



Risk Mitigation Consulting Inc.

Intelligence and Analysis Division

WHITE PAPER SERIES

The Unmanned Aircraft Systems (UAS) Threat to Aviation

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 Unmanned Aircraft Systems (UAS) Threat to Aviation

Introduction

In recent years, unmanned aircraft 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 interfere with aviation through deliberate, malicious acts as well as inadvertent or accidental events. This paper will examine the UAS threat to aviation, as well as select case studies in which UAS have interfered with aircraft or aviation activities. Although UAS has only recently proliferated into civilian hands, the large and growing numbers of UAS and UAS operators in the U.S. and abroad increases the potential for future aviation-related incidents involving UAS.

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-programmed 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.

Potential Threats to Aviation

Overview

UAS, by their nature and design, must inherently share airspace with conventional manned aircraft, although a variety of regulations exist to limit certain flight parameters. These parameters include permitted flight altitude, line-of-sight rules, and restrictions on usable airspace (for instance, the airspace around military installations). When these regulations, which in the U.S. are created by and enforced by the Federal Aviation Administration (FAA), are violated, UAS may interfere with other aircraft. It is important to note that such regulations can be violated deliberately and maliciously, or can be violated as a result of a number of non-malicious factors such as inadequate training, temporary distraction, or faulty equipment.

Deliberate Acts

UAS may be utilized by a wide range of malicious actors intent on targeting aircraft or aviation-related activities. Such actors may include terrorist groups/individuals, disgruntled employees, local citizens with a grievance against a military air facility or airport, or individuals engaged in



malicious activity for their own entertainment (such as teenagers looking to cause trouble). These malicious actors may utilize any number of tactics, techniques, and procedures (TTPs) involving UAS, which can vary widely in sophistication and potential impacts.

Some potential TTPs include harassment, which entails the flying of a UAV in a manner that distracts, annoys, or interferes with aircraft or aviation-related activities. UAS can also be utilized to conduct a kinetic or ramming-style attack against aircraft (whether airborne or on the ground) or aviation-related infrastructure (such as air traffic control towers or radar systems) with the intent to cause damage. More sophisticated actors (such as terrorist groups/individuals) may seek to outfit UAS with weapons to include incendiary devices or explosives, in order to cause a greater amount of damage and/or casualties. Additionally, it should be noted that UAS could be utilized as a pre-operational surveillance tool in advance of a conventional attack.

Accidental Events

Non-malicious actors utilizing UAS also pose a potential threat to aviation due to a variety of factors to include negligence, lack of proper training, or technical difficulties. A UAS operator may intrude into restricted airspace or takeoff/landing approach routes due to these or other factors, which could have serious consequences. Aircraft may be forced to divert course, the pilot(s) could become distracted and make a separate error, or a potentially serious collision could occur. Moreover, inadvertent intrusions that are detected may force a temporary halting of air operations at a military installation or other airport. Such intrusions could also result in accidental crashes with similar consequences to the aforementioned ramming-style attack.

The potential for collisions between UAVs and conventional manned aircraft has become a serious concern in recent years, as a number of sightings and near-misses have been documented, as well as a few confirmed collisions. Such collisions have been likened to the aviation phenomenon known as “bird strikes” in which aircraft collide with birds. In 2018, researchers at the University of Dayton conducted an experiment in which a small UAV was fired out of a cannon at 238 miles per hour into the wing of an aircraft to simulate a “drone strike.” The researchers conducted a similar test using a simulated bird, and found that the UAV caused more serious damage to the wing; particularly to a structural component that bears the weight of the aircraft. While the experiment was limited in scope, it highlights the potential for serious mishaps to occur due to collisions between UAS and conventional manned aircraft.¹

Case Studies

Overview

The following case studies provide a brief overview of documented incidents involving UAS and aircraft/aviation-related activities. However, because the widespread proliferation of UAS into civilian hands is a relatively recent phenomenon, there is not an authoritative database of such incidents, and the incidents that have occurred vary widely in nature. Still, incidents similar to the ones documented below are likely to increase in the coming years as UAS becomes more ubiquitous in the U.S. and around the globe. Existing and proposed regulations by the FAA and other international bodies have sought to curb the potential threats posed by UAS, however, such regulations are difficult to enforce and are likely ignored by a significant portion of UAS operators.



