

THE EFFECTIVE USE OF UNMANNED AERIAL VEHICLES FOR LOCAL LAW
ENFORCEMENT

by

Leighton Gasque

A Thesis Submitted in Partial Fulfillment
Of the Requirements for the Degree
Master of Science in Aviation Management

Middle Tennessee State University
December 2015

Thesis Committee:

Dr. Paul Craig, Chair

Dr. Wendy Beckman

ACKNOWLEDGEMENTS

Thank you to all of the men and women at Murfreesboro Police Department for their hard work and dedication to the residents. Special thanks to the Chief of Police for coordinating the study along with the officers involved with the study.

ABSTRACT

This qualitative study was done to interview local law enforcement in Murfreesboro, Tennessee to determine if unmanned aerial vehicles could increase the safety of police officers. Many police officers face dangerous scenarios on a daily basis; however, officers must also perform non-criminal related responsibilities that could put them in hazardous situations. UAVs have multiple capabilities that can decrease the number of hazards in an emergency situation whether it is environmental, traffic related, criminal activity, or investigations. Officers were interviewed to find whether or not unmanned aerial vehicles (UAV) could be useful manpower on the police force. The study was also used to find whether or not officers foresee UAVs being used in law enforcement. The study revealed that UAVs could be used to add useful manpower to law enforcement based on the capabilities a UAV may have. Police officers cannot confirm whether or not they would be able to use a UAV until further research is conducted to examine the relation of costs to usage

TABLE OF CONTENTS

	Page
CHAPTER I: INTRODUCTION.....	1
Literature Review.....	1
Keeping up with Technology for Safety.....	2
How UAV Could be Used.....	4
Manned vs. Unmanned Aircraft.....	6
Safety Issues during Emergencies.....	10
Current Regulations.....	11
Statement of Problem.....	13
CHAPTER II: Methodology.....	15
Participants.....	16
Design.....	17
Interview Questions.....	17
Procedure.....	18
CHAPTER III: DATA ANALYSIS.....	21

	Page
Analysis.....	21
Findings.....	25
Summary.....	27
CHAPTER IV: DISCUSSION.....	28
Conclusion.....	29
Limitations.....	31
Solutions.....	32
Recommendations.....	34
Future Research.....	34
REFERENCES.....	35
APPENDICES.....	38
Appendix A: IRB Approval Letter.....	39
Appendix B: Interview Questions.....	40

CHAPTER 1: INTRODUCTION

Unmanned Aerial Vehicles (UAV) have been used by the military and border patrol for many different operations to protect borders. The military will soon have a surplus of unmanned aerial vehicles and systems that will be transferred to domestic law enforcement. Police officers constantly have to respond to unknown situations without accurate information of the location or emergency. Officers receive a code over the radio to tell them what type of response or emergency they have. Descriptions can be very limited because they do not receive an actual visual or picture of what to expect. Most police officers walk into an emergency having to expect the worst because they have no clear description themselves until the first responder arrives to inform other officers of the current situation. A UAV could be effective and cost efficient if it was used to navigate an emergency response for officers. Surveillance cameras are not always useful because the cameras are stationed in a fixed location and are only useful for situations in their viewing field. Surveillance cameras are also very limited throughout suburban areas.

Literature Review

Local law enforcement normally arrives at 911 emergency calls with the broad details of an emergency situation. There are times when an officer responds and will have limited knowledge of the conditions at an emergency scene. Examples of what information a police officer would want to know is: how critical is the emergency situation, terrain if they must go off of paved roads, how many people are in the area, and where is the exact location. Populations in areas outside of major cities have increased because more inner city households are moving to suburban areas (Vim Zandt and

Mhatre, 2013). When population increases, the number of potential casualties may increase in an emergency. Many different suburban areas are becoming more congested as new buildings are being constructed; houses are built closer together to save space. Having updated maps are paramount for an effective police force to protect and serve the greater public.

Suburban areas now have more people moving to and selecting houses in those areas. Van Zandt and Mhatre (2013) completed a study comparing the correlation between suburban areas and criminals. It turns out, that because of subsidized and section eight housing, criminals are now moving more into suburban areas. The majority of criminals come from low-income areas, but these opportunities allow for some criminals to acquire housing in these areas. This study was completed to examine if proper screening has been accomplished for people if they are to be selected for housing. The Van Zandt and Mhatre study, about local authority responses and criminals found in suburban areas, can provide an example of why UAV may be useful for authorities in the suburban areas of large cities.

Keeping up with Technology for Safety

Preparation is the number one concern for all police officers when they are on duty because officers have a dangerous job. The main objective for a police officer is maintaining safety for the general public. It is difficult for law enforcement to do their job if they are provided with a task and do not have the adequate information. A lack of information can lead to compromising situations for a police officer that could potentially jeopardize safety. The use of UAV may be able to enhance the entire ability of a police

officer to perform his or her duties. In recent news the U.S. military has given law enforcement surplus military equipment to help combat the crime issues found with rising populations and to pass on improved technology. The U.S. is one of a few countries where citizens are able to carry a firearm as long as they have a legal documentation and abide by the laws of firearms. Police officers receiving military grade weapons use these to keep up with non-law-abiding citizens and criminals. A UAV was found with six pounds of methamphetamine, also known as, meth or crank, was found in a super market parking lot near the border of California (Gray, 2015). This is an example of cartels and gang members having advanced technology to perform illegal activities.

Criminals are not limited to just UAV, as they have bullet proof vests, armored cars, and automated weapons. Although a UAV carrying six pounds of meth is not very efficient for a multi-million-dollar drug business, it is an example of the need for police officers to keep up with technology to combat dangerous criminals. Police officers must also be prepared for domestic terrorists and with the rise of extremist groups like the Islamic State (ISIS) as such groups acquire members throughout America, there is more concern about having appropriate equipment and knowledge. There are hundreds of U.S. born citizens leaving the country to join ISIS (Hong & Grossman, 2015). ISIS also has a website and publications to teach the want-to-be extremist how to create bombs and weapons within their own house (Hong & Grossman, 2015). This is an example of the reason police officers may soon need to use UAV for their missions. The safety of the public may be enhanced, as long as the safety of the everyday officer, by using these devices.

