systems. Consequently, there is minimal standardization across Boko Haram's program. The only standard factor is the fact that the group relies on only DJI Phantom assets currently.

Boko Haram's Complex Operations Continuum



Assessment

Boko Haram scored a total of four points. It only needs to develop lethal operations to achieve hybrid operations and begin the development of its UAS program. Boko Haram's program requires significant expansion and improvement before it can reach complex operations. Namely, it will need to reduce its reliance on foreign platforms and expand its personnel. Lethal operations will not be difficult to achieve, and Boko Haram will pursue them to uphold its violent image. Boko Haram shares the vulnerabilities of the previous two groups but has additional issues. Its reliance on Chinese platforms leaves its program vulnerable should its access to purchase them be

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cut off. Furthermore, the high cost could limit its capability to expand its supply of UASs and conduct more advanced operations such as swarming.

Conclusion

Boko Haram has a long way to go to develop its program, but it should not be disregarded as a threat. It is known for its shock and awe tactics and unrelenting violence. It is highly likely that its desire for violence will transfer over into its UAS operations. Boko Haram, like other groups, will probably graduate from the pre-made Chinese platforms in pursuit of its own platforms. The Chinese platforms appear to be a starting point and provide easy entry into UAS operations. It would be in Boko Haram's best interests to create its own platforms as well to improve cost effectiveness. The primary targets will continue to be civilians who have little protection under government forces.

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CHAPTER 6

Conclusion

Conventional wisdom says that terrorist groups' use of UAS technology will not reach complex operations in the future. This thesis provided evidence to the contrary. Scholars in the United States are stuck in dispositions of old thinking and this paper provided insight as to why U.S. scholars are not theorizing more into this pressing national security issue.

The United States is historically reactionary to unforeseen national security threats. Terrorist groups are taking an interest in infiltrating airspace. ISIS, for example, effectively harnessed this battlespace and left the United States caught off guard and vulnerable. Not much progress occurred on behalf of the international community since ISIS started UAS operations. The United States must reassess its policies and defense measures to protect its citizens. Current U.S. policies and doctrine are insufficient.

A lack of imagination is also crippling the USIC in countering UAS operations. This study sought to assist with this obstacle through answering the question, "Why will the use of UAS technology by terrorist groups expand beyond a niche threat within the next five years?" Using ISIS as the standard for success, research demonstrated that groups are following in its footsteps to achieve their own successful UAS programs. This is done through development in three areas: simplicity, supply, and scale. Testing these three independent variables against the PKK, HTS, and Boko Haram provided evidence that some groups are not far from achieving the level of success that ISIS experienced. The United States and its allies can influence the success of terrorist groups if the

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appropriate actions are taken. The current minimal restrictions and regulations on UAS technology are useless. This is why UASs will be more than just a “niche” threat. Until regulations are established, and vulnerabilities of groups are exploited, the threat will continue to grow. The “second drone age” is engulfing the international community in chaos.

Findings

The analysis of the terrorist groups in the case studies provided insight into how far along some groups have come in adopting their own UAS programs. Both the PKK and HTS are close to realizing complex operations and well-rounded programs. Boko Haram is behind on UAS development but will likely continue to pursue complex operations. It will likely be on the same level of the PKK and HTS within the next five years.

Of the three independent variables, simplicity is the easiest to achieve. All three groups did so with either pre-made or handmade platforms. Platforms are generally intended for nonlethal uses, so this is essentially a free point for the purposes of the scoring system. From there, groups only need to find a way to attach weapons to the systems to achieve another point. This can be as simple as attaching a grenade to a given airframe, as demonstrated by ISIS. The only point in the simplicity category that can be difficult for some groups to achieve is replicability. For those like Boko Haram that rely on pre-made platforms manufactured in other countries, replicability is not feasible. Only once groups move to making their own platforms is replicability more feasible, such as the PKK who fashioned UASs out of Styrofoam and other materials that can be scavenged.