2018 Gatwick Airport Incident

Between 19 and 21 December 2018, Gatwick Airport (located near London, England) was temporarily shut down due to reported UAV sightings in the direct vicinity of the airport. The shutdown ultimately affected roughly 1,000 flights, causing disruptions for 140,000 passengers during the busy holiday travel season. Although an investigation into the incident is ongoing, many details are still unclear. Local authorities have issued a number of conflicting statements and retractions, and arrested two individuals before releasing them shortly after questioning. Still, police were reportedly aware of UAV sightings by at least 115 individuals, of which at least 93 were deemed credible.²

The Gatwick Airport incident highlights the potential impacts of UAS-related airspace intrusions. Although there is no reporting to suggest that any aircraft had a near-miss or collision with a UAV, simple reporting of UAS activity was enough to shut the airport down temporarily. Additionally, while it is not known whether the act was deliberate or inadvertent, a similar approach could be used by terrorist groups/individuals intent on causing public fear and/or economic disruption. Shortly after the Gatwick Airport Incident, the Islamic State terror group released a poster featuring a UAV that threatens attacks against the U.S. and Europe.³

2017 Quebec City Incident

On 12 October 2017, a commercial flight on its descent into Jean Lesage International Airport in Quebec City struck a UAV. The collision occurred just under 2 miles from the airport at an altitude of approximately 1,500ft. Those conditions indicate that the drone was being operated too close to the airport, at too high of an altitude, according to guidelines specified by Transport Canada. The plane sustained minor damage, and was able to land safely at the airport.⁴ A subsequent investigation by the Transportation Safety Board of Canada was not able to identify the UAS operator or their intent.⁵ This incident highlights the potential for mid-air collisions in the direct vicinity of takeoff/landing approach routes in the vicinity of airports. While this incident only resulted in minor damage, a UAV entering the jet engine of a large commercial aircraft could result in far more serious consequences, to include a major crash with the potential for mass casualties.

2017 Army Helicopter Incident

On 21 September 2017, a small quadcopter (a four-rotor UAV that is common among hobbyists) collided with a U.S. Army Black Hawk helicopter near Staten Island, New York. The helicopter was authorized to be in the airspace during a Temporary Flight Restriction (TFR) in place due to the United Nations General Assembly, while the UAS operator was not authorized to fly due to the TFR. Due to the pilot's ignorance of the TFR, as well as other factors (including operating his UAV beyond visual line-of-sight), the UAV collided with the helicopter. Fortunately, the helicopter suffered only minor damage and its crew was able to land at a nearby airport with no casualties reported.⁶ This incident highlights the potential for mid-air collisions (like the aforementioned "drone strike") by a non-malicious actor. In this case, the National Transportation Safety Board (NTSB), faulted the UAS operator for the crash, citing his lack of knowledge of regulations, as well as the deliberate flying of the UAV beyond visual line-of-sight.



Outlook

UAS poses a serious and increasing threat to the aviation sector due to the widespread proliferation of UAS into civilian hands; the ease by which malicious and non-malicious actors utilizing UAS can interfere with aviation; and the challenges surrounding enforcement of regulations regarding UAS ownership and operations. Although there is only a limited history of serious aviation-related incidents involving UAS, the list of incidents is likely to grow in coming years as the technology continues to grow in popularity and regulations struggle to keep up. Still, the potential for UAS-related incidents involving aviation should not be discounted, as even the mere reported sighting of UAVs near airports could result in widespread travel disruptions. Conversely, a handful of documented mid-air collisions have occurred, although none have resulted in any major damage or mass casualties. This trend may not continue, however, as the current state of UAS ownership and operation, coupled with an insufficient regulatory and security environment pertaining to UAS, likely increases the potential for future incidents. Furthermore, UAS may be increasingly utilized by malicious actors such as terrorist groups/individuals as the technology remains easily accessible and extremely customizable, while providing tactical advantages such as standoff distance and strategic advantages such as propaganda value.

Source List

1. LiveScience. *When A Drone Crashes Into An Airplane, Everyone Has A Bad Time*. 15 October 2018.
2. Sky News. *Gatwick Drone Inquiry: 93 'Credible' Sightings*. 29 December 2018.
3. The Daily Mirror. *ISIS Threatens Drone Attack Against The West After Gatwick Airport Chaos*. 21 December 2018.
4. CTV News. *Drone Strikes Commercial Aircraft in Quebec*. 15 October 2017.
5. Transportation Safety Board of Canada. *Aviation Investigation A17Q0162*. 14 February 2018.
6. Forbes. *NTSB Finds Drone Pilot At Fault For Midair Collision With Army Helicopter*. 14 December 2017.