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Unmanned Aircraft Systems: Factors That Affect The Acceptance Of Unmanned Aircraft Usage Within The United States National Airspace System

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UNMANNED AIRCRAFT SYSTEMS: FACTORS THAT AFFECT THE
ACCEPTANCE OF UNMANNED AIRCRAFT USAGE WITHIN THE UNITED
STATES NATIONAL AIRSPACE SYSTEM

by

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This thesis, submitted by Eric Dale Cameron, in partial fulfillment of the requirements for the Degree of Master of Science from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done, and is hereby approved.

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ABSTRACT

Unmanned aircraft have been around since before the Wright brothers took flight in 1903. Even though unmanned aircraft have had a history that well exceeds the century of manned aviation, they were primarily used by the military, and were mostly outside the public's purview. In recent years unmanned aircraft have made a giant leap from military use to commercial use within the United States and around the world. While pilots and operators flying these aircraft may have accepted the technology and its future potential; the public might have a different point of view on utilization over their home, town, state, or country. Numerous articles suggest that the public of the United States has a long history of determining which technologies will be readily accepted, slowly adopted, or fail before becoming commonplace. This thesis examines important issues regarding public perception of Unmanned Aircraft Systems (UAS), their use in the United States, where they fly, and, specifically, their use in a law enforcement setting. The study found that the public has a lower acceptance rate for unmanned aircraft than manned aircraft. Public perception of unmanned aircraft may create obstacles for the usage of this technology for law enforcement purposes.

CHAPTER I

INTRODUCTION

Unmanned Aircraft System (UAS) are becoming more commonplace within the United States and aerospace industry. While the technology for these unmanned aircraft is currently available to use throughout the United States, the laws governing the usage is still being debated. One wonders if the public shares the same optimism that has been found within the manufacturers and other aerospace organizations. This thesis examines the issue regarding the use and public perception of UAS.

Statement of the Problem

Unmanned aircraft have been around since the Wright Brothers took flight in 1903 (Hallenberg, 2013). Until recently the main uses of unmanned aircraft were for military operations being conducted overseas. The United States military has had little negative feedback from the United States citizen with respect to the use of unmanned aircraft overseas that protect American military members. Could the use of these same aircraft within the confines of the United States airspace give Americans a different sense of liberty? As United States lawmakers and the Federal Aviation Administration (FAA) find a way for unmanned aircraft to be integrated in the United States' airspace, there is still a need to understand whether citizens want them flying over their homes. It is important to determine what missions or roles these unmanned aircraft can be engaged in within the United States in the future.

Purpose of the Study

The use of Unmanned Aircraft Systems (UAS) is a new and unknown technology to many people. Numerous articles suggest that in the United States, the public has a long history of what technologies will be accepted and which will fail before becoming common. Some examples of successful technologies in the past 30 years are the Atari video games, the Compact Disc, VHS tapes, Digital Video Disc, and the I-Pad. The success of these technological devices relies not only on successful marketing but on the acceptance of individuals to use these technologies. There have been numerous examples of technological advances which the general public never accepted and therefore, were quickly discarded by the company. Some examples of these are the Betamax and Laser Disc from the late 1970s, and the Palm Pilot from the mid 1990's. A new technology, which may require new laws to govern it, may be partially dependent on society's willingness to accept the new advancement in technology.

At the time of this research study, the laws governing the use of unmanned aircraft are still in the early stages of development. With most new laws, it appears that public opinion regarding the matter will have a formative effect on the outcome of the approved regulations. With any new technology, it seems the public's perception or fear will not only steer the policy governing it, but also the technology's ability to succeed within mainstream America. Individuals have different levels of understanding of the types of technology and their ability to understand the technology may play a role in the acceptance of it.

In 2012, the Federal Aviation Administration (FAA) directed by Congress to integrate UAS into the national airspace by 2015 (Divis, 2013). While the FAA works on the "how to" portion of integration, Congress will have to work on the laws which will

govern the unmanned aircraft throughout the United States. Some of their concerns are related to the issues of safety and privacy concerns with the use of unmanned aircraft. Questions are raised regarding how an unmanned aircraft used for a task such as law enforcement can be differentiated from that of using a manned aircraft for the same mission. Fourth Amendment issues regarding the protection against unreasonable searches and seizures may need to be addressed. The public's preferences of what unmanned aircraft should and should not be able to do within a person's state, county, or city may create laws that are politically driven by the public's perceptions (Divis, 2013).

Significance of the Study

Results from an analysis of the supporting survey helped conclude whether people perceived unmanned aircraft as violating privacy rights versus the current modes of surveillance. The study also helped to determine whether an individual's background had a determining effect on his or her willingness to accept the use of unmanned aircraft in the United States and whether certain areas of the country might have a higher acceptance rate of UAS activities than other parts of the country. Also, the question of whether certain type of UAS missions are more widely accepted when compared to others, such as whether individuals that utilize a larger number of technological devices in their lives, demonstrates a higher acceptance rate for the use of unmanned aircraft.

This study should provide government officials, industry manufacturers, and private entities recent data to help them understand the public's acceptance rate of UAS and what, if any, restrictions the public would like to see on the use of unmanned aircraft systems. The study has allowed for a better understanding of the public's perceptions of the different roles of various unmanned systems within the United States and the public's influence on the implementation and acceptance of this new technology in society.

Research Questions

The review of literature helped create six research questions. A quantitative analysis of the information gathered will be used to explore each of the following questions. This study looked at whether there is any significance regarding the individuals' aggregate demographic information in determining the individual's acceptance of unmanned aircraft. The study was conducted by means of a Qualtrics online survey with individuals from across the United States. This was distributed via email, online forums, survey distribution sites, and social media to allow the widest distribution. The types of questions asked were used to determine respondents' current level of understanding about unmanned aircraft. Also, questions helped to determine whether people perceived a difference between manned aerial surveillance versus unmanned surveillance. The questions are:

1.   Is there a different level of acceptance between manned and unmanned law enforcement surveillance?

2.   Does an individual's demographic information have a determining effect on the acceptance of unmanned aircraft?

3.   Are there areas of the country where there is a higher or lower acceptance rate of unmanned aircraft uses?

4.   Are there missions for unmanned aircraft that are more widely accepted than others?

5.   Do individuals with more acceptance of other technology accept unmanned aircraft at a higher rate?

6.   Does the size of the unmanned aircraft have an effect on the acceptance rate of the unmanned aircraft?

Assumptions

1.   All participants were truthful in their responses to the survey.

2.   Each participant completed the survey only one time.

3.   Each participant completed the survey without any assistance from other individuals.

4.   All participants understood the terms used in the survey.

Limitations

1.   The study only examined data from at individuals that had access to the internet.

2.   The study divided United States into nine regions instead of all 50 states.

3.   Participants' knowledge of unmanned aircraft probably varied to a large degree.

4.   There could have been participants who currently operate unmanned aircraft or have previously operated unmanned aircraft.

5.   The survey was distributed to 132 different locations via craigslist.org as well as the researcher's personal Facebook page and email contact lists.

Acronyms and Definitions

FAA – Federal Aviation Administration is the national aviation authority of the United States. An agency of the United States Department of Transportation, it has authority to regulate and oversee all aspects of American civil aviation.

Loiter - is a phase of flight. The phase consists of cruising for a certain amount of time over a small region. Some aircraft used for special purposes, like aerial reconnaissance or ground-attack aircraft, may have the loiter phase in mid-flight.

NAS – National Airspace System means the portion of the atmosphere controlled by a country above its territory, including its territorial waters or, more generally, any specific three-dimensional portion of the atmosphere.

RPA – Remotely Piloted Aircraft is an unmanned aircraft which is piloted from a remote pilot station.

UAS – Unmanned Aircraft Systems is that system whose components include the necessary equipment, network, and personnel to control an unmanned aircraft.

UAV – Unmanned Aircraft Vehicles are devices which is used, or is intended to be used, for flight in the air with no onboard pilot.

VTOL – Vertical Take-Off and Land is an aircraft which can hover, take off, and land vertically. This classification includes fixed-wing aircraft as well as helicopters and other aircraft with powered rotors.

Review of Literature

The literature review provides a review of the history of unmanned aircraft as well as the evolution of unmanned system from a simple device used for engagements during wars, to the advances to what the systems accomplish in today's ever-changing environment. The first section is devoted to the historical background of unmanned aircraft and their traditional uses. The second section explores how surveillance has evolved over time. Since, at least in part, unmanned aircraft can be used for surveillance, this study must include this discussion. The third section provides examples and insight into the different technologies that have been accepted by mainstream society along with comments about those which have not been accepted, including technologies used for commercial, law enforcement or governmental purposes. The final section is focused on technophobia (a psychological fear of technology) and how it can play a role in an individual's willingness to accept new technology applications.

Unmanned Aircraft Systems

Unmanned Aircraft Systems is a term that describes the latest type of aircraft developed and has been considered a vital asset by the United States military for over a decade. The history behind unmanned aircraft is as deeply rooted in aviation culture as the Wright Brothers, and has at least as long a history as well.

The Kettering Aerial Torpedo was considered to be the first pilotless aircraft which was not a balloon; it was built shortly after World War I (Shima & Rasmussen, 2009). The Torpedo was developed to launch from a rail, and upon reaching its target, its 180 pounds of explosives would detonate upon impact with the ground inside enemy territory. The automatic deployment of the weapon was based on the distance traveled by

counting the rotations of the propeller, and once reaching the destination, the engine would stop, the wings would detach, and it would hit its intended target (Goebel, 2010).

Leading to what would become the modern cruise missiles; the aerial torpedoes were developed shortly after World War I for the first time, and later led to the further development of radio-controlled target aircraft by the United States and the United Kingdom (Goebel, 2010) (Shima & Rasmussen, 2009). As the years progressed after World War I, the unmanned systems became more complex and started to show their capabilities on the battlefield; becoming more and more accepted from World War II through the present day. In the early days of the 1940s and 1950s, the unmanned aircraft was followed by a chase plane which would have an additional pilot commanding the unmanned aircraft until it reached its destination. It is not a widely known fact that unmanned aircraft have been used in every major conflict that has involved the United States since World War I (Bone and Bolkcom, 2004).

Just prior to the invasion of Iraq into Kuwait in 1990, Northrop Grumman had briefed United States Air Force (USAF) officials on how decoys could be effectively employed in the Middle East (Goebel, 2010). A project codenamed SCATHE MEAN was created to utilize decoys for the Gulf War. The decoys chosen for the project were the BQM-74C Chukar drones. The drones were used to create confusion for Iraqi radar sites, which allowed the United States fighters and bombers to destroy the radar sites with minimal losses to friendly forces (Goebel, 2010). The unit designated as the "4468th Tactical Reconnaissance Group" was created to employ the decoys in combat. The BQM-74C was typically launched from a DC-130, F-15, or F-16 (Goebel, 2010). However, the 4468th Tactical Reconnaissance Group modified surplus ground based launchers in the

Navy storage which led to a ground based launch system as a supplement to aerial launches. There were 37 BQM-74C aircraft launched successfully in three successive waves. Two of the three groups made it to their assigned targets, while one group was intercepted by Iraqi fighter jets (Goebel, 2010). After the Gulf War, drones, decoys, and UAS evolved even further and were utilized during military actions around the world including the Gulf War, and the conflicts in Somalia and the Balkans (Bone and Bolkcom, 2004).