How UAV Could be Used

The justice department has looked into using UAVs for surveillance since 2006 (Yost, 2013). A few local authorities received over a million dollars for authorities to utilize UAVs in their departments, and the The Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) have used UAVs for their operations and Federal Bureau of Intelligence (FBI) has found many uses for UAVs and they are looking into ways to implement more into local departments (Yost, 2013). ATF and FBI are two prime examples of the justice system using UAV technology. The FBI has used UAVs 10 times to help with rescue missions, searches, and fugitive investigations (Yost, 2013). The Justice Department has increased their spending on unmanned aircraft because they do present abilities to aid authorities.

Olaeris started to produce a UAV for fire fighters, police, and rescue agencies in 2012, which was designed to be a first response vehicle. The goal of the UAV is to provide extra manpower and to be the first respondent in emergency situations. An aerial vehicle will arrive at locations faster than a response car, because a UAV does not need to navigate ground traffic (Olaeris Unveils Domesticated UAV, 2012). Countries like Argentina have been using UAV to find certain people or properties when they evade paying taxes (Allen, 2014). For cost purposes, the UAV a police officer would use must be small enough to fit in a trunk of a police car and fly for up to an hour and thirty minutes. This saves on time and money and will prevent a UAV from flying too far and becoming irretrievable. The UAV would be used to fly below 400 feet, but the FAA can approve a UAV for certain areas to fly up to a certain (feet above ground level) AGL and

this would be suitable for small suburban cities. This may not be useful in urban areas because larger cities have many tall obstacles at various heights that hinder optics and a UAV could collide with a building if a mistake was made.

Many police officers will be able to test UAVs or receive grants that may be put towards a UAV. For example, currently Michigan is testing a UAV for their law enforcement. The FAA approved their use, but the UAV will only be used if it is absolutely necessary (Roose-Church, 2015). The UAV may operate once a week, twice a day, a hundred times a year, or once a month depending on what type of emergency situation is encountered. The first mission for the UAV was an expected arson fire (Roose-Church, 2015). Predictions can be made that most police forces that acquire a UAV will follow the same guidelines, as though authorities may use it when they deem it necessary even though the regulations are in place to avoid any potential privacy concerns. A UAV for police officers would only need to be used for emergencies, warrants, and not for typical daily reconnaissance. The flight time would need to be limited to save resources such as money, fuel (if not electrical), and time (Roose-Church, 2015). A vertical takeoff would most likely be requested for the ability to hover over an area to capture pictures.

Manned vs. Unmanned Aircraft

Airplanes and helicopters in certain situations may lack human safety, which could result in disabling an officer from performing a reconnaissance operation. Each aircraft type has different capabilities, and can therefore be used for different situations. Technology has changed drastically since the first uses of aircraft because there have been new safety nets set in place (Younce, 2004). Having unmanned aircraft and rotorcraft can eliminate the human safety hazard if the aircraft goes down or collides with an obstacle. The earliest aircraft could only be used for reconnaissance flights, because they lacked adequate performance capabilities. The first aircraft were expensive, and not as cost effective as the aircraft of today (Younce, 2004). Aircraft developed more functions after WWII, due to the barnstormer era aircraft and pilots being used for delivering mail (Younce, 2004). The lessons learned from the first steps in aircraft development can be used when developing UAVs for local authorities if there is a significant need for the extra response vehicles. The UAVs must be cost efficient, safe, and have capabilities that can be used for more than just menial tasks.

Local law enforcement authorities have begun to use unmanned aerial vehicles and unmanned systems to help with border patrol and security in different parts of the country; Texas border control officers were one of the first authorities to use UAVs for monitoring (Electronic Frontier Foundation, 2013). The military has had a lot of success when using the unmanned systems. Civil applications were examined, and now local authorities can use them to aid with tactics and security. After September 11th, 2001

border control became more necessary to prevent any further attacks on United States soil (Electronic Frontier Foundation, 2013).

Border control is able to secure borders from a longer distance and now have extra manpower. U.S. Customs and Border Protection have made use of UAVs for law enforcement and the National Guard (Electronic Frontier Foundation, 2013). Government agencies are able to take advantage of the use of UAV because it provides another optic and perspective for observations. Unmanned vehicles can help with allocation of manpower because UAV provide a greater scope of vision that the human eye lacks from the ground. They can also cover more ground in a short period of time than a human can cover and more ground than land vehicles.

Many government agencies and authorities are experimenting with UAVs to test their applications and capabilities. Some law enforcement agencies and private security agencies are pushing for the use of UAVs and use UAVs for certain security tasks. UAVs have many functions and capabilities that help with domestic missions for state governments (Electronic Frontier Foundation, 2013). Choosing the applications and proper capabilities can be crucial when developing UAVs for authorities. The UAV should not have capabilities that would be rarely or never used.

Unmanned vehicles have many capabilities outside of military strike uses; reconnaissance is an example because can be done safely over certain areas thanks to UAVs and applying this capability domestically could be very promising. Many police use helicopters with one or two pilots operating it. An unmanned helicopter is a lot safer and cheaper to use and it does not waste manpower. One major disadvantage that is

slowing down the implementation of UAV into the national airspace is the lack of a human operator to think and feel independently (Browne, 2014). Humans do not always have senses like radar or vision like infrared, but they do have judgment outside of algorithms.

A UAV comes with many features such as: night vision, radar, thermal vision and motion detecting sensors. These features are great for observations throughout the day, night, smoke, and mist. The correct features in optics allow for the user to incorporate different strategies for different situations (Browne, 2014). Strategic optics in the air can provide for tactical local authorities to perform their duties more efficiently.

There are different types of unmanned systems that could be used for domestic security. Aerial UAVs do have limitations. Due to land obstructions, weather patterns, and certain areas with high aircraft activity, in some cases UAVs may not be as useful. Unmanned systems play a vital role in the modern military operation all around the world (Browne, 2014). Military operations occur domestically as well as overseas; some of the successes from UAVs could allow for local security to improve, and to achieve a new level of safety.

UAV pilots are typically stationed in a remote location that is virtually secure and has limited distractions. A safety hazard when pilots are operating a manned aircraft is the amount of workload placed on the pilot. The human body is susceptible to the environment when in the air at high altitudes. UAVs eliminate G forces acting on the human body, hypoxia, and extreme fatigue on the human body. However, as long as humans are using the technology, human error will still occur (Straw, 2011). Removing

the pilot will not always prevent human error, but safety nets can prevent hazards from becoming a tragedy.

