RISK AND SAFETY ANALYSIS FOR FLORIDA COMMERCIAL AERIAL APPLICATION OPERATIONS

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To Diego and Maggie Robbins

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LIST OF ABBREVIATIONS

AOPA	Aircraft Owners and Pilot's Association
BWC	Biological Weapons Convention
CEU	Continuing Education Unit
CFR	Code of Federal Regulations
CVM VETS	College of Veterinary Medicine Veterinary Emergency Treatment Service
DHS	Department of Homeland Security
ESF	Emergency Support Function
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
FBO	Fixed-Base-Operation
FDACS	Florida Department of Agriculture and Consumer Services
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
FLSART	Florida State Agricultural Response Team
FSDO	Flight Standards District Office
GDP	Gross Domestic Product
IFAS	Institute of Food and Agricultural Sciences
IRS	Internal Revenue Service
MARE	Mobile Animal Response Equipment
NAAA	National Agricultural Aviation Association
NAAREF	National Agricultural Aviation Research & Education Foundation
NSAS	National Strategy for Aviation
OTA	Office of Technology Assessment
PAASS	Professional Aerial Application Support System
PPE	Personal Protective Equipment

SART	State Agricultural Response Time
UFIRB	University of Florida Institutional Review Board
VFR	Visual Flight Rules
WNAAA	Women's National Agricultural Aviation Association

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The purpose of this study was to determine self-reported perceptions in the areas of agroterrorism, bioterrorism, chemical exposure and Federal Aviation Administration (FAA) oversight. The aerial application industry has been in existence since the 1920's with a gamut of issues ranging from pesticide drift to counterterrorism.

The attacks of September 11th, 2001, caused a paradigm shift in the way the United States views security and, more importantly, the prevention of malicious activity. Through the proper implementation and dissemination of educational materials dealing with industry specific concerns, it is imperative that everyone has the proper level of resources and training to effectively manage terrorist threats.

This research study was designed to interpret how aerial applicators view these topics of concern and how they perceive the current threat level of terrorism in the industry. Research results were consistent, indicating that a high number of aerial applicators in the state of Florida are concerned with these topics. As a result, modifications need to be made with respect to certain variables. The aerial application industry works day in and day out to provide a professional service that helps maintain the integrity of the food and commodities that we need to survive. They are a small

percentage of the aviation community that we all owe a great deal for the vital and necessary services they provide.

CHAPTER 1
INTRODUCTION

Issues in Aerial Application

Agroterrorism and Bioterrorism have existed since the beginning of known civilization. With increases in both technology and population, the threat of an attack of this nature has significantly increased, causing a high level of concern and the need for awareness within given communities. With the attacks of September 11th, 2001, millions of people directly viewed how a terrorist event could affect not only a nation, but the entire world. Security measures and protocols have been increased, however, is there any guarantee that this type of event will not occur again? Several government and state agencies have targeted terrorist activity with regard to aviation. Aviation operations, such as agricultural aerial applicators, have a very unique level of responsibility that many industries do not have on a daily basis.

The aerial application industry ensures our food is free of pests and capable of delivery to the global market. They work every day to provide a service, that without, many people would succumb to a number of consequences. The industry, however, can be very difficult to regulate, because of the lack of guidance and oversight from agencies who are overworked and understaffed. They are, nonetheless, responsible to provide protection from the ongoing threat of terrorist activity.

The issue of aviation and terrorism can be viewed as daunting to the average person, considering the number of flights that are flown annually solely in the commercial sector. This is where most people develop their insights and perceptions about terrorist threats. It is important, however, to educate the public about the dangers

of terrorism associated with other commercial aviation applications, such as aerial applicators.

The licensure of pilot's is federally controlled and each must have the proper rating or endorsement to fly a given category of aircraft within a given application. This is achieved through the use of written tests and practical exams administered by the Federal Aviation Administration (FAA). Aerial applicators are also licensed by their respective state in the procedures and protocols that may have an impact on local or state resources. They must complete state specific training within the state's guidelines to keep their license current, allowing them to operate as an aerial applicator. They are required to continue their education through the utilization of mandated continuing education units, (CEU's), along with state tests. These are designed to be industry specific and allow them to gain insight into current technology, while at the same time maintain their licensure requirements. The implementation of CEU's depends on the industry's concern for a given set of knowledge, skills, and abilities that may be in need of further education. The most prevalent topic discussed among aerial applicators is drift, or the unwanted movement of a product through the air that may come into contact with non-target organisms (EPA, 2009). This is an important concern, however anti-terrorism and safety countermeasures often are not in the forefront as the problem of drift. Agencies and advocates to the aerial application industry must hold these issues in high regard, as it is likely that a terrorist event could occur again with the use of agricultural aircraft as an instrument of destruction.

There is another concern of aerial applicators besides the threat of terrorism. The amount of noxious chemical that applicators are exposed to during each application

poses a serious threat to the health and well-being of those who apply agricultural chemicals on a regular basis. Many of the aircraft in use around the United States are considered to be aged and have accrued substantial amounts of flight time over their tenure as aerial application aircraft. These aircraft often have minor issues that may put their operator at risk for high levels of exposure to noxious chemicals to include faulty seals and antiquated ventilation systems.

It is important to determine where and how the above mentioned issues contribute to agricultural awareness. With a higher level of awareness, we may work to achieve a better tomorrow and a more sustainable future in reference to the effects of agroterrorism, bioterrorism, chemical exposure, and FAA oversight. A better understanding of these factors will represent a level of clarity that may comfort society, considering previous events.

Background and Significance

The purpose of this study was to examine how the research participants perceived the level of threat or concern to each of the above mentioned factors imposed and how relevant new educational materials would be to provide them with a higher level of intrinsic knowledge. The educational materials that aerial application professionals have at their disposal dealing with these issues are inadequate for the current level of threat. As a result, these materials need to be modified to allow a greater repository of resources dealing with the issues of agroterrorism, bioterrorism, chemical exposure and FAA oversight.

Statement of the Problem

Agroterrorism, bioterrorism, chemical exposure, and FAA oversight are paramount issues that aerial applicators deal with on a daily basis; therefore it is important to study

these factors within applicable populations. This study provides insight into the self-reported perceptions of professionals who currently work in this field and are susceptible to each of the above mentioned factors. It was used to understand which components of each relevant topic are pertinent and require the implementation of further training and education.