The current large scale UAS systems being utilized by the United States military include the MQ-1 Predator, MQ-9 Reaper, and the RQ-4 Global Hawk. The Predator was introduced into operation in 1995's summer and was subsequently used during the invasion of Iraq in March 2003. They continue to be used in reconnaissance and air to ground combat in Afghanistan (Goebel, 2010).

History of Surveillance

Surveillance is defined as closely watching or continually observing a person or group, especially if the observation falls within a military or law enforcement context. There has been surveillance since the beginning of time and examples can be found throughout written history. The Bible references the context of surveillance in 2 Samuel as David watched Bathsheba. Surveillance again, comes into play when King David required a census, including counting individuals and the types of people that were within a specific region of the country as well as how fertile the land was within that providence (Laidler, 2008). Surveillance is labor intensive which can limit the effectiveness and length of surveillance efforts. However, as technology has improved, the ability to create

more surveillance has also improved. This results in observers having more information collected with less reliance on humans to obtain it.

Modern day surveillance has expanded as fast as technology. In the 1950's, individuals that wanted to spy on someone, did so with listening devices placed in the vicinity of the individual (Williams and Durando, 2013). Technology advanced over the years, and by the 1970's, devices were getting smaller. This enabled someone to place devices inside personal items. Better range allowed for more distant monitoring of the individual without fear of being caught (Williams and Durando, 2013).

In the 21st Century, and the era of the digital age, the ability to track and monitor individuals has become increasingly more sophisticated and complex. Wire taps on individual's phones were once conducted at the phone company, but now they are covered under the Communications Assistance for Law Enforcement Act due to the digital telephone networks in place (Supreme Court of United States, 2012). The law allows the information to be routed straight to law enforcement with just a few clicks on a keyboard. This action permits even more covert surveillance on individuals through the phone system. The law enables law enforcement to be aided in criminal investigations by the phone company through the use of wire taps. It also requires the public telecommunications companies to provide any phone conversation recordings, as well as the phone call data, to law enforcement officials for use in criminal investigations (Supreme Court of United States, 2012).

This new technology allows law enforcement to single out individual phone records covered under a specific warrant during an investigation. While the laws for wiretaps and communication surveillance have had over 50 years to be vetted in Laws

and through Supreme Court rulings, UAS usage as a surveillance tool within the United States is a brand new concept which will likely experience the same trials and errors as other forms of surveillance. The difference in today's society centers on the speed at which information is sent via online social media. Good or bad, the information can become ubiquitous, and accurate or inaccurate public opinion can be formed quickly as to whether or not they have accurate information available.

History of Aviation in Law Enforcement

Since the early 1900's, both fixed-wing and rotor-wing airplanes have been used to support various law enforcement missions. Soon after the Wright Brothers flew their airplane at Kitty Hawk, N.C., law enforcement saw a use for aircraft within law enforcement and the need was filled by using different types of aircraft in their work. The early application of aviation in law enforcement was formalized in the mid-1920s where police officers used either an acquaintance or friend's aircraft and accompanied them on a flight for law enforcement purposes (Solosky, 2009). However, the first recorded use of an aircraft for law enforcement occurred in 1914 in Miami, FL, where there was a theft of jewels from a local hotel. In this case, law enforcement officers trailed a ship bound for Bermuda (Police Aviation 1914-1990 2010). At first, single-engine, fixed-wing aircraft assisted in searches, aerial surveillance and transporting personnel or equipment from different locations (Solosky, 2009). Once the helicopter was introduced in the 1940's, law enforcement departments started changing from fixed-wing aircraft to the helicopter because of its ability to assist directly in rescue operations.

Current Legislature Regarding Aerial Surveillance

The United States Supreme Court has upheld different rulings throughout the history of aerial surveillance. One such case was Florida v. Riley, in which a Florida sheriff received information that an individual was growing marijuana on his property (Michael & Riley, 2013). Using a police helicopter, the sheriff flew over the property and saw inside a greenhouse, in the back of the property, what appeared to be marijuana plants (Michael & Riley, 2013). With that information a warrant was obtained and marijuana was ultimately found inside the greenhouse. The case had arguments on both sides of the issue as to whether the aerial surveillance was legal without a warrant or if it needed to have a warrant under the Fourth Amendment of the United States Constitution. The final ruling by the United States Supreme Court reversed the ruling by the Florida Supreme Court stating that the defendant, Mr. Riley, did not have an expectation that the greenhouse was protected under the Fourth Amendment simply due to an aerial observation (Florida, Michael & Riley, 2013).

The Supreme Court upheld the ruling stating the national airspace above someone's residence can be used for surveillance without a warrant and is within the legal realm of law enforcement. An individual conducting illegal activity in plain view of other individuals from an aircraft, whether on private property or not, is not covered under the protection of the Fourth Amendment (Florida, Michael & Riley, 2013).

A second case involving aerial surveillance and the Fourth Amendment is found in the case of California v. Ciralo in which police used a private aircraft to fly over the defendant's property, at approximately 1000 feet above ground level. Observations were used by the police officer aboard, to obtain a search warrant which resulted in the

discovery of marijuana on the property. The ruling by the Supreme Court was that there was no violation of Fourth Amendment rights since there was no perceived privacy from aerial observations (Supreme Court of United States, 2012). This case demonstrates not only that law enforcement aircraft are allowed to fly over an individual's property looking for illegal activity, but private aircraft with law enforcement on board are not required to have a warrant or to have a probable cause to warrant further investigation.

While the Supreme Court has made several rulings regarding the Fourth Amendment and aircraft utilization for surveillance purpose, lawmakers are still adjudicating state or federal regulations which will govern the usage of unmanned aircraft for such purposes. Some states have started to enact, or, at a minimum, have introduced laws to govern unmanned aircraft. See Figure 1 below.
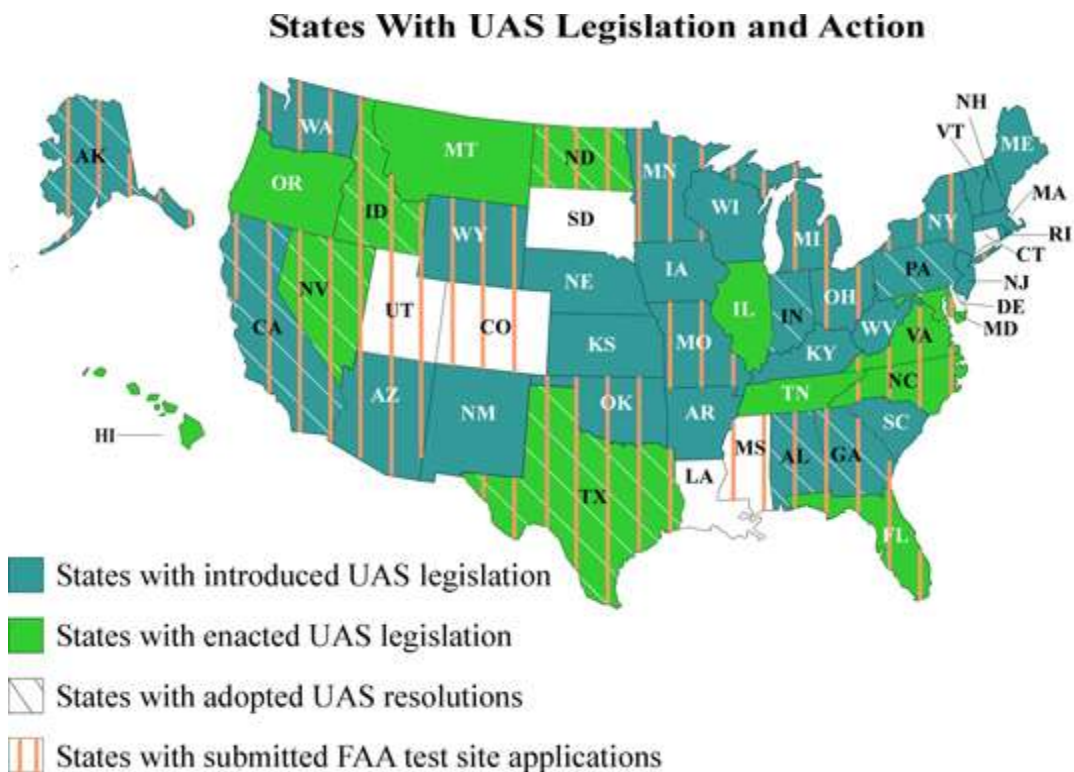

Figure 1. States with UAS Legislation and Action (Unmanned Aircraft, 2013)

Figure 1 shows that 43 of 50 states, at the time of this publication, either had enacted legislation or had introduced legislation involving UAS aircraft operations within their respective states (Unmanned Aircraft, 2013). Two states, South Dakota and Louisiana, (as indicated by the solid white color) are the only states who have adopted UAS resolutions that did not submit a proposal to the FAA in its solicitation to establish six test sites for the integration of unmanned aircraft into the national airspace. In 2013, there were over 100 Bills introduced across 43 states regarding UAS. Some of the common issues being addressed currently define what operating roles would be allowed by different states (2013 Unmanned Aircraft, 2013). A main theme, found throughout each of the legislation proposals involving the use of UAS for law enforcement require that a warrant must first be obtained prior to utilizing a UAS (2013 Unmanned Aircraft, 2013). One law, enacted in Idaho, stopped all UAS operations in the state for law enforcement purposes, except in the case of a bona fide emergency (Bohm, 2013). This law significantly restricts the use of an unmanned aircraft to take pictures of private property without the written consent of the owner (Bohm, 2013).

Current Surveillance Methods Employed

There are numerous ways in which aerial surveillance can be utilized. The most common, or well recognized method, incorporates the use of a helicopter. As of 2009, the helicopter was used in over 176 different aviation departments spanning the Federal, State, County and local levels of law enforcement (Solosky, 2009). Helicopters have varying missions throughout the spectrum of law enforcement and one of them is aerial surveillance. The helicopter is able to fly over and, with the use of high tech equipment, gather different types of information (Solosky, 2009). A second method of aerial

surveillance utilizes fixed-wing manned aircraft, this category of aircraft range in size from single-engine aircraft to large multi-engine jet aircraft (Solosky, 2009). One example of a smaller single-engine aircraft, used for aerial surveillance, is the Cessna C-172 Skyhawk (Cessna, 2012). This aircraft is able to fly for up to five hours and loiter over a target to gather intelligence. Since this type of aircraft is common among general aviation, it does not tend to draw as much attention to individuals as helicopters (Cessna, 2012).

Public Perceptions of UAS

Public perceptions and opinions of UAS operations vary greatly throughout the United States. These range from opposition to any UAS over their community to complete support of UAS missions. Some of the anticipated uses for unmanned aircraft outside the realm of law enforcement include aerial photography for home sales, construction sites, and major motion pictures. These activities are currently being conducted by manned aircraft. The public perception of an unmanned aircraft flying over their neighborhoods may generate a different perception.