Supply and scale are both difficult to achieve due to the reliance on technology needed to score full points in each category. Counter-surveillance technology under supply is necessary to

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protect personnel and assets and to ensure the survival of a terrorist group's UAS program. The only group that had the potential of possessing said technology was HTS, who may have MANPADS. Without protection from surveillance, personnel and locations essential for each group's UAS programs are vulnerable to be targeted and destroyed. Manufacturing equipment under scale is another area where groups are lacking and preventing them from creating UASs in mass quantities. The number of UASs that can operate at one time will be restricted to how many groups can purchase or handmake before a given operation. The easiest point to achieve in supply is personnel. So long as groups are actively recruiting, there will be personnel available to dedicate to UAS operations. Groups must possess acquisition networks to acquire either pre-made UAS platforms or the materials to create their own. The risk of an acquisition network is dependent upon each group's preference for platforms. Buying pre-made assets online, for example, is risky because it leaves a footprint that can be exploited by counterterrorism entities regardless of the deception tactics a group may take (i.e., cover identities). Gathering materials to assemble platforms can be much less risky as foraging by hand leaves no evidence that can be exploited. In the PKK's instance, Styrofoam can come from numerous different sources so it will be difficult to restrict its ability to obtain it. Under scale, indicators of program expansion go together with recruiting. Other indicators can include an increase in the number of UASs used in operations to show that groups are building their capabilities. Achieving standardization is dependent on each group's UAS preference for operations. Handmaking UAS platforms make them easier to standardize. Standardization can also be achieved by constantly assessing operations. ISIS conducted after action reports to refine their operations to ensure success. In doing so, it set the standard for future operations. Operational goals could be met by learning from trial and error.

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The research also provided answers to the initial key questions. First, scoring each group on the complex operations continuum exposed the primary obstacles for program development. Counter-surveillance technology, replicability, and manufacturing equipment are the three largest obstacles. Counter-surveillance technology will be essential in the survival of each group's UAS program. Replicability is necessary to easily expand the number of UAS platforms a group maintains. The reliance of some groups, such as Boko Haram, on pre-made platforms minimizes replicability and makes their programs vulnerable should access to these platforms be cut off. Only until groups achieve manufacturing capabilities will they be able to conduct large-scale aerial operations. Obtaining such technology can be difficult in third world countries where some terrorist groups operate either because it does not exist or is not specific to UAS manufacturing. The most efficient and cost-effective option for groups would be manufacturing through 3-D printing and additive manufacturing. 3-D printers are available to the public so a group could purchase one online as it does its UAS platforms. Second, there are varying reasons as to why some groups fail in developing UAS programs while others succeed. Compared to HTS and the PKK, Boko Haram is experiencing limited success. This is largely because it has not achieved lethal operations. Boko Haram has the supplies and knowledge to make explosives as demonstrated in its current operations. This setback is likely a result of members not possessing the necessary technical knowledge to attach a payload to the pre-made platforms. Another setback could be a lack of access to resources, hence some groups' reliance on outsourced platforms. Personnel rarely seems to be an issue as terrorist groups continue to recruit members either voluntarily or through force. Since UASs are designed to be operated by the public as a hobby, anyone can be trained to use them. Additionally, establishing a robust acquisition network is challenging. Relying on external resources to obtain UAS technology is risky and costly. To achieve the expansive network that ISIS established, a group would have to

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have a large scale of human capital to facilitate the network, resources to establish front companies, and sound deception techniques. However, even when all is said and done, the risk of the acquisition network being detected is still high. The expertise of ISIS was not enough for its network to go undetected. Finally, groups hope to rival Western aerial operations through achieving the development of robust UAS operations. The ability of terrorist groups to achieve complex UAS operations will essentially act as a deterrence measure; in removing aerial superiority from Western powers and establishing an atmosphere of fear in the aerial battlespace, groups will be able to minimize the threat to their operations through the consequent loosening of restrictions from a decreased presence of Western troops and platforms in the respective regions where they operate. On the other hand, if Western powers increase the capabilities applied to this threat, then terrorist groups will not be able to achieve complex operations. Currently, Western powers do not possess adequate technology or countermeasures to protect themselves from smaller UAS platforms. If terrorist groups fully realize complex UAS operations, then Western troops will likely have to be removed from certain theaters for protection. The international community must take the terrorist UAS threat seriously if it intends to prevent terrorist groups from realizing their goals.