Objectives

Identifying the perceptions of agricultural aerial applicators in the state of Florida and how they pertain to underlying variables that may affect their operations and the well-being of the public. Specifically this study has four main objectives:

- Determine the level of threat that aerial applicators in the state of Florida perceive in regard to agroterrorism and bioterrorism.
- Determine whether or not agricultural aerial applicators in the state of Florida desire more educational materials that pertain to counter/anti-terrorism.
- Investigate the relationship between agricultural aircraft currently in use and how agricultural aerial applicators feel about their respective levels of chemical exposure.
- Interpret the relationship that currently exists between agricultural aerial applicators and state/federal agencies that support them.

CHAPTER 2
REVIEW OF RELATED LITERATURE AND RESEARCH

Summary of Relevant Data

The aviation industry is constantly adapting to the same forces that drive every other industry. In today's global society, technology allows us to reach almost any point on the earth's surface. With this growth comes an increase in risks and threats associated with terrorism. The information paradigm, which started with widespread mail carriage and improved routes of communication, has been a component of our lives since the beginning of the 19th century. Today, with the use of computers and the internet, it has made us capable of accessing vast amounts of information at relatively instant rates. With this paradigm, comes the possibility of a collection of information that can be used for malicious planning. Terrorist cells that exist both in the United States and abroad work without delay to develop plans and ideas to cause harm to their target groups and are a serious cause for alarm. Every industry must constantly evolve to meet the demands of counterterrorism, however, with flight, many businesses face a unique set of challenges, which are not representative of normal industry.

The dynamics that drive agricultural aviation are unique in respect to the entire aviation community as we know it. They are required to produce a viable service in often remote or obscure locations, sometimes with little notice. Instead of operating from a standard airport with security parameters and protocols in place, many work out of unimproved areas that have very little security. It is the responsibility of the operator and those who are working with the given mission to have sound knowledge and be cognizant of the ongoing threat of terrorist or malicious activity.

History of Aerial Application

At the turn of the 20th century the airplane was still in its developmental stage. Two brothers, Orville and Wilbur Wright, were working on a prototype aircraft, which would be both powered and controllable (Kane, 2007). Prior to this time, prospective fliers were taking to the skies in gliders, balloons, and just about anything else that would sustain some kind of buoyancy in the air. In 1906, John Chaytor, took to the skies in a tethered hot air balloon over a swamped valley floor in Wairoa, New Zealand (NAAA, 2011). This flight was monumental, because it was the first recorded use of an agricultural product being applied by an aircraft and was referred to as aerial "seed sowing." It proved to be a breakthrough that would lead to the inception of a wide-spread industry that we depend on for food and crop production today. A problem with aerial seed sowing was the delivery method. Tethered balloons, even-though mobile to some degree, could only cover small areas and were therefore not very effective. A few more years were required to provide something sustainable, and secure the future of agricultural aerial application.

> The first well-documented use of aircraft to control an agricultural pest in the United States occurred in 1921. An article by C.R. Neillie and J.L. Houser in the March, 1922, issue of "The National Geographic Magazine: described how lead arsenate dust was spread on catalpa trees near the Ohio Agricultural Experiment Station by being poured through a hole in the deck of a Curtis JN6 (Jenny) aircraft's observation cockpit. From this humble beginning, aircraft have had a role in the production of agricultural crops (Dean, 1999).

This was one of the first instances of true aerial application as we know it today. Under the direction of the Ohio Department of Agriculture, Lt. John A. Macready, a U.S. Army pilot, made the first application. The government then utilized aerial application in the Southern states. By 1922, Curtis biplanes were used to dust cotton fields near

Tallulah, LA, to control bollweevils and by 1923, Huff-Daland Duster, Inc. – the forerunner of Delta Airlines – established the first commercial dusting of crops with their own specially built aircraft (NAAA, 2011). All of this innovation, however, did not come without a price.

> As news began to spread and other farmers looked for local pilots when they faced invasions, pilots would teach others how to drop down on a field, fly with their wheels almost touching the crops to reduce "chemical drift" and then pull up sharply at the end of the field. The trick was to know where obstacles like power lines, fence posts and water standpipes were. Hitting an obstacle could kill you. And more than one pilot was responsible for killing the power to a nearby town or rural area by snagging the power lines with his or her tail.
>
> On the ground, "flagmen" were stationed to help the pilot keep track of what parts of the field still needed to be sprayed. This was almost as dangerous a job as the pilots, both because of the possibility of being hit by the plane and the long-term exposure to deadly chemicals. Both pilots and flagmen used to boast that they didn't have to worry about being bit by mosquitoes after a day of spraying (Ganzel, 2007).

World War II and Beyond

The U.S. Air Force has had a long history of aerial applications of pesticides to fulfill a variety of missions, the most important being the protection of troops through the minimization of arthropod vectors capable of disease transmission. Beginning in World War II, aerial application of pesticides by the military worked to effectively control vector and nuisance pest populations in a variety of environments (Breidenbaugh & Haagsma, 2008). When the war was over, several factors contributed in the favor of the civilian aerial application industry and allowed it to have a very high prospectus for growth and innovation. The following are a list of notable events that allowed aerial applicators to grow over the later years of World War II:

- The war, when finished, brought new chemicals to the civilian market that became popular with farmers.

- The need for pilots during WWII trained thousands of potential “crop dusters”, most of whom wanted to keep flying afterwards.
- The military produced thousands of military training aircraft that then became surplus. For instance, the Piper J-3 Cub was the airplane that 80 percent of U.S. military pilots learned to fly during the war. A total of 14,125 Piper Cubs were built between 1939 and 1947, which equated to the production of one every 20 minutes. After the war, the government relinquished 30,000 surplus airplanes on the market at low prices. Surplus two-wing, two-seat Boeing Kaydet trainers were sold for as little as $250, so many of these aircraft were converted into crop dusters (Ganzel, 2007).

Today, aerial application has evolved into an extremely viable method to control pest populations. The industry has evolved from the low powered, low capacity aircraft of the early to mid 20th century into aircraft with much more capability. Aerial application accounts for up to one fourth of the delivery of crop production products in American agriculture. Farmers value the use of aircraft because they can cover vast amounts of area quickly, without disturbing the soil or the growing crops. Aircraft can glide over the crops at up to 140 miles per hour, which is an important factor to consider, as some pests can cause serious damage in less than 24 hours (NAAA, 2011).

Many companies have worked to develop high efficiency aircraft, which include not only airplanes, but helicopters. Some of the newer aircraft are capable of carrying 850 gallons of product and can weigh as much as 16,000 lbs (AirTractor, 2011). This makes them a very useful source for longevity, however, it also makes them a viable tool for terrorist activity.