A recent study published in the Christian Science Monitor involving the support of civil unmanned aircraft systems was conducted by the Aerospace Industries Association (AIA) in 2013 and had almost 3,800 individuals from the United States as respondents for the survey (Aerospace Industries Association, 2013). The survey found that over half of the individuals were in favor of an increased use of unmanned aircraft with 27% opposing and 20% being neutral to the idea (Aerospace Industries Association, 2013). The survey concluded that the top two issues which needed to be addressed in the future relate to the privacy concerns of the unmanned aircraft conducting operations and

the safety of the individuals on the ground. According to this study, 80% of the individuals surveyed stated they were somewhat aware, if not very aware, of their understanding of how unmanned aircraft are presently being used for non-military purposes (Aerospace Industries Association, 2013). This study shows how there are varying opinions regarding UAS operations and the continuing issue of privacy. While this study does not address how to change public perception on the perceived loss of privacy with the implementation of UAS operations, it does address issues regarding the public's perception of UAS operations.

Successful Technologies

With every new technology, some make it into the marketplace and into consumers' hands while others fail soon after being released. One of the most recent successful technologies is the iPad and its variation, the iPad mini. Apple has sold over 170 million iPads since it was released in April of 2010 (Ingraham, 2013). Another example of a successful technology is the compact disc (CD). While the CD is no longer prominent in mainstream society as one of the most popular forms to play music, it has been replaced by newer technology such as digital downloaded music and online streaming music. The CD gave way to technological advances such as the digital video disc (DVD) and, most recently, the Blu-ray disc. These are just a few examples of technologies which were not only successful but revolutionized their particular industry.

Fear of Technology and the Unknown

The saying that "individuals do not like change," seems to repeat itself through numerous online news articles and blogs (Rosabeth, 2013; Halvorson, 2011; 5 Reasons People Don't Like Change and 5 Things You Can Do About It, 2012). There are many

different examples of people who fear technology or have fears of the unknown. The clinical term for a fear of technology is technophobia. Technophobia is the fear or distaste of any complex technology or any advanced system; typically referring to computers, however covering all technology (Luddite, 2013; Oxford Dictionary, 2013). Technophobia is an irrational fear of technology; however, individuals typically believe their fear is justified. A general term used today regarding someone who has an opposition to technology or modernization is a Luddite. This term came from the 19th century and refers to artisans of that time that were against different types of modernization of the textile manufacturing processes (Luddite, 2013).

There are many individuals living with different levels of stress due to technology. Individuals can have a condition called Techno-Stress, which is a disease that came about from the computer age and is characterized by the inability to handle new technologies in a socially acceptable manner. This condition can manifest itself in numerous ways such as the inability to sleep, headaches, nauseas and even nightmares (Brod, 1984). Techno-Stress may be a contributing factor to an individual's acceptance of new technology, such as unmanned aircraft. Technology today are being received and fielded at a faster pace than previous technology. This faster pace could play a factor in one's Techno-Stress level and willingness to accept a newer technology than one to which a person was previously accustomed.

Acceptance Model of Technology

The Technology Acceptance Model is a model which provides a theory of how an individual will accept a specific technology. Venkatesh and Davis (2000) recently updated the model which was originally created in the 1980's. The model has been used

in numerous studies and uses a number of factors to describe an individual's decision to

accept a new piece of technology (Venkatesh & Davis, 2000) Figure 2 shows the original

acceptance model designed by Davis which has been used to assist in the implementation

of new technologies (Venkatesh & Davis, 2000). While there is an updated model, the

original is simplified and more relevant to this study due to its simplistic design. It shows

how the public's perception of technology can move to the adoption of that technology

by means of its attitude and behavioral intentions. This helps to understand a primary

influence for the survey responses of those participating in this study.
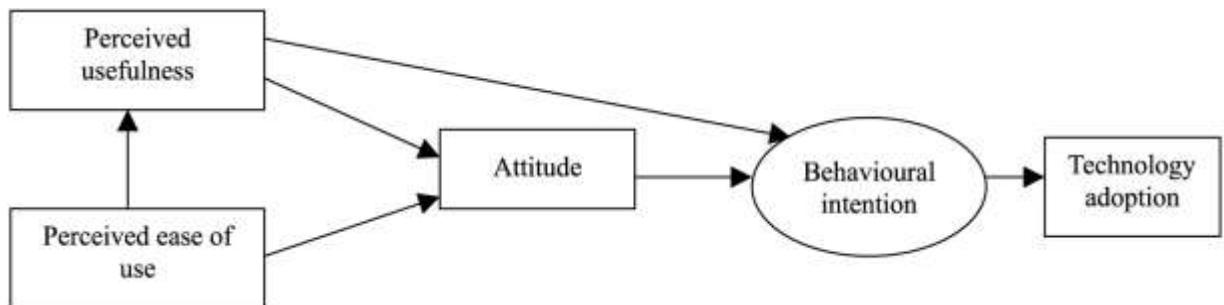
Figure 2. Technology Acceptance Model (Venkatesh & Davis, 2000)

Conclusion

This literature review leads to a better foundation for understanding public

perceptions regarding UAS operations. This study is intended to measure the public

perceptions and analyze them in order to recognize the willingness of people to accept

and adopt UAS. UAS use within the United States for commercial and law enforcement

purposes has not come to fruition and currently the jobs are being performed by manned

assets. UAS use is rooted deep into the history of aviation, though it was widely unknown

to most citizens until it was publicized during the 2001 and 2003 invasions of

Afghanistan and Iraq. History allows for an understanding of where the platform has come from and where it could be headed in the future.

While surveillance is not the only aspect of the capabilities of an unmanned aircraft, it along with the law enforcement aspect, is the main subject of this study. The constitution and other laws generally outline what can legally be accomplished under surveillance; current laws do not specifically address unmanned aircraft use in surveillance. States are quickly adopting new laws and restrictions or limitations under which UAS aircraft may operate. Understanding the individual citizen's concerns regarding UAS will allow lawmakers to pass laws that balance the demand for this new technology and the rights of the citizens concerning privacy or other issues that arise.

There have been similar studies by the *Christian Science Monitor* involving the use of unmanned aircraft there is still a lack of understanding of what the people feel about UAS uses. While the Monitor study centered on the individuals' understanding of UAS and whether they favored increased use of UAS for commercial operations it did not address the specific areas of approval.

The difference between a successful technology and one that fails is directly related to the perception of people that will use or be affected by the technology. High Definition Digital Video Device (HD-DVD) and Blu-ray are examples where one succeeded and the other did not.

There is always a fear of the unknown, such as how new technology might help or hurt the individual or community. Individual apprehension about a specific item of technology requires an understanding how to overcome one's fear (Rosabeth, 2013). One has to understand why he or she is apprehensive in the first place. Someone with a

predisposition to fear technology, such as an individual with Techno-Stress, could have a higher degree of resistance to the technology. Even if the individual is not using the technology, such as an unmanned aircraft flying over someone's city or neighborhood, they are affected, at least in their minds, by its operation. Accepting a new technology takes several key factors, and there has to be a perceived usefulness for the technology. Without a benefit or something to gain from using or having the product used, there will be resistance to the new technology.

No one person can perceive all the issues people could have regarding UAS flying in the national airspace. The understanding of some of the possible concerns help better understand how to handle those issues.

CHAPTER II

METHODOLOGY

Introduction

This quantitative study examines the perceptions of individuals regarding the use of unmanned aircraft within the United States airspace. The following methodology sections outline how the research questions were created, and how the data will be analyzed.

Setting

This study utilized a survey, see attached Appendix A, which was administered completely online. No specific group or location was targeted. The individuals self-selected themselves to participate in the study. The sample was a sample of convenience which utilized different methods to gain participants to complete the survey.

Participants

The participants of this study were individuals within the United States and the population for the study consisted of members from the general public. This study was partially biased due to the usage and distribution through the researcher's personal Facebook page and email contact list.

Selection Criteria

The individuals selected had the following characteristics:

1. A current residence within the United States.

2. Varying degrees of understanding of an unmanned aircraft system.

3. Internet access.

4. Eighteen years of age or older.

Data Collection

The data was received from a single-source online service provided by the qualtrics.com research suite. The survey tool was distributed via email, online forums and blogs, as well as postings on numerous free websites which allowed for the free distribution of newsworthy events and general postings. The survey consisted of four sections. The first section required a participant's informed consent. The second section of the survey gathered demographic information. The third portion of the survey was comprised of quantitative questions. In some questions, respondents selected different types of unmanned aircraft that might be used in law enforcement applications. There were also questions regarding the amount of technology the respondents might have owned; such as a laptop, a personal computer, a smart phone, or a tablet.

Limitations and Assumptions of the Study

This research was conducted under several assumptions as articulated in chapter one. The study is also limited by the confines of the researcher's online expertise and ability to distribute the survey effectively. The researcher assumed that all individuals met the qualifications to be in the study and all individuals were forthcoming about their understanding and thoughts about unmanned aircraft systems.

Completed Data Analysis

This study used SPSS statistical software for computations and identification of significance. The survey was made available online for a two-week period, at which time, if an individual volunteered to take the survey, it was completely anonymous and no identifying information was collected or recorded. Using SPSS 21 statistics software, descriptive statistics were collected from the data. A one-way analysis of variance (ANOVA) assessed potential relationships between the independent variables and the dependent variables to determine significance. Significance in all statistical tests were set at a minimum of $p < 0.05$. Research Questions 1, 4, 5 and 6 were analyzed using a descriptive statistic. Research Questions 2 and 3 were analyzed using a One-Way ANOVA.

<div align="center">Protection of Human Subjects</div>

Participation in this study was voluntary for all respondents. The plan for the study was sent to the Institutional Review Board (IRB) with approval number IRB-20130-148 at the University of North Dakota. This study was reviewed and approved by the University of North Dakota's Institution Review Board. At the time of the study, there were no foreseeable risks to the participants. In order to keep all data and participants confidential, all identifying information was removed from the report. If there was only one specific characteristic of an individual within the study, it was de-identified or excluded if accidental identification would be possible. All records and data used during the study are stored in a safe location and are password protected to further ensure data was only accessible to the researcher and research advisor. After a period of three years, all records used in this study will be destroyed.