Recommendations

Undoubtedly, the USG is working hard to protect its homeland. Discussions are happening on the threat, working groups are being established, and countermeasures are being developed. Progress is happening but there is much work to be done. As such, eight recommendations are provided below to help navigate the gaps in current efforts.

On October 5, 2018, the president signed the Preventing Emerging Threats Act of 2018 which expanded the authority to counter UAS threats to the Department of Homeland Security

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(DHS), where it was previously only limited to the U.S. Secret Service (USSS) and U.S. Coast Guard (USCG).²²⁸ This is beneficial because it brings together perspectives from multiple agencies and thus will provide a holistic approach to mitigating the threat. The legislation also provided authorities to DHS legacy components. U.S. Customs and Border Protection (CBP) and the Federal Protection Service (FPS) were granted authority to counter the UAS threat.²²⁹ The USG then shifted focus to the private and local sectors. The FAA, Department of Justice (DOJ), Federal Communications Commission (FCC), and DHS issued an interagency legal advisory on UAS detection and mitigation technologies in August 2020. The advisory is intended to “assist non-federal and private entities...to detect and mitigate UAS...and provide an overview of potentially applicable federal laws and regulations.”²³⁰ The document focuses on the protection of U.S. citizens and infrastructure at home. None of the laws listed are specific to UASs and instead are previously established laws that could assist in defending against enemy assets. While this is a useful starting point, the threat will continue to evolve and expand in the future and pre-established legislation will probably not be enough to encompass the threat in the future.

Recommendation #1: Legislation specific to the UAS threat should be published to cover gaps in current laws and regulations.

²²⁸ Joseph V. Cuffari, “DHS Has Limited Capabilities to Counter Illicit Unmanned Aircraft Systems,” Office of Inspector General, Department of Homeland Security, June 25, 2020, 3, <https://www.oig.dhs.gov/sites/default/files/assets/2020-06/OIG-20-43-Jun20.pdf>.

²²⁹ Ibid., 4.

²³⁰ “Advisory on the Application of Federal Laws to the Acquisition and Use of Technology to Detect and Mitigate Unmanned Aircraft Systems,” U.S. Federal Aviation Administration, August 2020, https://www.faa.gov/uas/resources/c_uas/media/Interagency_Legal_Advisory_on_UAS_Detection_and_Mitigation_Technologies.pdf.

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Implementation of counter-UAS (c-UAS) legislation continues to be a shortfall. At DHS, the Office of Policy did not execute a uniformed approach to expand c-UAS capabilities as dictated by the 2018 act.²³¹ Components could not advance because resources were funneled elsewhere. The Office of Policy did not request funding for the initiative because it could not compete with other mission priorities for budget resources.²³² Consequently, legacy components were stunted. CBP and FPS did not obtain any c-UAS capabilities.²³³ The expansion of c-UAS capabilities did not happen at other relevant agencies either. The USSS continued operating c-UAS capabilities just for protective missions and the USCG did not expand beyond its maritime escort mission.²³⁴ As it stands, the ability to execute c-UAS capabilities remains poor. If c-UAS programs continue to be eclipsed by other priorities, the United States will become increasingly vulnerable. The country will fall behind while the threat continues to evolve. Another issue for DHS was an unrealistic c-UAS work plan established by the Office of Policy. The plan provided difficult timelines, incomplete guidance for resource allocation, and was outdated.²³⁵ These factors handicapped DHS' c-UAS efforts.

Recommendation #2: Agencies should dedicate resources specifically to c-UAS missions, especially planning and funding, to protect the United States against the threat.

²³¹ Cuffari, "DHS Has Limited Capabilities," 6.

²³² Ibid., 5.

²³³ Ibid, 6.

²³⁴ Ibid.

²³⁵ Ibid., 7.

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Recommendation # 3: Agencies should implement the directives provided under recent legislation to establish the defensive measures that are necessary to protect the homeland.

Recommendation #4: Plans established to develop c-UAS capabilities should be realistic, achievable, clear, and timebound.

