Risk Mitigation Consulting Inc.

Intelligence and Analysis Division

WHITE PAPER SERIES

The Weaponization of Unmanned Aerial Systems (UAS)

INTENT

This white paper is designed to provide an in-depth analysis of relevant, publicly available information on threat and hazard events/trends and their potential impacts to the interests of the United States, both at home and abroad. This product is not intended to be an all-encompassing assessment of the subject, rather, it provides a brief overview to provide the reader with situational awareness regarding topics with which they may not be familiar.

The Weaponization of Unmanned Aerial Systems (UAS)

Introduction

In recent years, unmanned aerial systems (UAS) have surged in popularity in the U.S. and abroad due to their wide appeal for recreational and commercial users. UAS, also commonly known as drones, encompass a variety of remotely piloted platforms with varying capabilities and intended uses. However, all of these platforms have the potential to be weaponized and used as an attack vector. This paper will examine the proliferation of UAS into civilian hands, the ways in which commercially-available UAS can be weaponized by malicious actors, as well as select case studies in which this weaponization has already occurred. Although the weaponized UAS threat is still in its early stages, many observers have expressed concerns that the emerging technology could be increasingly utilized by malicious actors in years to come.

Analyst Note: Unmanned Aerial Vehicles (UAVs), also known as drones, encompass a wide array of aircraft with no pilot on board. These aircraft can be flown remotely by a pilot at a ground control station or utilize a pre-programed flight plan. The FAA has adopted the acronym UAS (Unmanned Aircraft System) to reflect the fact that these complex systems include ground stations and other elements besides the actual air vehicles. For the purposes of this paper, the term "UAS" will refer to commercially-available systems such as those used for recreational or commercial purposes, as opposed to the more technologically-advanced military UAS. Additionally, it should be noted that model aircraft can be weaponized in a manner similar to commercial UAS.

Platform Overview and Weaponization Techniques

UAS: Introduction, Commercialization, Proliferation

Unmanned aircraft have existed for decades in various forms, from incendiary balloons to target drones, however, the emergence of the quadcopter in recent years has fueled a boom in the popularity of UAS for recreational and commercial purposes.[1] Quadcopters (a four-rotor platform) have proliferated widely into civilian hands, as they are typically relatively small in size, affordable, easy to fly, and often come equipped with an onboard camera(s). These drones are usually controlled via a user-friendly interface such as a remote controller, a mobile app (on a smartphone or tablet computer), or via a laptop computer. Additionally, many drones can be pre-programmed to follow a specified flight plan.

Small quadcopter drones are often flown by hobbyists for recreation and aerial photography/videography. However, quadcopter drones (and their larger siblings – such as hexacopters/octocopters) have found a variety of commercial applications in recent years. Hexacopters and octocopters have six and eight rotors each, respectively, which allows for greater payload and greater stability, both of which are beneficial in commercial applications. Drones are

currently widely used in industries such as agriculture for purposes to include mapping/surveying and livestock monitoring.[2] Moreover, several companies are examining potential future applications for drones, such as internet retail giant Amazon, which is currently testing a drone delivery program called Prime Air.[3]

The widespread proliferation of UAS into civilian hands in the U.S. has been met with a variety of concerns regarding safety and security. In response, the Federal Aviation Administration (FAA) has implemented a variety of regulations on UAS to include mandatory registration for certain categories of UAS as well as restrictions on when and where drones can be flown.[4] Additionally, the registration database allows the FAA to communicate with drone operators and provide relevant information such as educational materials. In January 2018, Secretary of Transportation Elaine Chao announced that the FAA had reached a milestone of one million registered drones in the U.S. At the time, the figure represented roughly 878,000 registrations by hobbyists (for whom a single registration can apply to multiple drones) while 122,000 were drones registered for commercial purposes (which must be registered individually).[5]

Options for Weaponization

Drones can be outfitted with a variety of different payloads. Current hobbyist UAS are typically outfitted with cameras that stream video back to the operator, while some commercial platforms carry more advanced sensors (such as thermal imaging devices in the agricultural sector). Malicious actors have sought to equip drones with various types of weapons, and some have been successful. While selected case studies will be examined later in this paper, it is important to understand the general options available to those who might seek to weaponize UAS.

Drones could potentially be outfitted with weapons to include firearms, explosives, incendiary devices, or chemical, biological, or radiological agents. Alternatively, a drone could be used as a kinetic weapon for a ramming-style attack (for example, against a the engine of a jet airplane). The options for weaponization are only limited to the technical capabilities of the drone (specifically, the weight of the payload it can accommodate) as well as the resources and creativity of the malicious actor. It should be noted that the range of the drone could be reduced based on the weight of the payload carried. However, UAS such as hexacopters and octocopters can accommodate larger payloads. The now-weaponized drone could be guided to its target through a variety of means to include line-of-sight control, an onboard camera, or even on a pre-programmed "fire-and-forget" course.

Future Techniques: Drone Swarms

Drone "swarms" are an emerging area of research and development, as well as an increasing security concern. Currently, drone "swarms" are merely groups of multiple drones operated simultaneously, or perhaps pre-programmed to act as a group in advance. Still, researchers are working to integrate multiple drones into a single networked group, or swarm, in which the individual drones can communicate with each other and behave as an autonomous, cohesive unit.[6] Once operational and in widespread use, swarming technology could exponentially increase the security threat posed by weaponized UAS. Swarms could carry a larger quantity of weaponized payloads to an intended target and would be much more difficult to stop than a single drone.