A study was completed to examine the differences between manned and unmanned mishaps. The majority of the incidents for unmanned aircraft occurred because of a lack of guidance for following procedures. Many manned incidents happen due to fatigue and poor decision making from the pilot (Straw, 2011). There are other mishaps that happen because of engine failure (Straw, 2011). Many mishaps occur from latent conditions, but proper preparation, decision-making, and training can help to eliminate those issues. Safety will always be a factor when choosing to provide police officers with UAV technology. Human factors will always play an influential role in the use of unmanned systems because they are still being developed. UAV must have proper procedures put into place for them to be successful.

Congress is still not ready to allow UAVs to fly without strict restrictions within the national air space system because they could collide with general aviation or air carrier aircraft. These small unmanned systems could be dangerous to other aircraft in the sky. Over the next four years UAVs will be tested for authority use, and by 2018 UAVs are expected to be in full use by certain local authorities (Yost, 2013). Safety is the biggest concern for the use of unmanned aircraft, but once that is settled then UAV will be completely utilized by local authorities and not just FBI. and ATF. Until the see-and-avoid issue can be solved to know limit the potential hazards from flight, UAV still cannot be permitted without a watchful eye from the FAA.

Safety Issues during Emergencies

A lack of perspective gives innocent-by-standards less safety while within an emergency area. A police officer could have a hard time identifying suspects, where to begin a pursuit, and determining when to call for assistance from another officer. The majority of UAV use will be done under warranted situations or in extreme situations. When there is a riot or an active protest a UAV could be used to provide safety to people involved in the area, to provide people who are trying to avoid the commotion with a cautionary notice. In the U.S. there are some dangerous extremist groups that are allowed to have group meetings. There are times when police officers will be called into these situations unknowingly and be exposed to multiple violent criminals at once (Anti-Defamation League, 2015). Police officers must face numerous challenges depending on the location they will respond to for a call, since there could be multiple criminals in an area that will feel threatened just by the police officers' presence (Anti-Defamation League, 2015). In these situations, a UAV will most likely not be permitted for use unless an officer has a warrant for an individual.

When searching for multiple criminals together in an area a police officer might require an extra vantage point for searching. This will allow officers to determine when to pursue and how many by-standers will be at harm if the suspect is deemed armed and dangerous. A police officer is supposed to minimize damage and act swiftly. There are confrontations and standoffs that may last longer than they need to (Anti-Defamation League, 2015) without the correct equipment, information, and appropriate resources. A UAV could respond to these situations more quickly for reconnaissance to allow a plan to

be made swiftly. Manpower can become scarce when standoffs and confrontations occur and limit officer responses in other areas of a city or town. Unlike large cities a smaller suburban city or area will not have the ability to get officers to arrive as swiftly when multiple officers are immersed in an emergency.

Current Regulations

The first of the new rules, issued February 2015, allowed for UAV under 55 pounds to enter the national airspace. This was done to allow for UAV to advance in technology and to encourage safety among UAV operators. Small UAV must remain in the operator's line of sight. UAV are only permitted to fly during day-light hours (Federal Aviation Administration, 2015). Commercial and private entities are able to obtain a Special Airworthiness Certificate for experimental aircraft. Recreational aircraft must have an FAA Restricted Category Type Certificate to fly. Government entities must obtain a Certificate of Waiver or Authorization to operate a UAV. The FAA made 6 test sites for UAV, located in Fairbanks, Alaska, Nevada, Rome, New York, North Dakota, Corpus Christi, Texas, Blacksburg, Virginia (Federal Aviation Administration, 2015). However; UAV used by law enforcement are not recreational aircraft.

The current UAV regulations are strict depending on the area in which it is operated. The main for rules a UAV defined as a recreational aircraft, must follow is "the aircraft is flown strictly for hobby or recreational use; the aircraft is operated in accordance with a community-based set of safety guidelines and within the programming of a nationwide community-based organization; the aircraft is limited to not more than 55 pounds unless otherwise certified through a design, construction, inspection, flight test,

and operational safety program administered by a community-based organization; the aircraft is operated in a manner that does not interfere with and gives way to any manned aircraft; and when flown within 5 miles of an airport, the operator of the aircraft provides the airport operator and the airport air traffic control tower ... with prior notice of the operation (Federal Aviation Administration, 2015).” These rules include that the aircraft must operate below 400 feet as long as it is operated in low populated areas with very few structures and property that could be damaged if the aircraft collided with the ground.

Some regulations may be dismissed if a special request is written to the FAA and all airports within the area are notified. These request are made when flying in an area on the UAS in the National Airspace System Roadmap (Federal Aviation Administration, 2015). A college or university is an example of a community-based organization that would be authorized for testing a UAV for outside of a government entity. The weight rule can be dismissed as well if the aircraft is approved by the FAA. Currently, new rules are still in the draft process to correct safety issues involving unmanned aircraft. The FAA passed a Modernization and Reform Act of 2012 to speed up the Certificate of Waiver or Authorization filing process so that public safety agencies could operate UAV in the future. In 2013 the FAA and Department of Justice made an agreement to allow for the increase of UAV weight from 4.4 pounds to 25 pounds (Federal Aviation Administration, 2015). The rule change allows for different advancements to be made for UAV. Public safety agency UAV require more equipment; however, 25 pound limits might be enough for their UAV.

Statement of Problem

Currently there are multiple cities around the United States experiencing high rates of population growth. Major cities have been growing at a consistent rate over the past few years. Many citizens have chosen to make longer commutes to work by living in an area outside of a major city. In this survey Nashville, Tennessee is the major city of consideration and Murfreesboro, Tennessee is the suburban area that many people are choosing to move to. The cost of living in many major cities is higher than in most suburban areas. With an increase of population growth there will be a need for police stations to increase the size of their task force. Criminal activity and enforcing law is not the only reason for increasing the task force of a police station. Police officers must be able to respond to multiple emergency situations. Some situations may put many officers in danger, depending on how many responders must be at the emergency scene.