Certification of Pilots

Pilot certification in the U.S. is regulated by the Federal Aviation Administration (FAA) under Code of Federal Regulations (CFR) Part 61 of the Federal Aviation Regulations (FAR’s). To obtain a commercial pilot’s license in the U.S. applicants are required to meet the following criteria:

- Be at least 18 years of age.
- Be able to read, speak, write and understand the English language.
- Hold at least a private pilot certificate.
- Meet the aeronautical experience requirements of this section that apply to the aircraft category and class rating sought.
- Pass a written knowledge test.
- Pass a practical test administered by the FAA or someone designated by the FAA to give such exams (FAA, 2011).

An applicant for a commercial license applying for an airplane single engine rating must also meet the certain criteria with regard to the total amount of flight time in aircraft. If applying for a commercial pilot certificate with an airplane category and single engine class rating the applicant must log at least 250 hours of flight time as a pilot (of which 50 hours, or in accordance with FAA Part 142, a maximum of 100 hours may have been accomplished in an approved flight simulator or approved flight training device that represents a single engine airplane) that consists of at least:

- 100 hours in powered aircraft, of which 50 hours must be in airplanes.
- 100 hours of pilot in command flight time, which includes at least 50 hours in airplanes and 50 hours in cross-country flight in airplanes.
- 20 hours of training on the areas of operation as listed for this rating, that includes at least 10 hours of instrument training, of which at least 5 hours must be in a single engine airplane, 10 hours of flight training in an airplane that has a retractable landing gear, flaps, and a controllable pitch propeller, or is turbine-powered, one cross-country flight of at least 2 hours in a single engine airplane in day Visual Flight Rules (VFR) conditions, consisting of a total straight-line distance of more than 100 nautical miles from the original point of departure, one cross-country flight of at least 2 hours in a single engine airplane in night VFR conditions, consisting of a total straight-line distance of more than 100 nautical miles from the original point of departure.
- 10 hours of solo flight in a single engine airplane, including one cross-country flight of not less than 300 nautical miles total distance and as specified, and 5 hours in night VFR conditions with 10 takeoffs and 10 landings (with each landing involving

> a flight in the traffic pattern) at an airport with an operating control tower (FAA, 2011).

The requirements to become a commercial pilot are strenuous and very detailed. This training provides pilots enough background to safely operate aircraft in regard to providing services to the public. Aerial applicators are required to have a commercial license in the category and class of aircraft they are flying and also a state license for the application of chemicals by air.

Aerial Applicator Certification in Florida

The Florida Department of Agriculture and Consumer Services (FDACS) is the regulatory body within the state of Florida that outlines registration and record keeping requirements for aerial applicators in the state. State requirements vary, however some states do have “quasi” reciprocal agreements which allow non-resident licensed applicators to work under someone who is currently licensed in the given state. These reciprocal agreements vary from state to state, but most often require the licensure candidate to complete all of the necessary requirements beyond written examinations.

Federal Aviation Administration (FAA) Part 137 Requirements

Initially aerial applicators must attain compliance with the certification requirements listed under part 137.19 of the FAR’s. There are two classifications for certification contained within this regulation, private applicators and commercial applicators. Commercial applicators differ from private applicators because they “contract” services to the public and are required to meet more stringent requirements set forth in paragraphs (c), (d), and (e) of this section, which are outlined below:

> (c) Commercial operator-pilots. The applicant must have available the services of at least one person who holds a current U.S. commercial or airline transport pilot certificate and who is properly rated for the aircraft to be used. The applicant himself may be the person available.

(d) Aircraft. The applicant must have at least one certified and airworthy aircraft, equipped for agricultural operation.

(e) Knowledge and skill tests. The applicant must show, or have the person who is designated as the chief supervisor of agricultural aircraft operations for him show, that he has satisfactory knowledge and skill regarding agricultural aircraft operations, as described in paragraphs (e) (1) and (2) of this section.

(1) The test of knowledge consists of the following:

(i) Steps to be taken before starting operations, including survey of the area to be worked.

(ii) Safe handling of economic poisons and the proper disposal of used containers for these poisons.

(iii) The general effects of economic poisons and agricultural chemicals on plants, animals, and persons, with emphasis on those normally used in the areas of intended operations; and the precautions to be observed in using poisons and chemicals.

(iv) Primary symptoms of poisoning of persons from economic poisons, the appropriate emergency measures to be taken and the location of poison control centers.

(v) Performance capabilities and operating limitations of the aircraft to be used.

(vi) Safe flight and applications procedures.

(2) The test of skill consists of the following maneuvers that must be shown in any of the aircraft specified in paragraph (d) of this section, and at that aircraft's maximum certificated take-off weight, or the maximum weight established for the special purpose load, whichever is greater.

(i) Short-field and soft-field takeoffs (airplanes and gyroplanes only).

(ii) Approaches to the working area.

(iii) Flare-outs.

(iv) Swath runs.

(v) Pullups and turnarounds.

(vi) Rapid deceleration (quick stops) *Helicopters only* (FAA, 2011)

Once in compliance with FAA regulations, the applicant files an application for a certificate listed under Part 137.5 of the FAR's. This regulation is a general rule for all states and regulated by the nearest Flight Standards District Office (FSDO) to the applicants respective home base. The rule states:

> An application for an agricultural aircraft operator certificate is made on a form and in a manner prescribed by the Administrator, and filed with the FAA district office that has jurisdiction over the area in which the applicant's home base of operations is located (FAA, 2011).

Once the certificate has been issued to the operator it is valid until it is surrendered, suspended, or revoked. The holder of an agricultural aircraft operator certificate that is suspended or revoked shall return it to the administrator as prescribed under part 137.21 of the FAR's (FAA, 2011).

State regulations are very specific to the state in which licensure is to be requested and applicants must adhere to those rules in order to obtain the proper license for the desired application.

Knowledge and Category Exams

Knowledge tests in the state of Florida consist of two different options based on the role of the given applicator. For a person who distributes any chemicals listed under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), but does not make any ground applications or decisions pertaining to the use of the given pesticide, they may only be licensed under the testing requirements for that of an aerial applicator. Conversely, if the applicator is responsible for ground application or decision making in regards of how to, where to, or when to distribute a given pesticide, they must be

licensed in the appropriate ground categories to be treated, e.g. agricultural row crop, forestry or right-of-way (Braxton, 2006). In addition to the aerial category, pilots must also provide a valid FAA license to FDACS before receiving certification in this category. The testing requirements by the state of Florida require a minimum grade of 70% and are submitted to FDACS for certification after the test has been administered by a representative of the Agency.