CHAPTER III

DATA ANALYSIS

Demographics of the Participants

The total sample size consists of 535 (N=535) individuals who completed the survey. To get the widest dissemination of the survey as possible, online forums and social media websites were utilized. Appendix B includes a full list of websites that were used to distribute the survey to as many individuals as possible. Appendix C shows the message potential participants saw before entering the survey site. Of these total participants, 489 disclosed their gender; there were 426 males and 63 females. Figure 3 illustrates the gender breakdown.
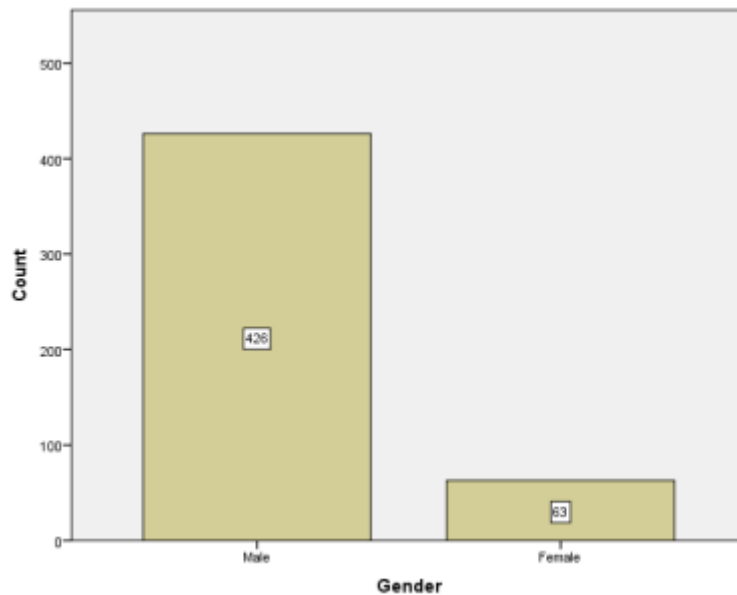
Figure 3 Participants Gender

There were 494 participants that provided their age. 20 individuals were aged 18-23; 60 individuals were aged 24-33; 63 individuals were aged 34-40; 90 individuals were aged 41-48; 229 individuals were aged 49-67; and 32 individuals were aged 68 or older. Figure 4 illustrates participant age demographics. According to this figure, it is clearly stated that a variety of people from different age groups are enclosed in the sample population of this research. This indicates that the research was not centered or focused on a particular age group of people rather it covers people from all age groups.
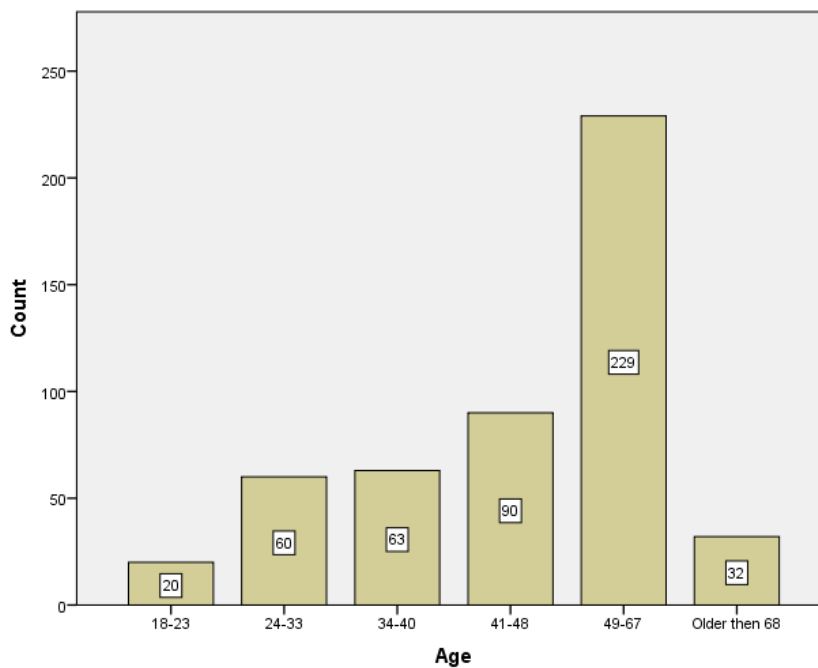
Figure 4. Participants Age

There were 455 participants that provided their race information. 419 individuals were White; Seven Black or African-Americans; six individuals identified themselves as Asian; six American Indians; nineteen individuals selected other; and 37 individuals preferred not to answer the question. Figure 5 illustrates participant racial demographics. Similar to the last figure outcomes, this information from this figure also demonstrates that there is no discrimination done between the research participants. Participants from every race were afforded an opportunity to participate in the research survey to enhance the credibility of the research. By involving participants from each race, it is assured that people from all races are valued. However, since there is such a low number in all of the different categories except one, it would be impossible to make any determinations or conclusions based on the small sample size from each of the different racial categories.
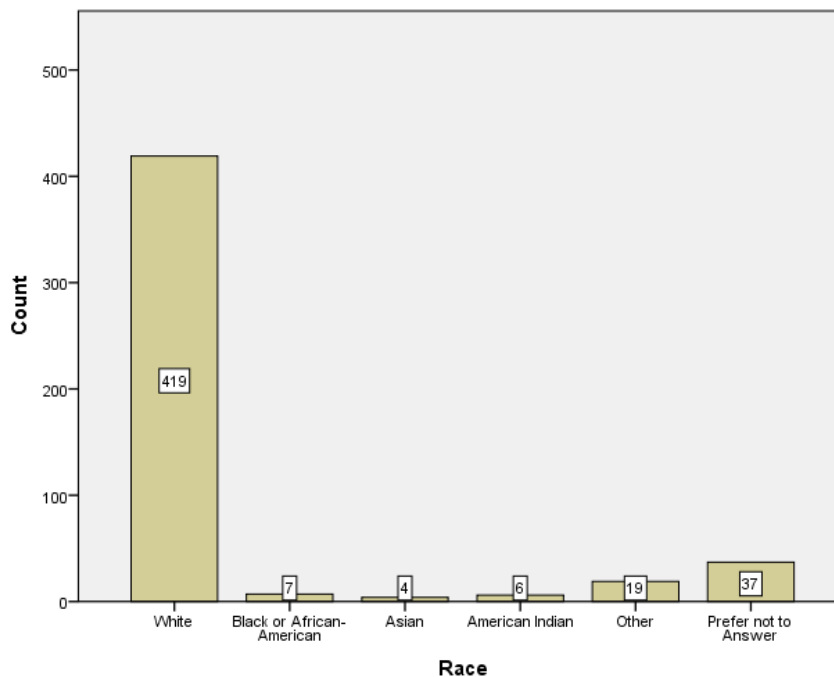
Figure 5. Participants Race

There were 494 participants that provided information about their highest level of education. Thirteen of the individual had less than a high school diploma; 80 either had a high school diploma or equivalent. The largest category included those with some college but no degree with 171 individuals; 68 individuals had an associate degree; 90 had their bachelor's degree; 40 had their master's degree and 32 individuals had their Doctorate degree. Figure 6 illustrates participant racial demographics. This figure illustrates the number of individuals from a different education level which enrolled to participate in the research. With the help of this figure, it is clear that a variety of people from different educational level acquire knowledge about the UAS and a variety of people were encouraged to provide their perspective about the modern technology.
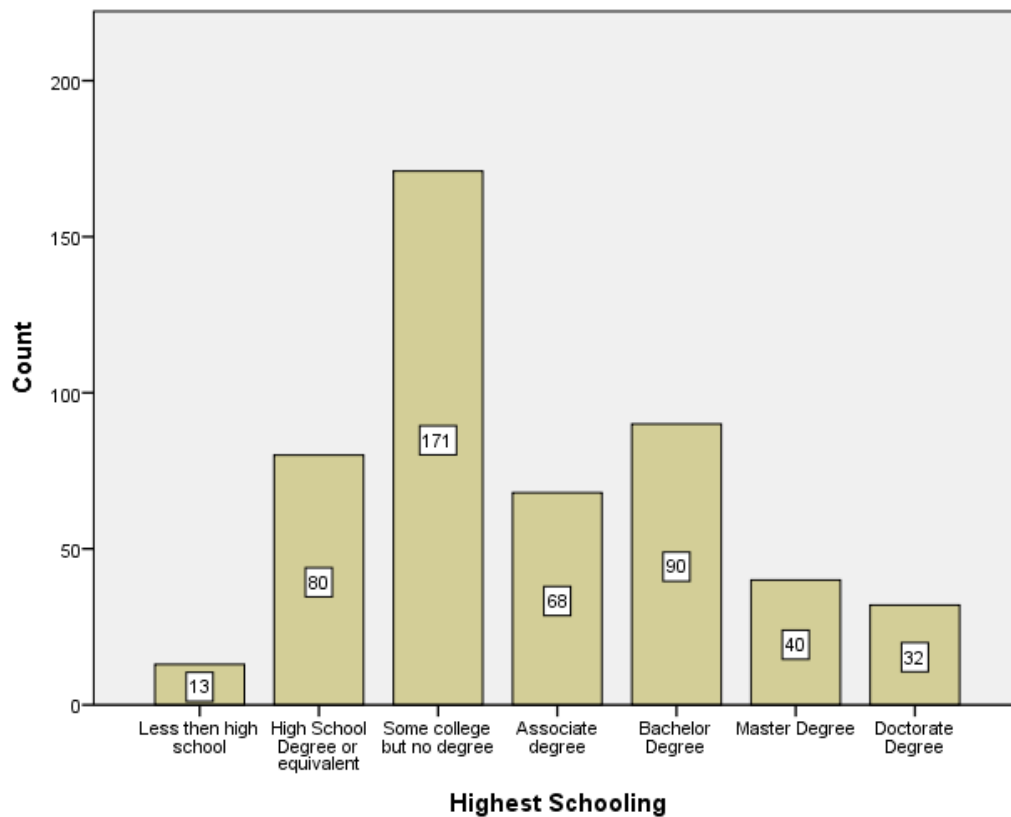
Figure 6. Participants Highest Education

There were 479 participants who disclosed the region of the United States they reside and 475 participants disclosed their city size in which they currently reside. Figure 7 illustrates participant location within the United States. This figure demonstrates that people from diverse areas of the country participated in the research study. The U.S. was divided up by regions instead of states, as illustrated in the survey tool, to allow for general groups to be created.
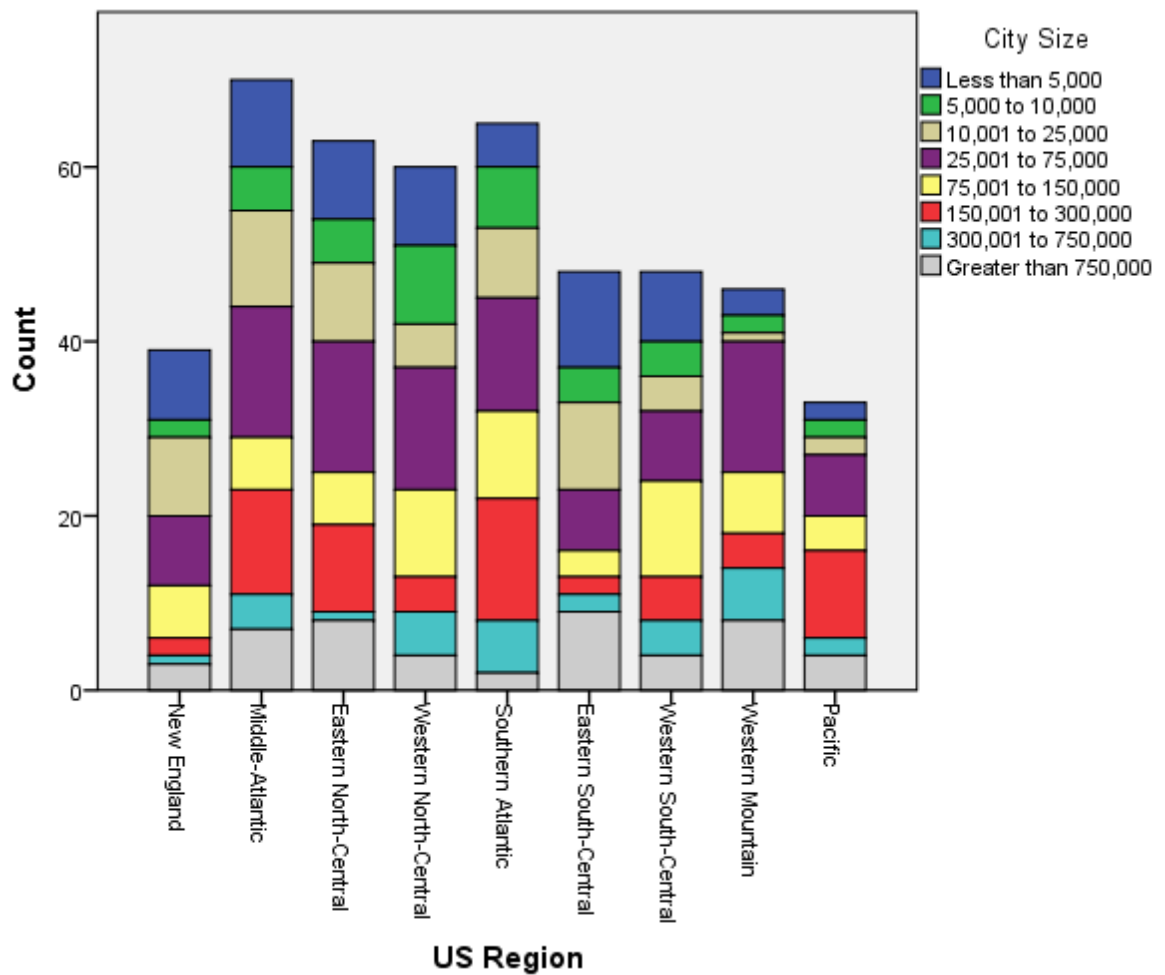
Figure 7. Participant's City Size broken down by Region