Weather events such as floods, hurricanes, and tornados could also put an officer's safety at risk when attempting to survey an area. If there is a wild fire that is difficult to contain, an aerial view would be more helpful to see and predict where a fire could spread. Outdoors citizens may get stranded or into an accident and require multiple officers to search through a large area. Many people overlook the responsibilities a police officer must burden as their duty entails; thus, providing safe, efficient, and swift ways to accomplish police tasks is extremely important. The research questions to be answered by this study are:

1. Can UAV potentially add useful manpower to local authorities?
2. Do the majority of police officers participating in this study agree that a UAV could be a valuable resource in the future?

CHAPTER II: METHODOLOGY

The purpose of this study was to interview the Murfreesboro Chief of Police along with selected officers on the command staff, which perform their duties in the suburban area of Murfreesboro, TN. Through qualitative research, the potential utility of UAV in a typical suburban police force will be identified, along with exploring if UAV are seen by officers having a future in the police department. This study attempts to discover if there is applicable use for UAV by suburban police forces. Suburban cities in this survey will be defined as having a population less than 200,000 as of the 2013 population estimates from United States Census Bureau (U.S. Census Bureau, 2015). An interview was conducted with the police chief as a preliminary interview, but this data was not within the study to protect the anonymity of the participants. There is only one chief on the police force and it would be easy to identify this individual as one of the participants. One barrier to implementing UAV that was not considered in the survey is the privacy and legal dispute involving the use of UAVs and surveillance technology. Privacy concern research would require the surveying of a different set of participants including judges, other local authorities, and different types of attorneys. Although this implementation barrier was excluded there is a section in the conclusion to very briefly discuss privacy issues.

Participants

This study was approved by the Middle Tennessee State University Institutional Review Board, under protocol #15-223 for human subject participation (See Appendix A). The participating local authority for this study was the Murfreesboro Tennessee Police Department. The Murfreesboro, TN department was chosen because the residential population was above 100,000 and below 200,000. Murfreesboro's police department has a large variety of police officers from multiple backgrounds which aided in the quality of research. Murfreesboro police have had many diverse encounters handling emergency situations that have required multiple resources and tactical abilities. Due to the department's high workload, it was not possible for staff members to participate in this research study, and those selected chose to participate in interviews on their limited breaks or free time. Murfreesboro's local authority was also chosen for proximity concerns, so the researcher would be able to commute to the department. The police chief did the first interview and questions were developed based off of the police chief's guidance, so questions more applicable to the study could be utilized. The police chief did not request for the researcher to change the interview questions, however, the data from the police chief was not used in the data recorded. Six interviews were conducted. Police officers have a high workload, so interviews were limited to only 15 minutes of their time.

Design

The design of the research was to take a qualitative approach to determine what benefits a UAV can present an officer to increase their level of safety, based off of their experience, previous encounters, and firsthand knowledge. Using the interview research methodology eliminated low quality information obtained from a general closed end questionnaire. All officers were contacted through email to find willingness to participate.

Data collected was examined for responses that occurred more than once or if other colleagues provided any similar response. The interviews were all open ended questions, and each officer completed an individual interview. The interviews were approximately 15 minutes or less. Six interviews were completed through e-mail because of schedule and time restraints.

Interview Questions

The interview question, “How long have you been a part of law enforcement?” This interview question was not used to answer the research questions, but it was used to validate the quality of information by determining if the participant had enough experience to not be disqualified from the study.

The interview question, “What information or knowledge do you have about unmanned aerial vehicle use?” This interview question was not used to answer the research questions, but it was used to determine whether or not information about UAV

was presented to the participants at any point of time in the past, or if they had prior knowledge of UAV.

This interview question, “What are situations when a UAV would be useful?” This interview question was used to answer the research question, “Can UAV potentially add useful man power to local authorities?” The interview question’s answers were used to determine if uses of UAV could be used to perform tasks to add to manpower that an officer would normally do.

The interview question, “How could a UAV improve the level of safety for police officers?” This interview question was used to answer the research question, “Can UAV potentially add useful man power to local authorities?” The interview question answered it by determining whether or not the UAV could be used in dangerous situations in place of a police officer or if a UAV could be used to make a dangerous situation safer for police officers.

This interview question, “If granted to use, what features would you want your UAV to have?” This interview question was used to answer the research question, “Can UAV potentially add useful man power to local authorities?” The interview helped to answer the question because certain capabilities could make tasks for police officers more efficient.

The interview question, “What are cost concerns for UAV?” This interview question was used to answer the research question, “Do the majority of police officers participating in this study agree that a UAV could be a valuable resource in the future?”

This interview question to answered it by determining if a UAV can be funded to find a justifiable use.

The interview question, “What are potential threats or concerns if using an UAV not cost related?” This interview question was used to answer the research question, “Do the majority of police officers participating in this study agree that a UAV could be a valuable resource in the future?” The interview question answered the research question by addressing outside concerns that are not associated with the monetary cost, for example: the political concerns, safety concerns, and any other barrier that may prevent or allow for officers to use a UAV.

Procedure

The participants answered questions individually. Each participant was selected by the Chief of Police from the staff he felt would be the most appropriate based off of time, experience, and knowledge of duties. The researcher provided the police chief with the interview questionnaires via e-mail along with the informal consent forms. No officer was permitted to put any personal information on the interview questionnaires. Each officer chose to do an interview in person, by phone, or through e-mail. All officers sent their completed interviews to the front desk secretary. After all interviews were received along with any informed consent forms the research was complete. The researcher was called by the police station once all items were collected. The researcher picked up the completed interviews from the police station. The participants no longer have to participate in the research any further. All participants were given the researchers contact

information if they had any further question or to request an electronic copy of the completed study.

CHAPTER III: DATA ANALYSIS

The qualitative data from the interviews were analyzed for recurring themes that seemed constant in each interview. Six primary interviews were completed by the selected members of the staff. Each interview was assigned a phonetic name ranging from Alpha to Foxtrot. The interviews were named in random to ensure confidentiality. The data examined were found to be consistent across the majority of the interviews.

Analysis

The first interview question, “How long have you been a part of law enforcement,” was to measure the level of experience a police officer had. It was relevant to disqualify a subject from the study if they did not have adequate experience. The amount of experience from the officers interviewed can increase the validity of the responses provided. The number of years totaled that was interviewed was 202, the average years of experience was 28.9, the maximum was 38, and the minimum was 20. No Data was eliminated as all participants had significant experience.