The first test that must be taken to achieve the aerial applicator category licensure in Florida is the core exam. It is designed to provide assessment of an adequate base knowledge for individuals wishing to apply pesticides. The exam is administered at all county cooperative extension offices affiliated with the University of Florida Institute of Food and Agricultural Sciences (IFAS). The category exams, which are based upon the type of application to be conducted, are comprised by IFAS and administered in select cooperative extension offices. Once the appropriate exams have been passed with a minimum score of 70%, FDACS will send the applicant a license application, which will require the payment of fees for certification before a license will be issued. The fees for application are listed along with recertification or re-currency requirements in Appendix A.

Recurrency and continuing education are a very important component of the aviation industry, but especially in the case of aerial applicators. With constant advances in technology it is important to remain current and up-to-date on procedures and protocols which may make application more efficient or safe. Once state licensure has been obtained, there are requirements to keep it in current standing. Some re-certifications or re-currency can be done by simply taking the licensure exams after they

expire, however most re-currency can be achieved by successfully completing Continuing Education Units (CEU's) within the time frames listed in Appendix A. Commercial applicators renewing with CEU's must earn 4 core CEU's plus the applicable number of CEU's.

In regards to reciprocal agreements and operations in other states, Florida has defined agreements with Mississippi, Georgia, Alabama, North Carolina, South Carolina, and Indiana (Braxton, 2006). Applicators who move to Florida and desire to be aerial applicators are only waived from the exam requirements but not any of the licensure requirements. The important consideration to infer is that regulatory policies differ by state, but are still overseen by the FAA and their specific requirements to operate as a certified aerial applicator.

Aviation Security

> The security and economic prosperity of the United States depend significantly upon the secure operation of its aviation system and use of the world's airspace by the Nation, its international partners, and legitimate commercial interests. Terrorists, criminals, and hostile nation-states have long viewed aviation as a target of attack and exploitation. The tragic events of September 11, 2001 and the Heathrow plot of August 2006 are telling reminders of the threats facing aviation and the intent and capabilities of adversaries that mean to do harm to the United States and its people (DHS, 2007).

Since the inception of the "jet age", beginning in the 1950's, the world has become much smaller. Vast amounts of people have attained the utility to travel not only across state borders, but around the entire globe within a very short time frame. This increase in air travel has resulted in a mixture of cultures and groups, which have been a relevant cause for concern as it pertains to the security and welfare of all who travel. As the skies over the entire world become more and more congested, the number of people traversing continental boundaries have increased substantially. It is the responsibility of

federal and state agencies to support aviation security by assigning and maintaining safety as the highest priority in air commerce (TSA, 2001). Figure 2-1 depicts the total number of domestic and international commercial airline enplanements in the United States in 2008, which represents 740 million passengers in a one year period.

The number of commercial travelers varies annually due to such things as the economy and passenger security concerns; however; air travel is the most cost-effective and efficient way to travel over large areas (Kane, 2007).

In the commercial sector, passenger opinion can range greatly in how effective aviation security is currently. With increases in threat come increased security; however many view current airport screening methods as exaggerated or extreme. In June of 2006, building upon the Administration's successful efforts since 9/11, the President directed the development of a comprehensive National Strategy for Aviation Security (NSAS) to protect the Nation and its interests from threats in the Air Domain (DHS, 2007).

NSAS was developed to implement regulations and increase the level of security awareness by integrating public and private aviation security activities in a global effort to detect, deter, prevent, and defeat threats to the Air Domain. It also set out to reduce vulnerabilities, minimize the consequences of, and expedite the recovery from attacks that may occur (DHS, 2007).

The global perception of aviation security is that it only pertains to airline travel since most people are only exposed to that particular facet of aviation. However, private sector security is of paramount concern because of the potential that general aviation aircraft have to cause harm to the existing infrastructure. Another strong misconception

is the interpretation that all aviation attacks are going to be a product of foreign distension. It is important to include that malicious or terrorist attacks can be the product of both foreign and domestic entities.

> On February 18, 2010, Joseph Andrew Stack flew his single-engine airplane into a seven-story office building in northwest Austin, Texas. The building housed an office of the Internal Revenue Service (IRS), along with several other tenants. According to a statement he posted to the Internet before taking off on his suicide flight, Stack intentionally targeted the IRS due to a long history of problems he had had with the agency. In the statement, Stack said he hoped that his action would cause “American zombies to wake up and revolt” against the government. Stack also expressed his hope that his message of violence would be one the government could not ignore (Stewart, 2010).

This attack was used to convey one individuals dislike for the federal government with the utilization of a general aviation aircraft. In the finality of the event, Stack killed himself along with one other fatality and 13 injuries. Reports indicated that Stack had removed several seats from the aircraft and loaded a drum of aviation fuel inside the passenger compartment to increase the effects of his plan. If the aircraft would not have hit the concrete reinforcing floor “head-on”, the aircraft may have been able to further penetrate the building causing more casualties and property damage. This incident along with many others, indicates the need for concern in the general aviation sector. Vulnerabilities in certain areas of the industry are prevalent and must be viewed in detail in order to create a plan for prevention.

Security Countermeasures

The Aircraft Owners and Pilot’s Association (AOPA) has launched a campaign to increase awareness amongst the public in regards to the security of general aviation airports. Available on their website, http://www.aopa.org, is an interactive module that is designed to enhance general aviation security with regard to flight schools, aircraft

owners, renter pilots, fixed-base-operations (FBO), and flying clubs. The material contained within the module discusses how to identify potential threats to general aviation and also discusses different types of security countermeasures an airport may put in place to prevent or inhibit the occurrence of malicious intent. Several types of controls are used to deter would be assailants from breaching an airport perimeter and are commonly referred to in three categories: Perimeter controls, access controls and biometric controls.

Perimeter Controls

Perimeter controls are defined as countermeasures that prevent intrusion by surrounding the airport perimeter or by creating a boundary that prevents intrusion. Examples of perimeter controls are fences, gates, walls and bodies of water. (USGS, 2010). They can be very effective prevention tools, however most airports cover expansive areas of land, making maintenance difficult. Perimeter controls are considered primary devices against intrusion, which means that they are a first line of defense in protecting an asset. Perimeter controls are considered to be very effective and cost efficient methods to deter entry into a protected area and are therefore highly utilized in aviation security.

Access Controls

Access controls are defined as systems which enable authority to control access to areas and resources in a given physical facility or computer-based information system (CNSS, 2011). Examples of access controls are locks, card readers and turnstiles. These devices are considered a primary line of defense and exhibit a high level of efficiency, however, under certain conditions they may be rendered ineffective. For instance, most card reading devices are indiscriminate as to who is using the card.

So, if a card is stolen, entry may be obtained if biometric data or codification is not required to gain access to the desired entry point. These devices are highly utilized in commercial aviation sectors, however, their high initial cost deters all but a minority of operations from using them.