<div align="center">Statistics</div>

After compiling all the data, each research question required statistical analysis to answer the research questions posed in Chapter 1. Groupings of regions allowed for more streamlined data to be retrieved.

Research Question 1: Is there a difference of acceptance between manned and unmanned law enforcement surveillance? A frequency descriptive statistic was conducted to answer question 1. The data for research question 1 is shown in Table 9. When broken down to a simpler form of either "approve" or "disapprove", Tables 1-8 shows the approval and disapproval percentages by each type of unmanned and manned aircraft on the survey.

Table 1. Unmanned Micro Size Approve/Disapprove

		Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
	Disapprove	290	54.2	61.8	61.8
Valid	Approve	179	33.6	38.2	100.0
	Total	469	87.8	100.0	
Missing	System	66	12.2		
Total		535	100.0		

Table 2. Unmanned Rotocopter Approve/Disapprove

		Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
	Disapprove	285	53.2	61.2	61.2
Valid	Approve	181	33.8	38.8	100.0
	Total	466	87.0	100.0	
Missing	System	69	13.0		
Total		535	100.0		

Table 3. Vertical Take-off and Land (VTOL) Approve/Approve

		Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
	Disapprove	293	54.8	62.9	62.9
Valid	Approve	173	32.3	37.1	100.0
	Total	466	87.1	100.0	
Missing	System	69	12.9		
Total		535	100.0		

Table 4. Unmanned MQ-9 Reaper Approve/Disapprove

		Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
	Disapprove	295	55.1	64.7	64.7
Valid	Approve	161	30.1	35.3	100.0
	Total	456	85.2	100.0	
Missing	System	79	14.8		
Total		535	100.0		

Table 5. Unmanned Global Hawk Approve/Disapprove

		Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
	Disapprove	294	55.0	64.5	64.5
Valid	Approve	162	30.2	35.5	100.0
	Total	456	85.2	100.0	
Missing	System	79	14.8		
Total		535	100.0		

Table 6. Manned Cessna Skyhawk C-172 Approve/Disapprove

		Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
	Disapprove	109	20.4	24.7	24.7
Valid	Approve	333	62.2	75.3	100.0
	Total	442	82.6	100.0	
Missing	System	93	17.4		
Total		535	100.0		

Table 7. Manned Helicopter Approve/Disapprove

		Frequency	Percent	Valid Percent	Cumulative Percent
	Disapprove	88	16.4	19.9	19.9
Valid	Approve	355	66.4	80.1	100.0
	Total	443	82.8	100.0	
Missing	System	92	17.2		
Total		535	100.0		

Table 8. Manned Pilatus PC-12 Approve/Disapprove

		Frequency	Percent	Valid Percent	Cumulative Percent
	Disapprove	115	21.5	25.9	25.9
Valid	Approve	329	61.5	74.1	100.0
	Total	444	83.0	100.0	
Missing	System	91	17.0		
Total		535	100.0		

Table 9 shows the approval and disapproval ratings from least to greatest approval rating. The MQ-9 Reaper had the lowest approval rating with 35.3% for either local, federal, or both levels of law enforcement. The highest approval rating for unmanned aircraft was the rotorcraft copter with 38.8% approval for either one or both types of law enforcement uses. For the manned aircraft, the helicopter had the largest approval rating of 80.1% for one or both types of law enforcement uses.

Table 9. Approval Ratings Unmanned/Manned

Aircraft Type	% Approve	% Disapprove
Reaper	35.3	64.7
Global Hawk	35.5	64.5
Scan Eagle	37	63
VTOL	37.1	62.9
Micro	38.2	61.8
Fire Scout	38.3	61.7
Rotor-copter	38.8	61.2
PC-12	74.1	25.9
C-172	75.3	24.7
Helicopter	80.1	19.9

Research question number two asks, "Does an individual's demographic information have a determining effect on the acceptance of unmanned aircraft?" Significance was found in two of the seven types of unmanned aircraft as it relates to age. As shown in Figure 8, age group 24-33 showed the lowest acceptance rate of the MQ-9 Reaper being utilized in a local or federal law enforcement role. As shown in Figure 9, the 24-33 age groups also showed the lowest acceptance rate of the Global Hawk. Table 10 shows there was significance found with both the MQ-9 Reaper $p=.04$ and the Global Hawk $p=.031$. This significance shows that individuals in the age group of 24-33 showed a significantly lower acceptance rate of the MQ-9 Reaper and the Global Hawk aircraft. It also shows that there was no significance found for any of the other unmanned aircraft.

Table 10. Approve/Disapprove (D/A) Unmanned/Manned

		Sum of Squares	df	Mean Square	F	Sig.
Micro	Between Groups	1.356	5	.271	1.148	.334
	Within Groups	109.180	462	.236		
	Total	110.536	467			
Rotocopter	Between Groups	1.334	5	.267	1.122	.348
	Within Groups	109.212	459	.238		
	Total	110.546	464			
VTOL	Between Groups	1.639	5	.328	1.406	.221
	Within Groups	106.998	459	.233		
	Total	108.637	464			
Fire Scout	Between Groups	2.371	5	.474	2.022	.074
	Within Groups	107.871	460	.235		
	Total	110.242	465			
Scan Eagle	Between Groups	2.508	5	.502	2.173	.056
	Within Groups	103.859	450	.231		
	Total	106.366	455			
MQ-9 Reaper	Between Groups	2.657	5	.531	2.353	.040
	Within Groups	101.374	449	.226		
	Total	104.031	454			
Global Hawk	Between Groups	2.813	5	.563	2.488	.031
	Within Groups	101.508	449	.226		
	Total	104.321	454			

Figure 8, shows the results obtained regarding a MQ-9 Reaper/ Age. According to the values obtained for this, it is clearly shown in the graph that the maximum acceptance of this technology is seen in people who are older than 68 whereas the lowest level of

acceptance is seen in the age group of 24-33. Individuals over the age of 68 were more
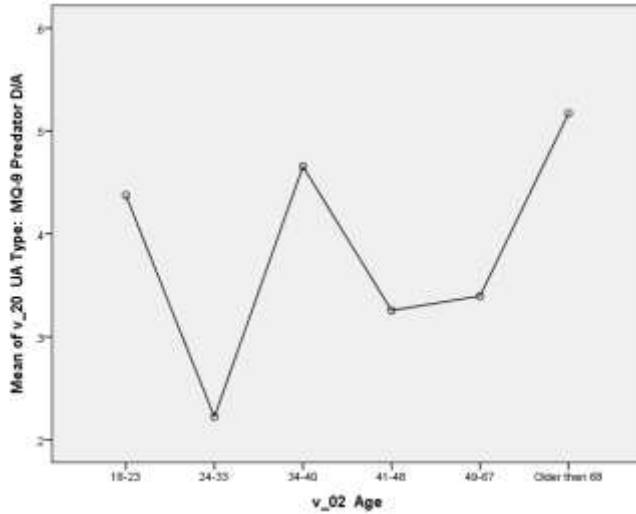
accepting of UAS.

Figure 8. MQ-9 Reaper/Age

Figure 9 shows the data obtained for the Global Black Hawk. For this technology,

the same results were obtained as for the MQ-9 Reaper as same age group of people

showed minima and maxima non-acceptance and acceptance level of the modern

technology, respectively.
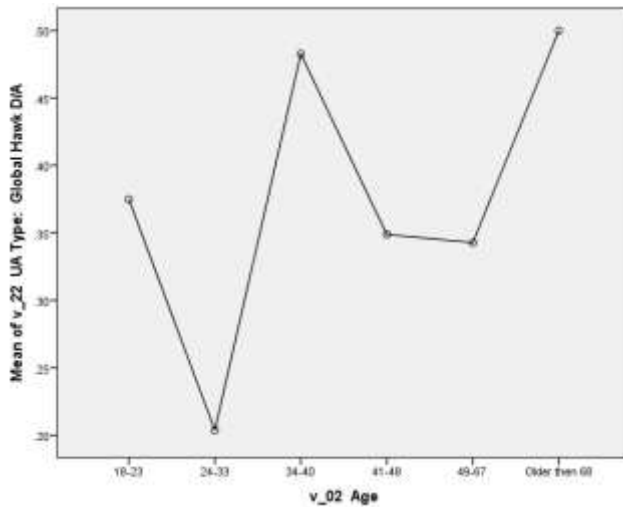
Figure 9. Global Hawk/Age

Regarding acceptance of unmanned aircraft, there was found to be significance with regards to the M-9 Reaper and gender p=.037 using a Chi-Square test. Females had a 47.5% acceptance rate versus males having a 33.5% acceptance rate.

Figure 10, shows the data collected with respect to the educational level of the participants. The figure shows that the highest approval of VTOL is seen in the participants holding Master's Degree whereas the lowest approval level is seen with participants whose educational level was below high school.