The second question, “What information or knowledge do you have about unmanned aerial vehicle use?” which, determined how much knowledge about UAV was circulating the department. The answers given were “very limited,” “Very little, only what I have read on my own,” “I know that law enforcement is beginning to utilize this technology,” “very little knowledge,” “limited,” “None; other than for photography,” and “some knowledge through news media.” Information was limited to what is present in the media, knowledge gained on the officer’s own free time, and discussed in legislative

reviews. There were some officers that did not have information about UAV. UAV are still in the development process and it was determined that there was a low amount of information presented to officers in the past.

The third question was “What are situations when a UAV would be useful?” The question required the officer to put their knowledge of tactics, experience from past situations, and prior knowledge of UAV to use to determine potential uses for UAV. Many officers foresee UAVs being used for temporary surveillance. The answers provided were “missing persons,” “aerial views of crime scenes,” “drugs,” “hostage situations,” “active crime scenes,” “any incident where witnesses provide descriptions and direction of travel,” “any situation where aerial surveillance would be an advantage,” “crime scene footage,” “surveillance,” “search in large areas,” “suspect search in large area,” “perimeter observation in barricade situation,” and “escaped prisoner.” 4 different officers said “missing persons”, and four officers mentioned “crime scene” or an “active crime scene.” Officers have thought of the most extreme situations and these answers are an example that the MPD would use UAV for emergency situations and tactical situations.

The fourth question was, “How could a UAV improve the level of safety for a police officer?” The officers answered, “survey a home or business in a dangerous situation,” “could provide overview of area without increased use of personnel,” “barricaded armed suspects,” “hostage situations,” “surveillance prior to operations,” “remote-controlled robots are already used in tactical situations to clear areas prior to the officers entering. UAVs could be used for the same purpose in areas that are not

accessible with the robot,” “takes away human equation,” “ambush situations,” “aerial searches prior to law enforcement entering an area; reconnaissance for active situations such as armed suspects.” The officers used past knowledge and common knowledge that they had from prior use of technology. Every officer gave a different answer for question 4. Three officers believed that an UAV would be used for active crime situations. One officer noted that human error could be minimized. Another officer noted that an UAV can increase manpower by using less officers for one task.

Question five was “if granted use, what features would you want your UAV to have?” The question was used to determine which features would be useful for an UAV. The answers provided were, “HD camera,” “live feed video,” “night vision,” “thermal optics,” “video recording,” “infrared,” “public announcement audio,” “video and still pictures,” and “facial recognition.” Five officers said that thermal and night optics would be important features to have. Officers answered the question taking in account budget restraints, so no officer said anything that they deemed too expensive to add. Each officer had a different level of knowledge of the costs associated with UAV features.

Question six was “What are cost concerns for UAV?” The answers given were, “how it would be funded,” “reoccurring costs,” “maintenance cost,” “annual upgrade cost,” “training cost,” “replace cost,” “initial cost,” “upkeep,” “minimal, much cheaper than a helicopter,” “the total cost of a UAV would be weighed against its productivity. If it proves not to be cost effective it probably wouldn’t be purchased,” “budget is always a concern,” and “is the limited use that will probably be seen be enough to justify expense?” Some officers may have more information about costs of a UAV than others

because of the varying answers. Some officers may have had more information about UAV costs. The most important concern for 2 officers was justifying the use of a UAV. Two officers were concerned about upkeep and replacement costs. One officer noted that a UAV would be cheaper than a helicopter and that is evidence that each officer may have different information about costs associated with UAV.

The seventh question was “what are potential threats or concerns if using a UAV; not cost related?” The question addressed issues and concerns that did not involve the budget. The answers provided were, “Public perception and not undermining public’s trust by use of UAV (privacy concerns),” “lawsuits and civil litigation,” “are there liability issues,” “my concern would be that there is little litigation governing the use of UAV which could lead to the misuse of these tools,” “privacy issues and safety in regards to other air traffic,” “legal issues involving privacy and search on private property,” and “suspect shooting UAV, battery life, deploy time, how many people would be trained and the availability of the UAV. For the the UAV to help law enforcement in a safety concern, deploy time is the biggest concern. How many times would we use it and is the cost worth the use?” All officers are concerned about privacy and surveillance laws regarding the use of a UAV. Each officer knows the public perception of a UAV is negative. Suspects or other people may shoot at a UAV. Battery life, deploy time, and the amount of officers that would need to be trained to operate a UAV is would drive the cost of a UAV up. The deployment time would be the greatest concern because certain situations may require a prolonged use of the UAV and if it does not out last an emergency then it would not be worth using. The next concern was air traffic within the

area because there is a municipal airport in Murfreesboro, TN, and some aircraft may be put in a dangerous situation while a UAV is deployed during an emergency. One officer was concerned about the misuse of a UAV.

Findings

The first consistent theme was that a UAV could be the next efficient wave of surveillance technology. Every police officer found multiple useful tasks for a UAV. A UAV could be used for tactical purposes to resolve active criminal emergencies. It was a common theme that UAV could be used to find and protect multiple individuals. With proper UAV equipment, information can be provided to law enforcement to enable them to resolve issues without endangering others. An over concentration of manpower can decrease efficiency within a tactical force, but having an area survey would allow proper delegation of tasks.

Another consistent concern was costs of operating a UAV compared to usage. Funding will always be an issue because of the multiple expenses a police department occurs. It costs money to get through the litigation required to acquire a UAV. Many stakeholders would have to be identified in order to completely make a justification on whether or not a UAV is efficient for a police station to use. Justifications made would be how many lives could be saved, injuries that could be prevented, maintenance costs, the number of operators needed, and training costs. There are hidden costs along the lines of insurance, how much it costs to operate the UAV, and personal damages incurred if a UAV crashed. A UAV would need to be used multiple times throughout the year so that it justifies the cost of obtaining one. A UAV would have to eliminate other costs, like fuel

for a helicopter and gasoline for patrol cars. If a UAV was dispatched and the operator was able to state how many responders were needed it could save on gasoline costs. A UAV that runs on electricity would not require fuel, however a UAV using fuel may fly longer. A UAV fuel tank is smaller than a helicopter's tank and that could save on the cost of fuel after the use the aircraft. The response time of a UAV may be faster than that of a helicopter or a police car. There are cost relationships to capabilities associated with a UAV that must be explained to justify to the usage of a UAV.