Biometric Controls

Biometrics are highly effective entry tools that consist of the utilization of methods for uniquely recognizing humans based upon one or more intrinsic physical or behavioral traits. They can be divided into two main categories:

Physiological – related to the shape of the body. Examples include, but are not limited to fingerprint, face recognition, DNA, palm print, hand geometry, iris recognition, and odor.

Behavioral – related to the behavior of a person. Examples include, but are not limited to typing rhythm, gait, and voice.

These devices are gauged on several different factors that pertain to individuals such as universality, uniqueness, permanence, collectability, performance, acceptability, and circumvention (Biometrics, 2011). All of these properties are used to derive the effectiveness of a biometric control, however, for most operations, they are considered to be a less viable option because of the inherent cost of the system.

Agricultural Aviation and Security

Agricultural aviation is a facet of industry that many lack knowledge. They are the professionals who often work from unimproved remote areas, most of which have very few security countermeasures. They are especially vulnerable to malicious activity; therefore, it is important to educate all stakeholders in the relevance of proper aircraft security and the storage of noxious chemicals which may be located on these premises.

Aircraft security is a primary concern because of the areas in which most aircraft are stored or kept. Many agricultural operations are based in remote areas which are not located within an airport perimeter, therefore increasing their vulnerability to unwanted trespassing and intrusion. Many operators use countermeasures such as locks and anti-theft devices; however; many of these devices are fairly easy to manipulate or allow access.

Aircraft Security and pesticide/fertilizer storage are two factors which are considered very important in promoting the overall protection of an agricultural aircraft base. Basic securing states generally that aircraft must be *"secured when not in use"* (NBAA, 2011). There are several methods outlined for keeping the aircraft secure such as keeping it in a locked building, locked in place securely, or mechanically disabling it from flying. Pesticides and fertilizers must not be accessible to unauthorized persons. The rule for secured storage states "fences with a minimum 6 feet height; door locks; valve locks; electronic security systems; disabling of mobile storage units; blocking of access, ingress, or egress; or any other reasonable method to prevent or deter theft or unauthorized use (NBAA, 2011). Buildings used to store pesticides and/or fertilizers must be of rigid construction so unauthorized entry cannot be achieved without the use of heavy machinery or equipment. If a portable building is used, the building must be secured in place so it cannot be towed or otherwise removed by unauthorized persons (Braxton, 2006).

Lastly, the state has specific requirements pertaining to record keeping. Records must be kept for a minimum for two years and must be in the areas listed below.

- Aerial application of all pesticides;
- Aerial application of all fertilizers;

- Aerial application of all seed (Braxton, 2006).

National Agricultural Aviation Association (NAAA)

NAAA is an advocacy group for agricultural aircraft based in Washington D.C. Their goal is to support the industry along with other organizations such as the National Agricultural Aviation Research & Education Foundation (NAAREF) and the Women's National Agricultural Aviation Association (WNAAA). These organizations work to promote agricultural aviation and make recommendations for issues facing the industry. From a safety and security standpoint they have worked to develop an educational program which emphasizes aviation security and safety and drift mitigation. Professional Aerial Application Support System (PAASS) was developed to provide educational support to aerial applicators through a collaborative effort with NAAREF and is delivered during the off-season for aerial applicators (NAAA, 2011). They have made some recommendations to prevent the occurrence of malicious or unwanted activity around agricultural operations, which are as follows:

- Storing aircraft and crop protection products in locked hangars with electronic security systems when not in use.
- Parking and disabling loader trucks, forklifts, or other equipment to block aircraft.
- In cases where the aircraft must be left outdoors, using propeller locks, propeller chains or tie-downs on aircraft.
- Removing batteries from planes and disabling engines from unused aircraft.
- Operators have installed hidden security switches to prevent unauthorized startup of the aircraft.
- Establish contact with federal and local law enforcement agencies to coordinate responses to security breaches at agricultural aviation facilities. Encourage operators to list the appropriate law enforcement agency telephone numbers in a prominent place within their operations. Also outdoor security lighting around hangars and operations is encouraged (NAAA, 2011).

Terrorism and Agriculture

Terrorism is defined as the systematic use of terror especially as a means of coercion (Webster's Dictionary, 2011). Since the attacks of September 11th, 2001, the world has gained a much clearer definition of terrorism. In the past, generations had been witness to terrorist activity as reported by the media, however; most would consider September 11th to be a turning point in not only the U.S. perception of terrorism, but that of the entire world. The United States Office of Technology Assessment (OTA) has estimated that an attack with less than 100 kilograms of aerosolized anthrax spores could cause as many as 3 million casualties, which compares to the lethality of a thermonuclear weapon (Koblentz, 2003/04). We now, as a society, have a clear idea of what can happen when terrorist groups target a nation's infrastructure. We have been able to observe loss of life, economic loss, and a heightened sense of concern for the protection of our country's assets.

Agriculture and the food industry are vital to the social, economic, and arguably, the political stability of the U.S. Although farming employs less than 2% of the country's workforce, 16% of the workforce is involved in the food and fiber sector, ranging from farmers and input suppliers, to processors, shippers, grocers, and restaurateurs. In 2002, the food and fiber sector contributed $1.2 trillion, or 11% to the gross domestic product (GDP), even though the farm sector itself contributed less than 1%. Gross farm sales exceeded $200 billion, and are relatively concentrated throughout the Midwest, parts of the East Coast, and California (Figure 2-2). Production is split nearly evenly between crops and livestock (Monke, 2004).

With the great responsibility of agricultural production, comes the protection of those crops by chemical means, much of which is done by air. "A major problem is the

inability to identify criminal intent rapidly in outbreaks of foodborne illness caused by common pathogens or animal-borne diseases" (Lee, Harbison, & Draughon, 2003. p. 664). The same qualities that make agricultural aviation such a viable tool, also make it a viable threat in the event of malcontent, from an agroterrorism or bioterrorism standpoint. The responsibility of agricultural aviation is one of epic proportions. Agricultural aviation plays a significant role in the prevention of terrorism because of the significant likelihood that agricultural aircraft could be used as an instrument of terrorism in an agroterrorism or bioterrorism event.

Agroterrorism and Bioterrorism

Agroterrorism is defined as the deliberate or intentional mishandling of agricultural chemicals, aircraft, implements, or personnel to cause harm to persons or property. It has been a threat tactic since the beginning of civilization. The food source, being one of the most important requirements for sustaining human life has been a constant tool for malicious attacks on civilizations. The intentional salting and burning of fields by the Roman's in an attempt to take over their adversaries was recorded as a historically well defined use of agroterrorism. When a food source is taken from a civilization, the people will revert back to an anarchical state as defined by Maslow's hierarchy of needs (Figure 2-3). This defines how we, as humans, will react to the deficit of certain stimuli within our environment. Physiological needs are amongst the first order, and are therefore the most important tool for survival (Simons, Irwin, & Drinnien, 1987).