Figure 10. VTOL Approve/Disapprove Regarding Education

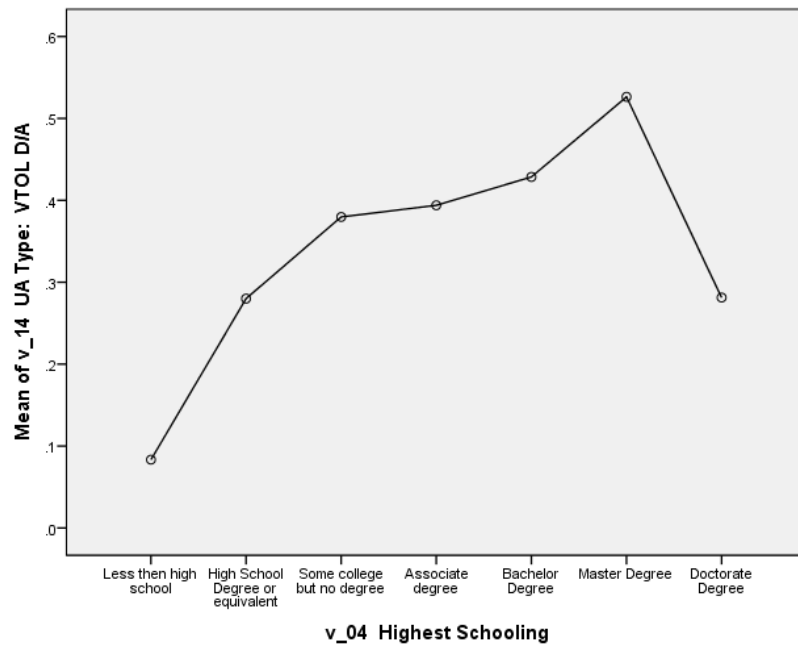Figure 11, which show results of the approval or disapproval of the Fire Scout with respect to the highest education of the participant; also tells that the approval or disapproval rate is affected by the level of education present with an individual. The highest approval is seen in the individuals who hold a Master's Degree and the lowest is seen in the individuals who are below the level of high school. Furthermore, a decline of approval level is also seen while the education level increases. It is seen in the beginning of the graph that with an increase in the educational level, an increase in the approval level is obtained but this is peaked at the Master's Degree level and declines when it comes to the Doctorate Degree level.
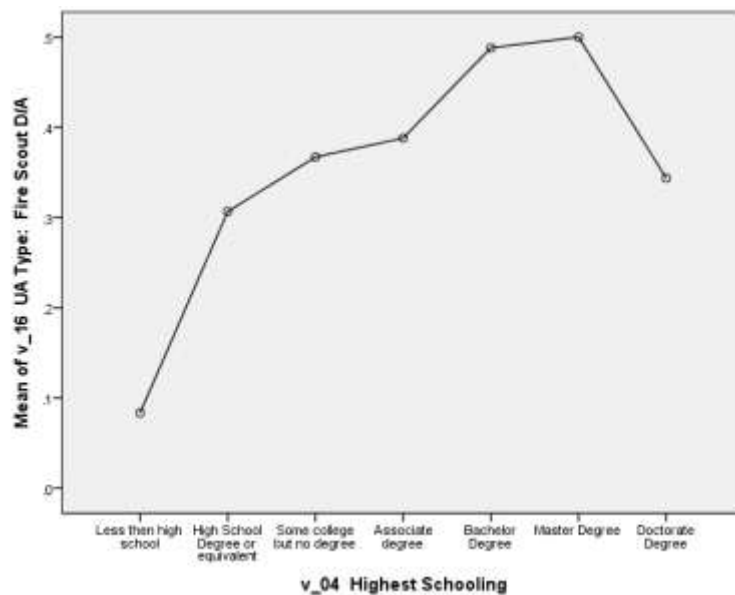

Figure 11. Fire Scout Approve/Disapprove Highest Education

Table 11. Acceptance of Unmanned Aircraft with Highest Education Level

		Sum of Squares	df	Mean Square	F	Sig.
Micro D/A	Between Groups	2.414	6	.402	1.716	.115
	Within Groups	108.122	461	.235		
	Total	110.536	467			
Rotocopter D/A	Between Groups	2.786	6	.464	1.973	.068
	Within Groups	107.760	458	.235		
	Total	110.546	464			
VTOL D/A	Between Groups	3.113	6	.519	2.252	.037
	Within Groups	105.523	458	.230		
	Total	108.637	464			
Fire Scout D/A	Between Groups	3.053	6	.509	2.179	.044
	Within Groups	107.189	459	.234		
	Total	110.242	465			
Scan Eagle D/A	Between Groups	2.334	6	.389	1.679	.124
	Within Groups	104.033	449	.232		
	Total	106.366	455			
MQ-9 Reaper D/A	Between Groups	2.040	6	.340	1.493	.179
	Within Groups	101.991	448	.228		
	Total	104.031	454			
Global Hawk D/A	Between Groups	1.688	6	.281	1.228	.290
	Within Groups	102.633	448	.229		
	Total	104.321	454			

The level of education versus the acceptance rate of the unmanned aircraft in law enforcement showed numerous levels of significance, see Table 11. This shows there was significance between the VTOL p=.037 and the Fire Scout p=.044. See Figure 10 and Figure 11 for a distribution of education level and acceptance. This shows a significant

difference between individuals with less than a high school diploma and the acceptance

rate increases as your education level increases until it peaks at the master's level and

drops down for individuals with their doctorate degrees.

Research question number three states, "Are there areas of the U.S. where there

are higher or lower acceptance rate of unmanned aircraft uses?" There was no

significance found regarding where a person lives as it relates to the acceptance of

different types of unmanned or manned aircraft.

Research question number four states, "Are there missions for unmanned aircraft

that are more widely accepted then others?" The lowest acceptance rate was for law

enforcement with weapons on board at 12.7% or 68 individuals. The two highest were

weather monitoring (61.3%) and search and rescue showing high percentage (64.9%).

These were the only two that were over 50%.

Table 12. Acceptance of Different Types of Unmanned Aircraft Missions

Type of Mission	Accept
Law Enforcement (Weapons on Board)	12.7%
Crowd Control	19.6%
Covert Surveillance	19.8%
Aerial Application	24.5%
Cargo Transportation	30.8%
Law Enforcement	32.0%
Traffic Observation/reporting	39.6%
Aerial Survey (Farming)	44.5%
Pipeline Patrol	48.6%
Weather Monitoring	61.3%
Search and Rescue	64.9%

Research question 5 asks whether individuals that tend to more readily accept

other technologies will also accept unmanned aircraft at a higher percentage rate. There

were several tests run to find out if there was any relationship between the use of

technology and the acceptance of unmanned aircraft. The first measured unmanned

aircraft against how long one had owned a Smartphone, if they owned one. There was no

significance found regarding how old one's Smartphone was in relation to the acceptance

of UAS. The second item was how old one's computer or laptop was, if the respondent

owned one. Again there was no significance found in the relationship to the length of

time one owned a computer/laptop and acceptance of unmanned aircraft. Third, analyzed

how old an individual's tablet was, if they owned one. There was no significance found

in relation to the length of time of owning a tablet and the acceptance of UAS. The

acceptance rate of an individual with a tablet, which was less than six months old, was

16.1% for the ScanEagle, whereas an individual who either owned a tablet six months or

longer, or did not own a tablet, had an average acceptance rate of 37.92%. The highest

acceptance rate was 44.6% for individuals who owned a tablet for 12 months or longer.

Research question number six asks whether the size of an unmanned aircraft has

an effect on the acceptance of that unmanned aircraft (Table 13). There was no

significance found between the sizes of the aircraft and the overall acceptance of UAS.

The micro unmanned aircraft did not have normal data and as such was excluded from

the test.

Table 13. Unmanned Aircraft Privacy Significance

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	12.341	3	4.114	1.415	.237

CHAPTER IV

DISCUSSION

Perception is difficult to measure. A participant's perception of their acceptance of unmanned aircraft in the national airspace could have been influenced by many factors.

The purpose of this study was to determine if there were factors which individuals possessed what would indicate a difference in acceptance of unmanned aircraft in the national airspace system. This was satisfied by answering the six research questions.

1. Is there a different rate of acceptance between manned and unmanned law enforcement surveillance?

2. Does an individual's demographic information have a determining effect on the acceptance of unmanned aircraft?

3. Are there areas of the country where there is a higher or lower acceptance rate of unmanned aircraft uses?

4. Are there missions for unmanned aircraft that are widely accepted than others?

5. Do individuals with more acceptance of other technology accept unmanned aircraft at a higher rate?

6. Do the different sizes of the unmanned aircraft have an effect on the acceptance rate of the unmanned aircraft?

Research Conclusion

Research question one was answered with comparative approval of either local federal or both for law enforcement uses. This data was then compared to the disapproval rating. The research found that there was a 37.2% approval rating versus a 62.8% disapproval rating for unmanned aircraft versus a 76.5% approval rating versus a 23.5% disapproval rating for manned aircraft. This number was found to be significant and showed there was a wide disparity between the approval rating of the manned aircraft and the disapproval rating of unmanned aircraft. There could be numerous factors that contribute to the lack of approval of unmanned aircraft, for example, the lack of understanding of how the aircraft works and operates could have been a factor in the difference.

The research shows there is a higher level of acceptance for manned aircraft versus unmanned aircraft when used for law enforcement. While the exact reason why there is such a difference between acceptance of unmanned and manned aircraft was not determined, the difference points to an issue which may need resolution before the FAA opens the airspace fully to unmanned aircraft.

Research question two was answered by breaking down the individual's demographic information and comparing it to their acceptance rate for unmanned aircraft uses. There was significance found between two of the seven different types of unmanned aircraft. Significance was found between the MQ-9 and the Global Hawk as it related to the age of the individual as to whether they approved or disapproved of their use. Regarding the MQ-9 Reaper and participant's age affecting the acceptance rating showed the highest acceptance rating for individuals older than 68 followed by ages 34-40 which

was above 40% well ages 24-33 had the lowest of 20%. One could theorize that it would have been the opposite, given that individuals in the 24-33 age categories have had more advanced technologies available throughout their entire lives. Age only showed significance in the two largest unmanned aircraft.

An individual's marital status made no difference in the acceptance of unmanned aircraft versus manned aircraft. Differences in earnings of an individual also showed no significance as to the acceptance rate of unmanned versus manned aircraft.

Additionally, education level was compared to the acceptance rate. The lowest acceptance rating for each type of unmanned aircraft was individuals with less than a high school degree, and was limited to individuals over the age of 18. The acceptance rates for each type went higher starting at fewer than 10% and peaking at around 50% at the Master's degree level before dropping down again for individuals with a Doctorate degree. The higher acceptance rate correlating to a higher education was what the research anticipated, though the drop for individuals with a Doctorate degree was unanticipated.

Research question three showed that there were no areas of the country where there was a significantly higher acceptance rate of unmanned aircraft than others. There were areas which were slightly higher than others, but a larger sample size would have to be utilized to confirm this information to be completely accurate.

Research question four was answered by comparing the highest acceptance rate of unmanned aircraft missions to the rest of the missions listed. The highest accepted mission was search and rescue where 64.9% of participates stated they were willing to accept an unmanned aircraft were used. The lowest mission acceptance was "law

enforcement with weapons on board" which was an anticipated result. Law Enforcement as a mission was at 32% which correlates with the first question of a different acceptance rate of unmanned versus manned for law enforcement which was 30.2-33.6% depending on the type of unmanned aircraft. The anticipated result of search and rescue having a high level of acceptance was found to be true. Though it was lower than anticipated it was still 64.9% acceptance. Weather monitoring was also high with 61.3% followed by 48.6% for pipeline patrol. Aerial Survey (Farming) was also high at 44.5%, however possibly the wording of it or a lack of understanding what it would entail kept it at a lower level. Commercial agriculture use of unmanned aircraft is anticipated to have the highest amount of growth in the next 20 years.