Case Studies

Early Developments

In 2011, a 26-year old Massachusetts man was arrested in a plot to bomb the Pentagon and the U.S. Capitol Building using model aircraft filled with C4 explosives. The suspect had acquired a large model plane, however, the C4 he had acquired was fake, provided by undercover federal agents.[7] While this incident occurred prior to the surge in popularity of quadcopter drones, it highlights the potential for malicious actors to utilize commercially-available remotely piloted aircraft to serve as a potential vector for an attack.

Early attempts at the weaponization of commercial quadcopter drones quickly emerged as the hobbyist use of drones grew in popularity. In 2015, a father-son duo in Connecticut uploaded two videos to YouTube showing drones that had been modified to carry weaponized payloads. In one video, a drone is shown with an attached handgun, which successfully fired four rounds of ammunition while airborne. In another video, a larger drone carrying a flamethrower roasts the family's Thanksgiving turkey.[8] While there is no evidence that the individuals involved intended to use the technology to launch attacks, the videos serve as a proof-of-concept for individuals intent on attaching weapons to drones.

Russia-Linked Actors in Ukraine

Ukrainian authorities have accused Russian actors of using weaponized UAS during the ongoing conflict between the two countries. In at least two instances, Ukrainian military bases have been targeted by drones carrying incendiary thermite grenades. In December 2015, Russian drones allegedly dropped 14 grenades at the Balakliya military base in Eastern Ukraine, where much of the fighting has occurred. The base was targeted again using the same tactic in 2017, in which the thermite (an incendiary substance which burns at extremely high temperatures) set off a chain reaction at an ammunition dump, causing a massive explosion and secondary effects such as artillery rockets firing randomly in all directions. One person was killed and five were injured in the 2017 attack.[9] Although it is unclear whether Russian state actors or Russia-backed rebels were responsible for these attacks, the alleged Russian use of weaponized UAS in these cases is unique because the primary objective appeared to be sabotage of Ukrainian materiel, which would hamper Ukrainian military efforts in the region (although casualties were still reported).

The Islamic State

UAS has also been utilized by the Islamic State terror group on the battlefields of Iraq and Syria for intelligence, surveillance, and reconnaissance purposes, as well as offensive purposes. The group and its affiliates have outfitted relatively inexpensive quadcopter drones (costing around $650 USD each) with ordnance to include grenades. During the battle for Mosul, Islamic State fighters reportedly flew over 300 drone missions, with one-third of those being armed strike missions.[10] While the Islamic State has not utilized UAS in any external attacks to date, the group's use of UAS in battlefield settings remain a concern. Moreover, the group's increasing competence and familiarity with UAS could increase the possibility of an external attack involving UAS in the future. The Islamic State operates a robust propaganda operation that could facilitate a dissemination of information regarding weaponized UAS to the group's followers around the world.

Maduro Assassination Attempt

It is important to note that a number of details regarding the 04 August 2018 assassination attempt on President Nicolás Maduro are still unclear due to conflicting accounts of how the event unfolded. However, according to the Venezuelan government's account of events, two drones (which, according to video of the incident, appear to be larger, commercial-application hexacopters) carrying a total of 4 pounds of plastic explosives reportedly flew toward the leader as he addressed members of the Venezuelan military at a public event. The Venezuelan military claims to have knocked one drone off-course electronically, while the other drone crashed into a nearby building. A Venezuelan government investigation has already resulted in several arrests, primarily of individuals critical of Maduro's regime, although opposition figures have contended that Maduro is using the attack as an excuse to crack down on his own opponents.[11] While neither drone reached their intended target, the incident (if it occurred as reported) would mark the first high-profile assassination attempt using weaponized UAS as an attack vector. Additionally, the incident may inspire copycat assassination attempts by criminal or terrorist groups in the U.S. and abroad.

Outlook

While most weaponized UAS incidents to date have been limited in scope, serious concerns remain regarding future incidents. Counter-UAS technology is still being developed, and the technologies that do exist have not yet been widely adopted by security forces. Therefore, many potential targets remain vulnerable to attacks from UAS. Some potential worst-case scenarios involve the dispersal of chemical or biological agents in a crowded public venue such as a stadium or festival, or, as seen in Venezuela, the assassination of a head of state at a public event. Perhaps in the future, a networked "swarm" of drones carrying explosives could be utilized. Lower-skilled attacks (such as crude explosive attacks) may also increase in frequency as terrorist groups continue to gain experience with UAS technology on the battlefield, and seek to export the acquired knowledge to affiliate groups or radicalized lone actors around the world. The threat from weaponized UAS is still dynamic and evolving, but it is unlikely to disappear anytime soon. Rather, we are likely to see an increase in the use of weaponized UAS by a variety of state-affiliated and non-state actors in the years to come.

Source List

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10. C4ISRNET. *How $650 Drones Are Creating Problems in Iraq and Syria*. 05 January 2018.
11. USA Today. *Venezuela Drone Attack: Here's What Happened With Nicolas Maduro*. 07 August 2018.