Agroterrorism was listed as the source for the Oklahoma City Bombing which occurred in 1995. On April 19th, the Alfred P. Murrah Federal Building in downtown Oklahoma city was considered to be the most destructive act of terrorism on American soil until September 11th, 2001 (Shariat, Mallonee, & Stephens, 1998). The attack took

place, utilizing a bomb made of 108 – 50 lb. bags of Ammonium Nitrate fertilizer and 3 – 55 gallon drums of Nitro-methane (FBI, 2011). These products are both readily available in the commercial market and very easy to obtain, which makes them a popular tool for terrorist attacks. The estimated damage in the event was $652 million with 168 fatalities (FBI, 2011).

The Oklahoma City bombing was a clear example of how agricultural products and chemicals can be used to create incendiary devices. The concern for agricultural aviation is that an aircraft could be used in this nature. For instance, the Air Tractor 802F, made by Air Tractor, Inc., has an operating weight of 16,000 lbs. at capacity with an empty weight of 7,210 lbs. This allows the aircraft to carry nearly a 9,000 lb. load without accounting for fuel. The hopper, or spray tank, on this aircraft has a holding capacity of 820 U.S. gallons, with a fuel capacity of 254 U.S. Gallons (Air Tractor, 2011). This type of aircraft, given its size and carrying capacity could be used to create an incidence of even greater destruction than the Oklahoma City bombing.

Agroterrorism is a subset of the more general issues of terrorism and bioterrorism. People more generally associate bioterrorism with outbreaks of human illness (such as anthrax or smallpox), rather than diseases initially affecting animals or plants (Monke, 2004). The use of biochemical warfare, which includes stockpiling and using biological weapons, was outlawed by the 1972 Biological Weapons Convention, (BWC). The rationale behind this treaty, which has been ratified or acceded to by 163 countries as of 2009, is to prevent a biological attack which could conceivably result in large numbers of civilian fatalities and cause severe disruption to economic and societal infrastructure (The Sunshine Project, 2007). Attacks of biological warfare have occurred for centuries,

from the purposeful infection of smallpox to native peoples, to the more current issues today with anthrax and other pathogens that may cause widespread losses to human and animal life.

Our current agriculture and food sectors have features that make them vulnerable to terrorist attacks. These include the high concentration of our livestock industry and centralized nature of our food-processing industry. As a result, chemicals and infectious pathogens can be intentionally added at various points along the farm-to-table food continuum (GAO, 2003). Florida's geographic location and extensive coastline increase the opportunity for terrorist accessibility. (Degraw, 2007). "Food and water are quite satisfactory vectors for pathogens causing both morbidity and mortality in target populations that are confined by geographic, industrial, or societal isolation" (Lee, Harbison, & Draughon, 2003, p. 666).

In the 1990's several attacks occurred in Wisconsin, most often caused by extremist environmental groups and disgruntled farm workers. In 1996, a cow carcass was intentionally contaminated with Chlordane, now banned in the U.S., and sent to an animal rendering plant where it was added to the feed. In this attack 4,000 tons of potentially contaminated animal feed was sent to 4,000 farms in four states causing a multimillion dollar product recall of dairy products and a 250 million dollar loss to the feed company. From this attack comes a level of awareness that biological attacks were still a relevant cause for concern. From an aerial application standpoint, chemicals or biological agents could easily be disseminated from an aircraft causing widespread damage to life and property. "Because of the importance of agriculture to American economic, political, and social stability, addressing the bioterrorism threat to agriculture

has taken on a new urgency" (Leviten & Olexa, 2003, p.64). This concern is not only dusting the food we eat, but the towns we live in, the schools where our children attend and the hospitals that provide care.

Florida State Agricultural Response Team (FLSART)

FDACS is the lead agency in Florida for dealing with agricultural and animal emergencies. FLSART was developed to implement planning, training, and response support with the aid of IFAS (FLSART, 2011). SART units can be developed at the Federal, state, and county level to implement a higher level of awareness in issues pertaining to agriculture and preparedness. Their website, http://www.flsart.org, contains a variety of materials that deal with both agroterrorism and bioterroism, that work to educate a number of people about these issues.

The following are a list of the SART programs strategic imperatives:

- Support an Emergency Support Function (ESF) 17 Multi-agency Coordination Group for state-level response activities for animal and agricultural issues.
- Develop and support an ESF-17 Management Team with equipment and training.
- Develop and support ESF-17 response resources such as the Mobile Animal Response Equipment (MARE) Units, College of Veterinary Medicine Veterinary Emergency Treatment Service (CVM VETS), Florida Veterinary Corps with funding and training.
- Develop and support County and Regional outreach, training and information coordination in order to enhance local and regional ESF-17 response capabilities (FLSART, 2011).

Agrochemicals and Security

Agrochemicals and Security have been reviewed in a training module developed by the Florida Cooperative Extension Service, under the direction of Dr. Carol Lehtola. This module was developed to increase awareness in safety and security to those who utilize or distribute dangerous chemicals such as fertilizers and anhydrous ammonia.

The module was distributed through the Florida AgSafe website, http://www.flagsafe.ufl.edu, which disseminates information to stakeholders in the agricultural industry. It contains background, pre/post tests and table-top discussions which are very effective systems for transferring knowledge. The main objectives of this program in cooperation with Florida Agsafe were developed to:

- Inform people about ways to be safe and secure, and thereby reduce the number of deaths, injuries and occupational diseases, particularly for agricultural workers and their families.
- To build a safety infrastructure for Florida through five activities: training of workers, training of students, publications, networks, and linkages.
- To encourage adoption of safe practices among employees and clientele. Every employee or client should be exposed to a safety tip or safety practice on a regular basis.
- To prepare the people of Florida to face disaster of any kind, to mitigate losses, both in life and property, and to promote rapid and effective recovery (Lehtola, Robbins, & Brown, 2005).