Research question five found no significant results as it was related to the acceptance level of other technologies. This was opposite to what was expected. One explanation for this difference is the distribution method of the survey which was online, which in and of itself means the individuals taking the survey have some level of acceptance of technology or they would not have access to the survey.

Regarding research question six which related to the physical size of the unmanned aircraft and its effect on the acceptance rate, there was no significance found. While there was a definite drop of acceptance depending on size of UAS it showed low acceptance rates on the small and large sizes, and the highest acceptance was from the unmanned aircraft which were smaller than a Cessna 172 but larger than quadcopters.

Overall Conclusion

In this study, significance was found in only two of the questions posed to respondents. The study was successful in showing that individuals have a lower acceptance rate for unmanned aircraft than their manned aircraft counterparts. This finding indicates that there could be hurdles for unmanned aircraft to be allowed to operate over populated areas for law enforcement purposes. There is a significant difference in the acceptance rate of unmanned aircraft versus their manned aircraft counter parts compared to their use within law enforcement. There was no significance found in different regions of the United States showing a higher or lower acceptance rate throughout specific regions. It is theorized that a more detailed survey structure towards a specific region of the country would be able to determine, unequivocally, whether or not there is a difference of opinion based on those different regions.

There was one distinctive observation which was not anticipated; the individual education level as it related to the acceptance of different types of unmanned aircraft. Only two of the seven unmanned aircraft produced levels of significance. Each mean's plot showed the same pattern for all types of unmanned aircraft. The individuals with less than a high school degree had the lowest acceptance rate for all types of unmanned aircraft systems (except for the MQ-9 Reaper). Those individuals who held a doctorate degree had the lowest acceptance rate for the Reaper. Individuals holding a master's degree had the highest acceptance rate in the seven types of unmanned aircraft described in the survey.

There are several recommendations from the completion this study, since UAS is a new technology to the populace of the United States. Finding that there is a large difference between acceptance of manned and unmanned law enforcement surveillance

should generate a more focused study as to the reasoning for this disparity. If the reasoning behind the difference is just lack of understanding of unmanned aircraft or how UAS is conveyed in the news or social media, there could be a concerted educational effort to bring the acceptance rate closer to that of manned aircraft. How to accomplish this task could be accomplished through education, news, and social media efforts.

Another recommendation would be more anecdotal. The survey had pictures of different aircraft, both manned and unmanned. One could indicate if an unmanned aircraft looked exactly like an manned aircraft, would it have a higher acceptance rate? Individuals could be biased towards preconceived notions of what an unmanned aircraft looks like and have a lower acceptance rate due to visual appearances. An unmanned aircraft that looks visually identical to a manned aircraft could have a higher acceptance rate than an aircraft which appeared to be "different" in the eyes of the public.

Future Research

Opportunities for future research have resulted from this study. Replicating this study and redesigning the questions may reveal significant differences than found in this study. Also a study could be designed to evaluate the education of individuals about the benefits of unmanned aircraft which could change the outcome of the study. This study had no funding and as such was limited in the distribution of the survey to the widest group of people across the country. This limitation did not allow for the greatest distribution of the survey. Lastly, the comparisons used in the study were comparing technology people currently used to unmanned aircraft. It could be reattempted with technology people have around them, and some examples for comparison could be TSA screening devices, stoplight cameras, or genetically modified foods. Ideas for future research which came from this study include research which is set to explore more

detailed aspects of acceptance and how to increase the acceptance rate of this emerging

technology could assist companies in production and in implementation of unmanned

aircraft.

APPENDICES

Appendix A

Survey

Informed Consent Form

This survey seeks to collect your opinion on the use of Unmanned Aircraft Systems (UAS's), also known as drones, with the United States Airspace. The information collected by this survey will provide the means to better understand public acceptance and knowledge about UAS as well as the preferred uses for UAS within the United States.

The results of this survey are kept completely ANONYMOUS. The final results will be a summary of findings in which no individual responses will be identifiable.

You can stop the survey at any time without any recourse. This survey should take you less than 7 minutes to complete.

If you have any questions or comments about this study, the researcher would be very interested in talking to you. Please do not hesitate to email the researcher, at ecameron@aero.und.edu and is available for your questions.

You are making a decision whether or not to participate. By clicking on the "YES - PARTICIPATE" button below, you agree that you are consenting to participate in this study. If you do not want to take part in this study, click on the "NO - REFUSE" button below. Please print a copy of this consent form for your records.

○ YES - PARTICIPATE

○ NO – REFUSE

Are you male or female?

○ Male

○ Female

What age range do you fall within?

○ 18 - 23

○ 24 - 33

○ 34 - 40

○ 41 - 48

○ 49 -67

○ Older than 68

Please identify the race that best describes you.

○ White

○ Black or African-American

○ Asian

○ American Indian

○ Other

○ Prefer not to answer

What is the highest level of school you have completed?

○ Less than high school

○ High School Degree or equivalent (e.g., GED)

○ Some college but no degree

○ Associate degree

○ Bachelor degree

○ Master's degree

○ Doctorate degree

What is your marital or relationship status?

○ Married

○ Widowed

○ Divorced

○ Never married

○ Refuse to Answer

What were your PERSONAL earnings in 2012? Best approximation is appropriate.

○ Less than $19,999

○ $20,000 - $40,000

○ $40,001 - $60,000

○ $60,001 - $80,000

○ $80,001 - $100,000

○ $100,001 - $150,000

○ $150,000 or greater

What is the size of the city you live in currently?

○ < 5,000

○ 5000 - 10,000

○ 10,001 - 25,000

○ 25,001 - 75,000

○ 75,001 - 150,000

○ 150,001 - 300,000

○ 300,001 - 750,000

○ > 750,000

What region of the United States do you live?

○ New England (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut)

○ Middle Atlantic (New York, New Jersey, Pennsylvania)

○ East North Central (Ohio, Indiana, Illinois, Michigan, Wisconsin)

○ West North Central (Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska,

Kansas)

○ South Atlantic (Delaware, Maryland, District of Columbia, Virginia, West Virginia, North

Carolina, South Carolina, Georgia, Florida)

○ East South Central (Kentucky, Tennessee, Alabama, Mississippi)

○ West South Central (Arkansas, Louisiana, Oklahoma, Texas)

○ West Mountain (Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah,

Nevada)

○ Pacific (Washington, Oregon, California, Alaska, Hawaii)

(From the picture below) Would you approve this type of unmanned aircraft to be used by your local or federal law enforcement officials?

Figure 12. Unmanned Aircraft

○ Approved for Local law enforcement use only

○ Approved for Federal Law Enforcement use only

○ Approved for both local and federal law enforcement use

○ Disapproved for both local and federal law enforcement

(From the picture below) Would you approve this type of unmanned aircraft to be used by your local or federal law enforcement officials?

Figure 13. Unmanned Aircraft

○ Approve of Local law enforcement use only Approved for Local law enforcement use only

○ Approved for Federal Law Enforcement use only

○ Approved for both local and federal law enforcement use

○ Disapproved for both local and federal law enforcement

(From the picture below) Would you approve this type of unmanned aircraft to be used by local or federal law enforcement officials?

Figure 14. Unmanned Aircraft

○ Approved for Local law enforcement use only

○ Approved for Federal Law Enforcement use only

○   Approved for both local and federal law enforcement use

○   Disapproved for both local and federal law enforcement

(From the picture below) Would you approve this type of unmanned aircraft to be used by local or federal law enforcement officials?

Figure 15. Unmanned Aircraft

○   Approved for Local law enforcement use only

○   Approved for Federal Law Enforcement use only

○   Approved for both local and federal law enforcement use

○   Disapproved for both local and federal law enforcement

(From the picture below) Would you approve this type of unmanned aircraft to be used by local or federal law enforcement officials?

Figure 16. Unmanned Aircraft

○   Approved for Local law enforcement use only

○ Approved for Federal Law Enforcement use only

○ Approved for both local and federal law enforcement use

○ Disapproved for both local and federal law enforcement

(From the picture below) Would you approve this type of unmanned aircraft to be used by local or federal law enforcement officials?

Figure 17. Unmanned Aircraft

○ Approved for Local law enforcement use only

○ Approved for Federal Law Enforcement use only

○ Approved for both local and federal law enforcement use

○ Disapproved for both local and federal law enforcement

(From the picture below) Would you approve this type of unmanned aircraft to be used by local or federal law enforcement officials?

Figure 18. Type of Unmanned Aircraft

○ Approved for Local law enforcement use only

○   Approved for Federal Law Enforcement use only

○   Approved for both local and federal law enforcement use

○   Disapproved for both local and federal law enforcement

(From the picture below) Would you of this type of aircraft to be used by local or federal law enforcement officials?

Figure 19. Type of Aircraft

○   Approved for Local law enforcement use only

○   Approved for Federal Law Enforcement use only

○   Approved for both local and federal law enforcement use

○   Disapproved for both local and federal law enforcement

(From the picture below) Would you approve this type of aircraft to be used by your local or federal law enforcement officials?

Figure 20. Type of Aircraft

○ Approved for Local law enforcement use only

○ Approved for Federal Law Enforcement use only

○ Approved for both local and federal law enforcement use

○ Disapproved for both local and federal law enforcement

(From the picture below) Would you approve this type of aircraft to be used by your local or federal law enforcement officials?

Figure 21. Type of Aircraft

○ Approved for Local law enforcement use only

○ Approved for Federal Law Enforcement use only

○ Approved for both local and federal law enforcement use

○ Disapproved for both local and federal law enforcement

What areas of the country would you be willing to have unmanned aircraft be utilized?

☐ New England (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut)

☐ Middle Atlantic (New York, New Jersey, Pennsylvania)

☐ East North Central (Ohio, Indiana, Illinois, Michigan, Wisconsin)

☐ West North Central (Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas)

☐ South Atlantic (Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida)

☐ East South Central (Kentucky, Tennessee, Alabama, Mississippi)

□ West South Central (Arkansas, Louisiana, Oklahoma, Texas)

□ West Mountain (Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada)

□ Pacific (Washington, Oregon, California, Alaska, Hawaii)

What type(s) of unmanned aircraft missions would you be willing to accept with the US? Check ALL that apply.

□ Law Enforcement   □ Aerial Application

□ Search and Rescue   □ Weather monitoring (such as tornadoes, hurricanes)

□ Pipeline patrols   □ Law Enforcement with weapons on board

□ Aerial Survey (Farming)   □ Crowd Control or monitoring

□ Traffic observation/reporting   □ Covert Surveillance (federal or local law enforcement)

□ Cargo Transportation (i.e. FedEx, UPS, DHL)

What concerns, if any, do you have of unmanned aircraft flying within the United States?

□ Dangers to other aircraft

□ Danger to property on the ground

□ Danger to people on the ground

□ None

□ Loss of privacy

□ Other (Please explain) [   ]

Do you think unmanned aircraft will invade your privacy?