Outside of the United States, the international community must come together to make a concerted effort against terrorist UASs. As mentioned in the literature review, c-UAS regulations and defensive measures in other countries are minimal or nonexistent. Recently, the countries under NATO developed the Alliance’s Defence Against Terrorism Programme of Work (DAT POW) to “prevent nonconventional attacks.”²³⁶ Countering UASs falls within the scope of this program, but it is not the focal point. In fact, it is one of at least nine other areas the project covers. DAT POW supports c-UAS capabilities through “tests, evaluations, exercises, concept development, and technical standardization.”²³⁷ Progress is being made on the international front. The outlined efforts are vague and there is no information available as to the success of the program thus far. DAT POW also focuses primarily on the development of technological solutions which does not fill the legislative gap that remains. The international community must get creative in countermeasures as laws and legislation alone will not deter terrorists.

²³⁶ “Defence Against Terrorism Programme of Work (DAT POW),” North Atlantic Treaty Organization, March 24, 2021, https://www.nato.int/cps/en/natohq/topics_50313.htm?selectedLocale=en.

²³⁷ Ibid.

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Recommendation #5: NATO and other countries should dedicate more funding, personnel, and planning to develop programs specifically aimed at countering the UAS threat.

Recommendation #6: The international community should come together to discuss and implement c-UAS regulations and measures.

Furthermore, this study highlighted the strengths and weaknesses that terrorist groups encounter when developing their own UAS programs. Simplicity, supply, and scale are integral factors that must be achieved for groups to successfully realize complex operations and establish sound UAS programs. Simplicity is the easiest for groups to achieve. Supply and scale are where groups face difficulties in building out their programs. The analysis of groups in their pursuit of UAS programs, as well as current literature on the issue, is lacking. Therefore, it would be beneficial to expand intelligence on the topic. The vulnerabilities identified in this study are also worth monitoring and exploiting as a starting point.

Recommendation #7: More analysts should be dedicated to the c-UAS discipline to stay ahead of the threat and monitor terrorist groups' progress in developing UAS operations.

Recommendation #8: The USG should focus on targeting acquisition networks, funding, and manufacturing equipment.

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Countries among the international community must look introspectively to address c-UAS gaps while relying on each other to strengthen the global effort. States or countries that fail to do so will continue to remain vulnerable to the threat and will progressively fall behind. Currently, the focus is more on the development of c-UAS technology. It is essential that more effort is put toward the protection of the United States' borders and to the vulnerabilities of the terrorist groups themselves versus those of the technology.

Future Research

There are many gaps in literature that need to be filled so there is no shortage of research that can be done. To start, research will need to focus on terrorist groups that are developing interest in UAS operations. Much literature exists on groups after they develop programs but those that have yet to develop them need to be monitored. Groups that are still developing their programs should not be ignored. HTS and the PKK, for example, should continue to be researched as they progress further towards complex operations. As groups develop programs, the intentions and motives behind said programs should also be identified.

Research should focus on UAS technology as it evolves. Namely, how artificial intelligence and additive manufacturing will impact UAS operations and efforts to counter them. Companies are always competing to create the best technology on the market to sell to consumers, and UAS technology will continue to be a prime commodity. The evolution of said technology also means continuous research into defensive measures is necessary. Jamming, for example, is ineffective against newer autonomous platforms. Additionally, research should expand on potential tactics that could be used. The current fear amongst scholars and government officials is swarming. This is echoed across literature. Many authors cover the idea of swarming, but this narrows the

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scope to one high impact tactic. Researchers need to be as innovative as the terrorists they study when it comes to brainstorming UAS tactics and countermeasures.

Finally, research needs to be conducted to fill the current gaps regarding how groups are acquiring UAS technology. Specifically, the acquisition networks need to be identified and targeted to prevent the expansion of UAS operations. In the three case studies, all groups acquired UAS technology but there was no literature as to how they did so. If groups pursue pre-made platforms, it is important to identify websites and retailers that could unwittingly be selling UASs to them. If groups make their own platforms, research needs to focus on the sources of materials, locations where the platforms are built, and who can assemble them. Groups may use front companies and cover identities as ISIS did which must be detected. Additionally, the sources of funding that makes the acquisition of UAS technology possible for terrorist groups must be identified. Once sources are identified, then efforts can be made to disrupt them.

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