Chemical Exposure

Chemical exposure is a serious concern for anyone who mixes, handles, or applies agricultural chemicals. The main routes of chemical exposure are through the skin (dermal), eyes (ocular), oral (ingestion), and inhalation. This hazard can expose aerial applicator pilots to serious conditions from exposure if the proper ventilation systems or maintenance issues are not in compliance on a given aircraft. Mechanical issues, such as dry-rotted rubber seals, unchanged filtration devices and antiquated components may be a cause for concern on older aircraft. The Kentucky Aerial Applicators Manual suggests using filtered air as a means for ventilation because it is nearly impossible for the pilot to avoid flying back through some of the swath of the previous flight passes. If a filtered-air helmet is not available, the pilot should at least

wear an approved respirator. Filter or canister type respirators appropriate for the chemical being applied should be used. If one is needed for extended periods during hot weather, the use of a respirator and crash helmet combination is recommended. (Overhults, 2011).

Pilots should never be involved in loading aircraft with pesticides. It is difficult, even with normal protective clothing and equipment, to load without some exposure. Accumulated exposures may bring on mild pesticide symptoms, including dizziness and fixed contraction of the pupils (miosis) of the eye. The latter symptom has been reported to have diminished visual acuity, especially at night. While these mild symptoms may not be serious to ground applicators, or the ground crew, they may be potentially fatal to a pilot (Overhults, 2011).

The Federal Aviation Administration

The FAA oversees the safety of civil aviation. The safety mission of the FAA is first and foremost and includes the issuance and enforcement of regulations and standards related to the manufacture, operation, certification and maintenance of aircraft (Kane, 2007). From an agricultural aviation standpoint, the FAA is responsible for inspection and certification of pilots, aircraft, and operational authority as listed under FAR Part 137.

FAA oversight has become a significant problem in the United States. Most of the FAA's resources are devoted to the commercial airline sector, which flies about 37,000 flights per day. There are currently 4,500 safety inspectors employed by the FAA (FAA, 2011) which creates some kind of disparity in regards to other types of operations. The amount of support provided to other sources of aviation may diminish because of the lack of support. The FAA relies partially on state agencies to aid in their effort to support

smaller components of the aviation community. The Florida Department of Agriculture and Consumer Services is an agency who advocates aerial application and provides a level of support in cooperation with the FAA. These agencies share a combined responsibility to ensure the safety and well-being of agricultural operations around the country.

Department of Homeland Security

The Department of Homeland Security (DHS) was established shortly after the attacks of September 11th. Their primary responsibilities are to protect the U.S. from terrorist attacks and provide natural disaster response (DHS, 2007). They have been influential in the increase of awareness with regard to agroterrorism, bioterrorism and chemical safety. DHS's website, http://www.dhs.gov, is a viable source for not only the aviation community, but anyone who seeks preparedness information in the event of a terrorist or natural disaster occurrence. They have called for a number of summits and workgroups that work together to increase awareness.

Summary

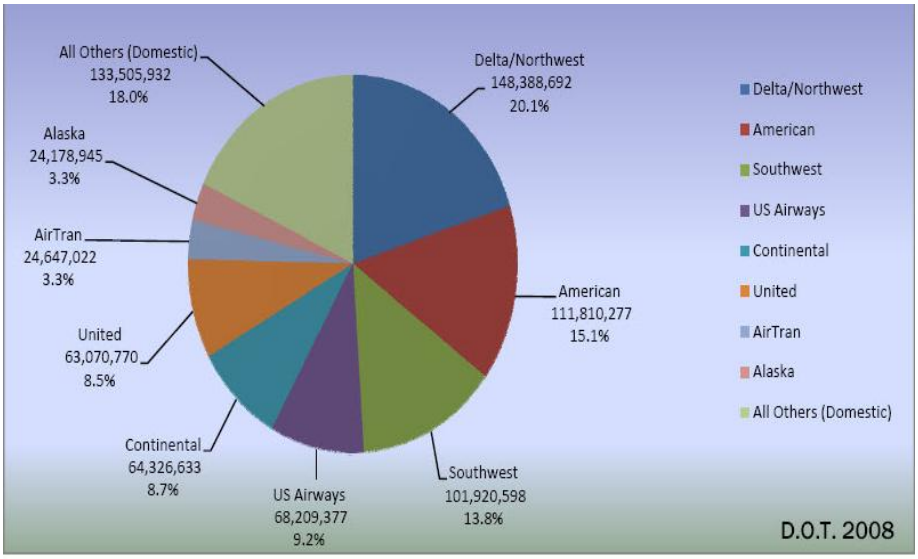
The literature review's purpose is to provide background into each one of the research topics to be discussed. It defines both outside and inside perceptions of some of the issues facing agricultural aviation presently and provides a solid overview of the operational definitions and causes for concern as they relate to agricultural aviation.

Based on the review of relevant literature, the following conclusions have been made:

- Agroterrrorism and Bioterrorism are of significant concern to aerial application operations.

- The proper education and implementation of best practices for safe storage and aircraft security is essential to provide aerial application operations and the public the highest level of safety.
- Chemical exposure on both older and newer aircraft can be of significant concern to pilots if they choose not to maintain their equipment or use the proper PPE.
- The FAA is understaffed and in need of modification to existing protocols to ensure agricultural aerial application operators are satisfied and protected with their respective level of service.
- The creation of materials that are specific to the concerns generated by agricultural aerial applicators are essential in providing a framework of support to the existing educational infrastructure.

It is imperative that research be done in order to measure pilot perception on the issues of agroterrorism, bioterrorism, chemical exposure, and FAA oversight in order to develop an understanding of their needs in the industry. In order to achieve an acceptable standard of safety, the current trends both inside and outside of the industry must be examined in order to ensure the welfare of the agricultural aviation community. These are important concerns and an area for heated debate which must be examined in order to better serve agricultural aviation.



740 MILLION ANNUAL AIRLINE PASSENGERS - 2008

Figure 2-1. Total Domestic/International U.S. Enplanements (DOT, 2008).