The last consistent theme associated with the interviews was the barriers that may prevent the usage of a UAV. Many areas have different politics regarding privacy and surveillance laws. There are multiple procedures law enforcement must go through and training that must be conducted before being able to record certain situations. Many residents may not want a UAV to be used by authorities even if it is for temporary uses only. The recording feature may not be allowed to be used until the UAV arrives within the emergency area, and some areas may be designated as restricted by a UAV. There are multiple issues of residential disputes about owning the air above their property. Does ownership of airspace go to a certain height or is there no ownership of the airspace except by the country? These questions could arise in legal situations. Making sure all rules and regulations are followed may become a burden on certain tasks for a UAV. Some citizens may feel "threatened" if they notice there is a UAV in the sky, but they may not be aware of an emergency. Residents in the area may submit multiple complaints if they do not understand or know why there is a UAV in the air. Legal transparency

issues that could affect the status of operations, tactical missions, and warrant situations could make UAV operations strenuous for police officers.

Summary

UAV surveillance seems to be main focus for the operation of a UAV within suburban cities and areas within the city limits that city police patrol. The research shows that there can be multiple uses to aid in protection for multiple parties, delegation of resources, and to assist with tasks outside of criminal activity. There are multiple ways to drop the costs of the actual UAV by placing out competitive bids for which company would provide one for purchase, maintenance, possibly operating, the number of officers trained to operate a UAV, and by selecting equipment and features. When an UAV is used to resolve emergency situations efficiently then costs will be easier justify. The uses for a UAV are greater than most people believe because it could be used to create advanced maps for developing areas. Murfreesboro, Tennessee is a growing city with an increasing population. Advanced maps for new buildings and roads would help response times and aid in limiting confusion in developing areas of the city. Privacy laws and surveillance laws are the largest barrier for UAV use. Many residents have the opinion that the government has too much power as it is, but without proper facts, knowledge of rights, and “one-sided” media coverage citizens can become improperly informed. A UAV would not be flown longer than its task at hand or it would drive costs enormously high so as to be unaffordable. As discussed in Chapter I, U.S. police that use a UAV only operate them in “extreme” emergency situations and are issued warrants. There are strict rules placed upon UAV operations so that it does not infringe upon a citizen’s rights.

CHAPTER IV: DISCUSSION

This study was designed to find whether or not UAVs could improve the level of safety for local law enforcement. Judging from the interviews conducted a police officer's safety could be improved by having a UAV as a resource. There are many variables that can alter over the next five to ten years that will decide whether or not unmanned aircraft can be used effectively by police officers. Politics on the state and federal level may change, FAA regulations change constantly, technological developments, changes in pricing, new needs for police officers, funding, and public perception are just a few variables that could influence if a UAV will be used in the future of law enforcement. The first interview question was to determine how much experience an officer had, which might influence their ability to recall a situation where having a UAV could be useful. The second interview question was used to determine how much information the officers interviewed knew about UAV. With UAV technology still in development along with changing rules and regulations, it was suspected that there was a lack of information about UAV technology, associated costs, and uses for law enforcement.

The third, fourth and fifth interview questions were used to answer the first research question, "can UAV potentially add useful manpower to local authorities?" Based on this study, a UAV could help increase the safety of police officers and the safety of citizens within an emergency area. Some responses show that officers must have the ability to examine a scene after the emergency has passed. Minimizing damages, limiting the spread of casualties, and resolving issues in a timely manner was taken into

consideration by officers. A UAV would have to be able to help officers and other people in a positive manner. An important aspect is limiting the presence of the human element. The human aspect in flight can sometimes be the cause of problems in manned aircraft. When operating a UAV, a human can operate the aircraft from a remote location and the aircraft does not have to be as large, use as much fuel, and will not require the same amount of time to take off.

Interview questions six and seven were used to answer the second research question, “Do the majority of police officers participating in the study agree that UAV could be a valuable resource in the future?” The answer to the research question is inconclusive. The responses to these questions expressed the limitations of the UAV and whether or not a UAV would be practical for police officers. There are multiple considerations that must be taken into account. The main hurdle would be the relationship between costs and applicable use. The other threats for acquiring a UAV would be how long a UAV could be used for operations, the cost of training personnel, and legislation that might determine the future of UAVs for law enforcement.

Conclusion

It appears that UAVs could be practical to enhance safety of police officers to add useful manpower when responding to emergency situations, as a UAV could provide an aerial view that could aid grounded officers. With the proper capabilities, such as hovering, high definition live feed, recording, still pictures, zoom lenses, and night optics it could be an extremely useful for police officers. UAV reconnaissance capabilities could be more efficient than human reconnaissance capabilities because humans cannot

fly without the assistance of an aircraft, flight technology can navigate over obstacles, respond areas that do not have roads, or areas lacking pathways, and optics will have a wider view of landscape. If a UAV incurs damage or crashes, it would be less expensive than a manned aircraft. Insurance could cover a UAV's replacement costs, and the smaller sizes will not cause as much damage if it crashes into an obstacle such as a building, house, tree, or power line. A manned aircraft could result in higher repair costs, replacement costs, and the loss of a human life. Manned aircraft would be much more expensive to replace, injuries received by an officer on-duty could result, along with any damages caused to other objects or obstacles.

Currently, officers do not have confidence that UAV will be in the future of law enforcement resources. The overall cost and use of a UAV would have to be justified before it could be purchased. Training costs, equipment, upgrade costs, insurance, replacement, and maintenance costs would be expenses to account for along with other potential hidden costs. A UAV would have to be field tested by the police force to find whether or not the costs could be justified. Public perception could force the use of UAV to be prohibited within certain areas or regions in the future once legal decisions are made about UAV. The rules and regulations for unmanned aircraft are still changing and being developed and reconsidered. Currently, any use of the UAV would need to be approved with a warrant or justified extreme conditions. These conditions would have to be identified and defined. Some residents may complain if they see an aircraft with a camera attached flying over their property. This may force UAV to operate along strict

routes or a certain area. Air traffic nearby airports would have to be alerted whenever a UAV is launched.