○ Yes

○ No

In rank order which aircraft are you concerned with invading your privacy?
(1 being least concerned 7 being most concerned)

Please rank this from 1 to 7 [＿＿＿＿]

Please rank this from 1 to 7 [＿＿＿＿]

Please rank this from 1 to 7 [＿＿＿＿]

Please rank this from 1 to 7 [＿＿＿＿]

Please rank this from 1 to 7 [＿＿＿＿]

Please rank this from 1 to 7 [＿＿＿＿]

Please rank this from 1 to 7 [＿＿＿＿]

What types of populated areas (Population Per Square Mile) would you be willing to have unmanned aircraft be utilized?
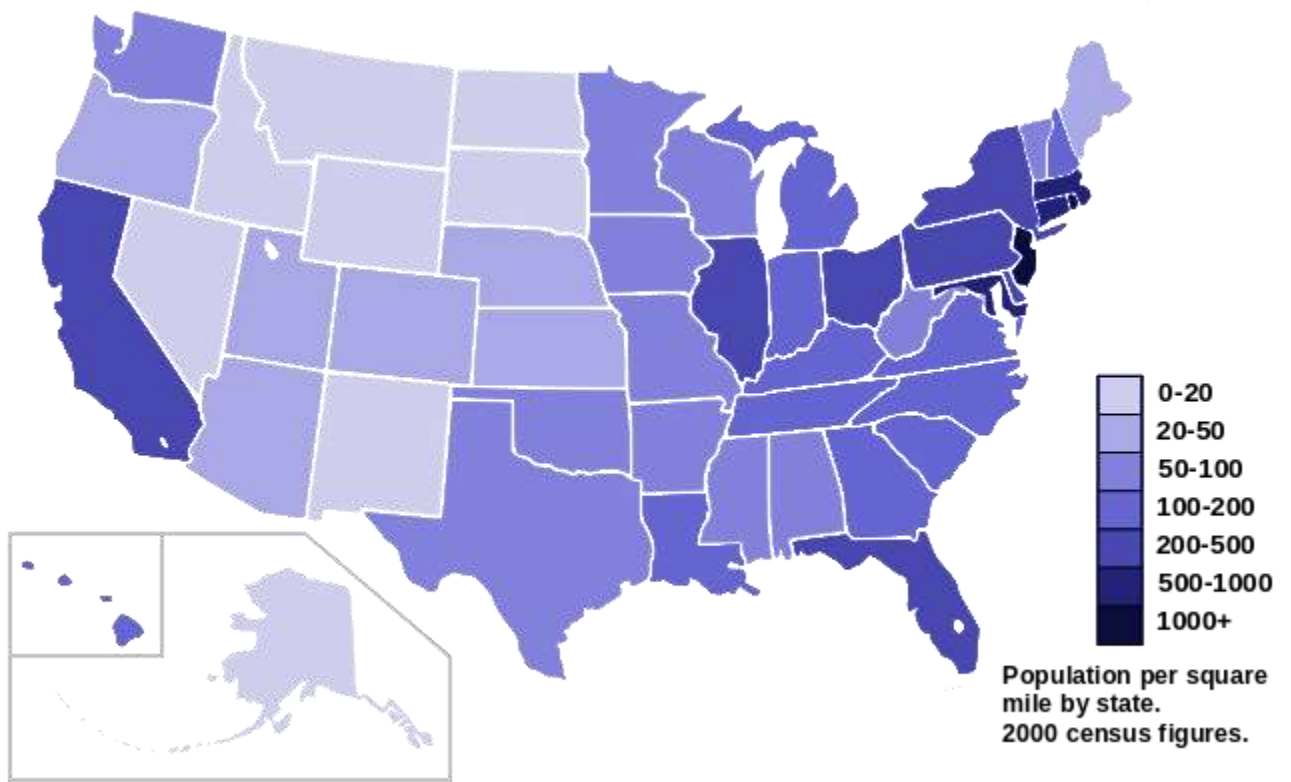
Figure 22. Types of Populated Areas

☐ 0-20

☐ 20-50

☐ 50-100

☐ 100-200

☐ 200-500

☐ 500-1000

☐ 1000+

☐ None of the Above

Which of the following do you own or subscribe to, currently?

☐ Personal Computer

☐ Laptop

☐ Tablet (i.e. IPad, Galaxy Note, Nexus, Kindle, etc.)

☐ Smart Phone (i.e. IPhone, Blackberry, Android, Windows Phone, etc.)

☐ Blue Tooth

☐ Wireless Router

☐ Online Video Service (Netflix, Blockbuster, Apple TV, Google TV, etc.)

If you own a smart phone how old is it?

○ < 6 months

○ < 1 Year

○ 1- 2 Years

○ 2-3 Years

○ > 3 Years

○ Do not own a Smart Phone

If you own a personal computer or laptop how old is it?

○ < 6 months

○ < 1 Year

○ 1- 2 Years

○ 2-3 Years

○ > 3 Years

○ Do not own a personal computer or laptop

If you own a tablet how old is it?

○ < 6 months

○   < 1 Year

○   1- 2 Years

○   2-3 Years

○   > 3 Years

○   Do not own a Tablet

If you went hiking with a group of people (friends or family) and became lost would it matter to you whether it was a manned aircraft or unmanned aircraft that found you?

○   Yes - Prefer manned aircraft

○   Yes - Prefer unmanned aircraft

○   No

○   Don't care

○   Refuse to answer

Appendix B

Table 26. Survey Distribution Locations

Date Posted	Craigslist Postings	Date Posted	Craigslist Postings
11/2/2013	San Francisco, CA	11/3/2013	St Louis, MO
11/2/2013	Los Angeles, CA	11/3/2013	Raleigh, NC
11/2/2013	Orlando, FL	11/3/2013	Atlanta, GA
11/2/2013	Dallas, TX	11/3/2013	Savannah, GA
11/3/2013	Washington DC	11/3/2013	Omaha, NE
11/3/2013	New York, NY	11/3/2013	Central NJ
11/3/2013	Montgomery AL	11/3/2013	North Jersey
11/3/2013	Phoenix, AZ	11/3/2013	South Jersey
11/3/2013	Anchorage, AK	11/3/2013	Albany, NY
11/3/2013	Memphis, TN	11/3/2013	New Hampshire
11/3/2013	Austin, TX	11/3/2013	Maine
11/3/2013	Nashville, TX	11/3/2013	Kansas City, KS
11/3/2013	Honolulu, HI	11/3/2013	New Orleans, LA
11/3/2013	Minneapolis, MN	11/3/2013	Wyoming
11/3/2013	Birmingham, AL	11/3/2013	Galveston, TX
11/3/2013	Flagstaff, AZ	11/3/2013	Vermont
11/3/2013	Yuma, AZ	11/3/2013	Salt Lake City, UT
11/3/2013	San Diego, CA	11/3/2013	Des Moines, IA
11/3/2013	Orange County, CA	11/3/2013	Kirksville, MO
11/3/2013	Sacramento, CA	11/3/2013	Quad Cities, IA
11/3/2013	Gainesville, FL	11/3/2013	Rockford, IL
11/3/2013	Tampa, FL Pinellas CO	11/3/2013	Milwaukee, WI
11/3/2013	Miami, FL Broward CO	11/3/2013	Cleveland, OH
11/3/2013	Panama City, FL	11/3/2013	Columbus, OH
11/3/2013	Lakeland, FL	11/3/2013	Pittsburgh, PA
11/3/2013	Philadelphia, PA	11/3/2013	Charleston, WV
11/3/2013	Scranton, PA	11/3/2013	Billings, MT
11/3/2013	Syracuse, NY	11/3/2013	Worcester, CT
11/3/2013	Boston, MA	11/3/2013	North Dakota
11/3/2013	Cambridge, MA	11/3/2013	Albuquerque, NM
11/3/2013	Rhode Island	11/3/2013	Santa Fe, NM
11/3/2013	Richmond, VA	11/4/2013	Jersey Shore, NJ
11/3/2013	Baltimore, MD	11/4/2013	Northwest CT
11/3/2013	Harrisburg, VA	11/4/2013	Owensboro, KY
11/3/2013	Fort Collins, CO	11/4/2013	Chattanooga, TN
11/3/2013	Boulder, CO	11/4/2013	Asheville, NC

| 11/3/2013 | Houston, TX | 11/4/2013 | Huntington-Ashland, NC |

Table. cont.

11/3/2013	Abilene, TX	11/4/2013	Western MD
11/3/2013	San Antonio, TX	11/4/2013	Reading, PA
11/3/2013	San Angelo, TX	11/4/2013	Delaware
11/3/2013	Wichita Falls, KS	11/4/2013	Allentown, PA
11/3/2013	Oklahoma City, OK	11/4/2013	Fredrick, PA
11/3/2013	Little Rock, AR	11/4/2013	Charlottesville, PA
11/3/2013	Shreveport, LA	11/4/2013	Louisville, KY
11/3/2013	Tulsa, OK	11/5/2013	Eastern Kentucky
11/3/2013	Fayetteville, AR	11/5/2013	New Haven, CT
11/3/2013	St. Joseph, MO	11/5/2013	South Coast, NJ
11/3/2013	Las Vegas, NV	11/5/2013	Southwest, MS
11/3/2013	Reno, NV	11/5/2013	Bloomington, IN
11/3/2013	Monterey, CA	11/5/2013	Augusta, FL
11/3/2013	Modesto, CA	11/5/2013	Mobile, AL
11/3/2013	College Station, TX	11/5/2013	Hattiesburg, PA
11/3/2013	Brownsville, TX	11/5/2013	Dothan, AL
11/3/2013	Madison, WI	11/5/2013	Jackson, MS
11/3/2013	Eau Claire, WI	11/5/2013	Pensacola, FL
11/3/2013	St Cloud, MN	11/5/2013	Gulfport, MS
11/3/2013	Cincinnati, OH	11/5/2013	Knoxville, TN
11/3/2013	Dayton, OH	11/5/2013	Huntsville, AL
11/3/2013	Toledo, OH	11/5/2013	Williamsport, PA
11/3/2013	Denver, CO	11/5/2013	Rochester, NY
11/3/2013	Hartford, CT	11/5/2013	Buffalo, NY
11/3/2013	Eastern CT	11/5/2013	Ithaca, NY
11/3/2013	Chicago, IL	11/5/2013	Hudson Valley, NY
11/3/2013	Indianapolis, IN	11/5/2013	Western Massachusetts
11/3/2013	Detroit, MI	11/5/2013	Long Island, NY
Other Locations			
11/2/2013	Personal Facebook Page	11/4/2013	cherokeeforum.com
11/2/2013	http://www.topix.com	11/4/2013	nationalgunforum.com
11/2/2013	yahoo.news	11/2/2013	Email Distribution

Appendix C

My name is Eric C and I am conducting a research study for requirements for my graduate degree at the University of North Dakota. Your input can help to better understand the privacy concerns with unmanned aircraft. It's estimated that it will take you approximately 3-7 minutes to complete the survey.

Simply click on the link below, or cut and paste the entire URL into your browser to access the survey:

https://und.qualtrics.com/SE/?SID=SV_6Eivus57M9LoKk5

Your input is very important and will be kept strictly confidential (used only for the purposes of research for this project).

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