Limitations

A limitation to the research is that it was based on a small number of interviews with police officers who have yet to operate a UAV for police operations. UAV have been used by border patrol and many police stations around the U.S. have begun to use UAV for law enforcement; however, the MPD has not yet started such operations. Another limitation was that only one police department was interviewed. Each area and situation is different, but each department may have different abilities or reasoning to why UAV could be used or not. For instance, a concern for air traffic within the growing region of Murfreesboro because there is a municipal airport that many student pilots use throughout each day. This may or may not be a consideration for other police departments.

Time was a limitation for not just the researcher, but also for the entire police staff interviewed. The officers that participated in the research had to endure a high workload throughout the day. Attempting to get other officers involved was not possible because their duties required their full attention and they were in court, filling out paper work, or attending to an emergency. The regular tasks of officers can change every day and that meant altering scheduling and times for completing the interviews. The interview was designed to take no longer than fifteen minutes, but some officers may have felt rushed during interviews, so some may have felt that they did not have adequate time to answer some of the questions because some answers were extremely brief in the interview

responses. The chief distributed the surveys, so some officers may only have wanted to answer questions so that there was no bias or conflicting information provided. Liable or conflicting information would have automatically eliminated a participant from this study.

A final limitation presented to the researcher was the lack of information on UAV. UAV in the media have mostly involved military operations, border control, and recreational activities. Other uses have not been publicized to citizens. It is sometimes difficult to explore anything related to UAV as the technology is still new and developing. The FAA has considerable recommendations that may or may not take effect over the next few years. Technology that is in its infancy is difficult to gain proper knowledge of, due to constant changes over short periods of time.

Solutions

The barriers preventing the use of UAV for law enforcement can most likely be solved over time. Unfortunately, upgrading police resources and technology is usually done out of a reaction to certain events or a chain reaction to multiple complaints. Many police stations may be underfunded, undermanned, or with outdated equipment. Cost justification can be solved once the vast uses of a UAV are explored and revealed. Emergency situations like high speed chases, deadly accidents, active shooters, fire emergencies with the chance of a fire spreading to multiple areas, tactical operations, and missing persons will all be apart of cost justifications. Police officers have a high work load that increases each week and finding alternative ways to increase manpower will be helpful. Using a UAV could take the place of sending extra police officers to a large

emergency area. The population of Murfreesboro, Tennessee is well over 100,000 and if two large emergency scenes occurred at once it could severely increase response times to other events.

Eventually, police technology will have to be able to keep up with current criminal technology. The rise of extremist and terrorists like ISIS and criminal organizations as explained in the Chapter I show that they are acquiring technology fairly quickly. Battling these entities will require an upgrade in technology for police officers. Becoming efficient in resolving issues in a timely manner, increasing safety, and protecting citizens as well as officers is very important. When an officer is injured, property is damaged, or a bystander becomes a casualty it makes completing tasks and operations difficult and hazardous. Losing an officer greatly decreases the functionality of a police force. Damaged property can result in a vast number of issues if the city has to pay for damage, owner's insurance does not cover the damage, or resources are could decrease which can hinder future operations.

Legal issues and privacy laws can be solved with the creation of a rules and regulations that are easy to follow for operators and police. A UAV's best use might be for warrant situations and emergency situations because it provides a task for the UAV. This gives the operation time efficiency. If a UAV is in the air without a specific task and just patrolling a city, it probably would be losing money on its investment. Proper usage would protect the citizen's rights and add proper manpower to the police force.

Recommendations

Recommendations for UAV usage may be complex and will require time in order to accomplish. The main recommendation is for police departments to acquire the proper equipment, but to not get a capability or feature for a situation that rarely occurs. There is no need to equip a UAV with too much technology, because it could drain the battery or fuel too quickly, making it inefficient. Extended battery life in case an emergency like a “standoff” occurs or a suspect is on the move over an area that would spread police officers thin, should be explored. Defining an “emergency situation” so that it is not difficult for high ranking officials and the police chief to make a go or no go decision will be required. An example would be that a fire in a remote location that most likely will not spread would not require a UAV, but a fire in an area that has many buildings close together and is spreading to multiple structures might require a UAV to determine where to evacuate people and predict the spread of fire.

Future Research

Further study needs to be conducted to present enough evidence for a numerical justification of UAV used by police forces. Another important next step to continue this research would be to interview additional suburban city police departments within different states. It is also important to interview police departments what have already used UAV for their operations to determine their opinions on the used of the drones. It would be beneficial to compare and contrast police departments that have already used UAV with those that have not.

REFERENCES

- Allen, N. (2014, September 25). Argentina uses UAVs to root out wealthy tax evaders. The Telegraph. Retrieved from <http://www.telegraph.co.uk/news/worldnews/southamerica/argentina/11121984/Argentina-uses-UAVs-to-root-out-wealthy-tax-evaders.html>. 22 February 2015.
- Browne, J. (2014, May 2). Unmanned vehicles are gaining ground: using a variety of propulsion systems and a wide range of electronic subsystems, these unmanned vehicles are playing increasingly important roles in modern military strategies. *Electronic Design*, 5. 16-20. 3 February 2015.
- Electronic Frontier Foundation. (2013, December). Law enforcement agencies using UAVs list, map. governing the states and localities. Retrieved from <http://www.governing.com/gov-data/safety-justice/UAVs-state-local-law-enforcement-agencies-license-list.html>. 12 February 2015.
- Federal Aviation Administration. (2015, February 15). Fact sheet – Unmanned aircraft systems (UAS). Washington, D.C. Department of Transportation. http://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=18297. 3 February 2015.

Federal Aviation Administration. (2014, June 18). Interpretation of the special rule making for model aircraft. Washington, D.C. Department of Transportation. 26

February 2015.

Gray, E. (2015, January 22). UAVs may soon have a new customer: drug cartels. *Time*.

Retrieved from <http://time.com/3678745/UAVs-drugs-meth-mexico-cartel/>. 17

February 2015.

Hong, M. & Grossman, A. (2015, March 5). U.S. authorities struggle to find a pattern

among aspiring Islamic State members. *Wall Street Journal*. Retrieved from

[http://www.wsj.com/articles/u-s-authorities-struggle-to-find-a-pattern-among-](http://www.wsj.com/articles/u-s-authorities-struggle-to-find-a-pattern-among-aspiring-isis-members-1425586022)

[aspiring-isis-members-1425586022](http://www.wsj.com/articles/u-s-authorities-struggle-to-find-a-pattern-among-aspiring-isis-members-1425586022). 17 February 2015.

Olaeris Unveils Domesticated UAV (2012, June 19). Olaeris for fire, police and rescue

agencies. *PR Newswire*. Retrieved from

[http://ic.galegroup.com/ic/bic1/NewsDetailsPage/NewsDetailsWindow?failOverT](http://ic.galegroup.com/ic/bic1/NewsDetailsPage/NewsDetailsWindow?failOverType=&query=&prodId=BIC1&windowstate=normal&contentModules=&display-query=&mode=view&displayGroupName=News&limiter=&currPage=&disable)

[ype=&query=&prodId=BIC1&windowstate=normal&contentModules=&display-](http://ic.galegroup.com/ic/bic1/NewsDetailsPage/NewsDetailsWindow?failOverType=&query=&prodId=BIC1&windowstate=normal&contentModules=&display-query=&mode=view&displayGroupName=News&limiter=&currPage=&disable)

[query=&mode=view&displayGroupName=News&limiter=&currPage=&disable](http://ic.galegroup.com/ic/bic1/NewsDetailsPage/NewsDetailsWindow?failOverType=&query=&prodId=BIC1&windowstate=normal&contentModules=&display-query=&mode=view&displayGroupName=News&limiter=&currPage=&disable)

[Highlighting=false&displayGroups=&sortBy=&search_within_results=&p=BIC1](http://ic.galegroup.com/ic/bic1/NewsDetailsPage/NewsDetailsWindow?failOverType=&query=&prodId=BIC1&windowstate=normal&contentModules=&display-query=&mode=view&displayGroupName=News&limiter=&currPage=&disable)

[&action=e&catId=&activityType=&scanId=&documentId=GALE%7CA2965973](http://ic.galegroup.com/ic/bic1/NewsDetailsPage/NewsDetailsWindow?failOverType=&query=&prodId=BIC1&windowstate=normal&contentModules=&display-query=&mode=view&displayGroupName=News&limiter=&currPage=&disable)

[17&source=Bookmark&u=tel_middleten&jsid=fe723e7ced16ddf2be194966734e](http://ic.galegroup.com/ic/bic1/NewsDetailsPage/NewsDetailsWindow?failOverType=&query=&prodId=BIC1&windowstate=normal&contentModules=&display-query=&mode=view&displayGroupName=News&limiter=&currPage=&disable)

[db97](http://ic.galegroup.com/ic/bic1/NewsDetailsPage/NewsDetailsWindow?failOverType=&query=&prodId=BIC1&windowstate=normal&contentModules=&display-query=&mode=view&displayGroupName=News&limiter=&currPage=&disable). 18 February 2015.

- Roose-Church, L. (2015, March 12). Michigan state police show how they will use UAV. Detroit Free Press. Retrieved from <http://www.freep.com/story/news/local/michigan/2015/03/12/michigan-state-police-UAV/70214866/>. 8 February 2015.
- STRAW, J. (2011, February). The trouble with UAVs. *Security Management*, 55(2), 22-24. 20 February 2015.
- Van Zandt, S. S., & Mhatre, P. C. (2013, September). The effect of housing choice voucher households on neighborhood crime: longitudinal evidence from Dallas. *Poverty And Public Policy*, 5(3), 229-249. 20 February 2015.
- United States Census Bureau. (2015, January 21). State and county quick facts. United States Department of Commerce. Retrieved from www.census.gov. 1 March 2015.
- Younce, E. (2004, June 1). Aircraft of World War I/Battles of World War I/Events leading to World War I (Book). *School Library Journal*, 50(6), 166-167. 3 February 2015.
- YOST, P. (2013, September 26). Justice department spent nearly \$5M on UAVs. *AP Top News Package*. 12 February 2015.

APPENDICES

APPENDIX A – IRB APPROVAL LETTER

4/21/2015

Dear Investigator(s),

The MTSU Institutional Review Board, or a representative of the IRB, has reviewed the research proposal identified above. The MTSU IRB or its representative has determined that the study poses minimal risk to participants and qualifies for an expedited review under 45 CFR 46.110 and 21 CFR 56.110, and you have satisfactorily addressed all of the points brought up during the review.

Approval is granted for one (1) year from the date of this letter for 8 (EIGHT) participants.

Please note that any unanticipated harms to participants or adverse events must be reported to the Office of Compliance at (615) 494-8918. Any change to the protocol must be submitted to the IRB before implementing this change.

You will need to submit an end-of-project form to the Office of Compliance upon completion of your research located on the IRB website. Complete research means that you have finished collecting and analyzing data. **Should you not finish your research within the one (1) year period, you must submit a Progress Report and request a continuation prior to the expiration date.** Please allow time for review and requested revisions. Failure to submit a Progress Report and request for continuation will automatically result in cancellation of your research study. Therefore, you will not be able to use any data and/or collect any data. Your study expires **4/22/2016**.

According to MTSU Policy, a researcher is defined as anyone who works with data or has contact with participants. Anyone meeting this definition needs to be listed on the protocol and needs to complete the required training. **If you add researchers to an approved project, please forward an updated list of researchers to the Office of Compliance before they begin to work on the project.**

All research materials must be retained by the PI or faculty advisor (if the PI is a student) for at least three (3) years after study completion and then destroyed in a manner that maintains confidentiality and anonymity.

Sincerely,

Institutional Review Board Middle Tennessee State University

APPENDIX B – INTERVIEW QUESTIONS

How long have you been a part of law enforcement?

What information or knowledge do you have about unmanned aerial vehicle use?

What are situations when a UAV would be useful? (ex. Missing persons, car pursuits)

How could a UAV improve the level of safety for police officers?

If granted to use, what features would you want your UAV to have? (Facial recognition, night vision, thermal optics)

What are cost concerns for UAVs (equipment, training, upkeep, and personnel)?

What are potential threats or concerns if using an UAV not cost related?