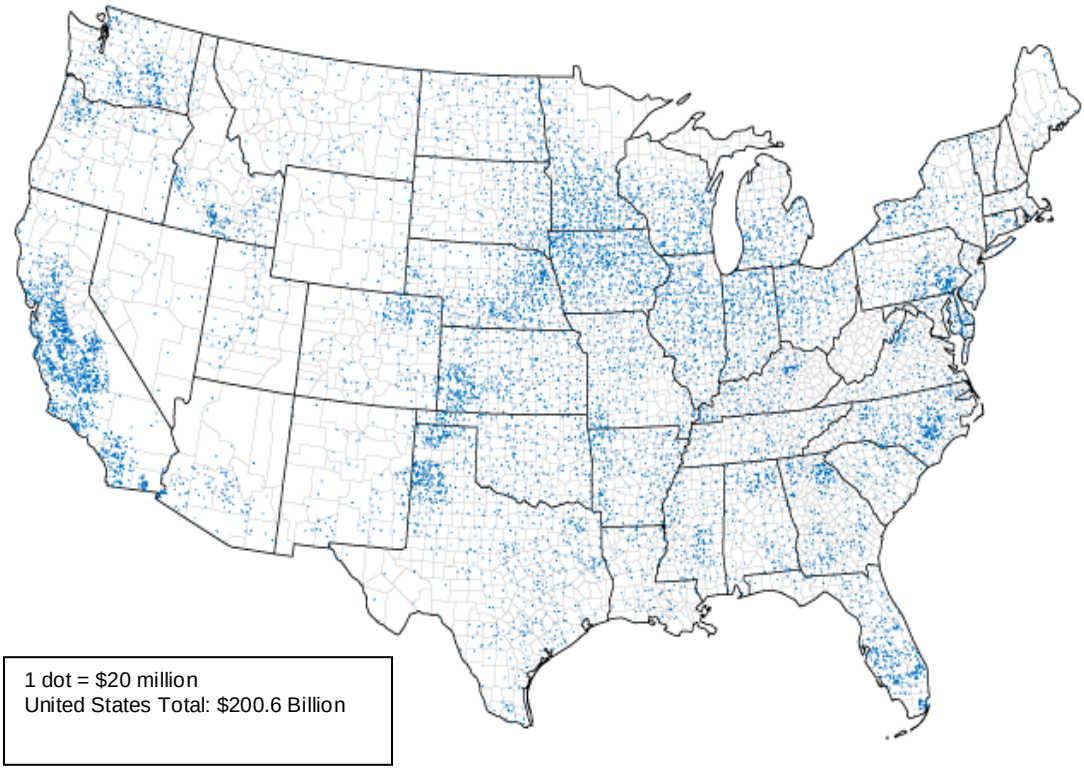


Figure 2-2. Geographic Concentration of Agricultural Production (USDA, 2002).

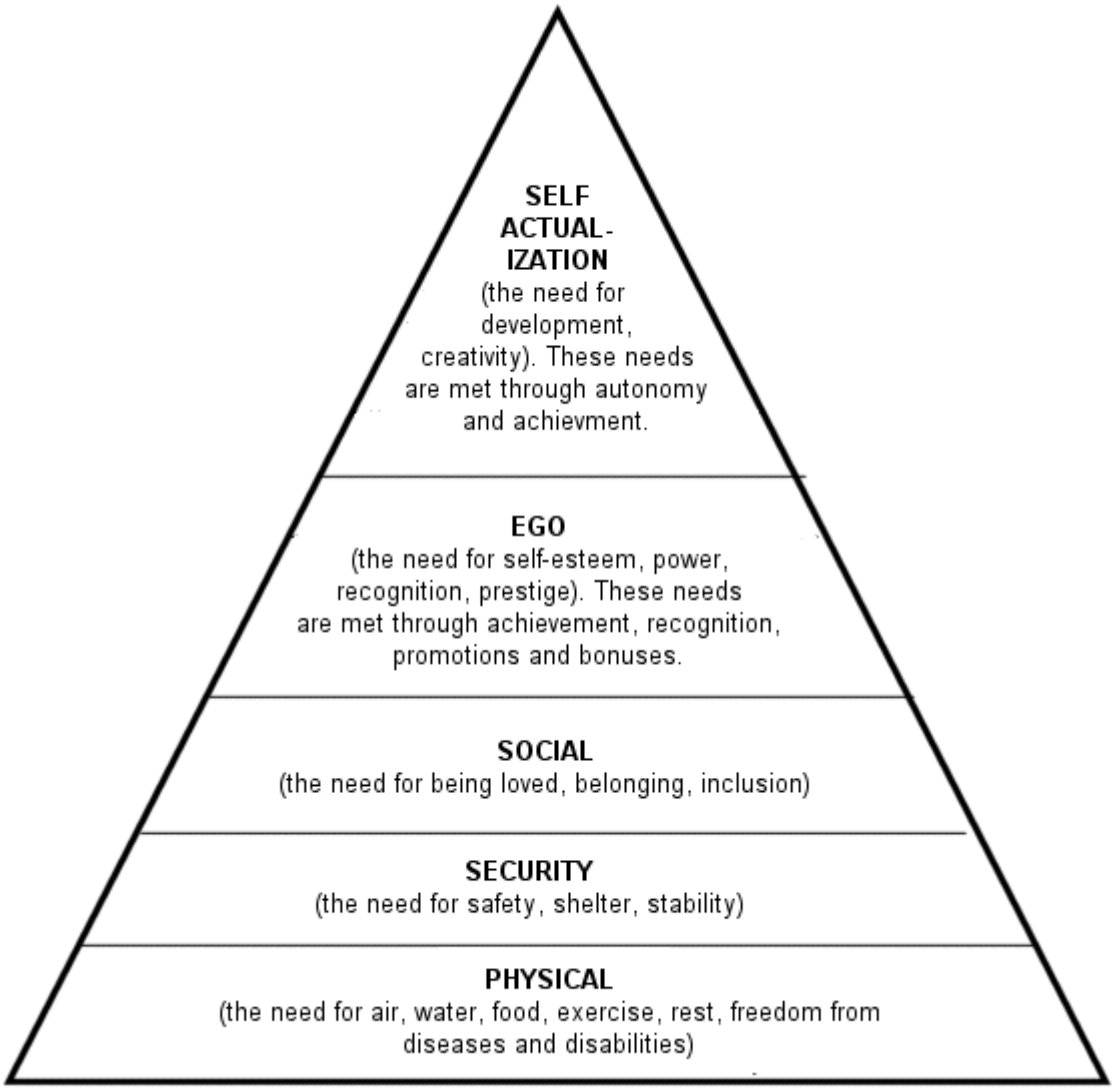


Figure 2-3. Maslow's Hierarchy of Needs (Russellkeppner, 2010).

CHAPTER 3
RESEARCH METHODOLOGY

The purpose of this research was to gain agricultural pilots perspectives on the current levels of threat in regard to agroterrorism and bioterrorism along with their insight on the amount of concern for chemical exposure and Federal Aviation Administration (FAA) oversight. This study reflects current trends and regulations which must be assessed on a regular basis in order to maximize safety throughout the agricultural aerial application industry. The previous chapter's discussion has covered literature that is related to the need for this research, and explains how all of these factors need to be researched in order to develop proper insights. The study is a non-experimental quantitative research design. This study was initiated upon the researcher's concern for the ramifications of a future terrorist event and the possibility to create training materials that are viable references for agricultural aerial applicators. Pilot perception is an integral part of the research process because it allows for an unbiased representation of the need to either keep or modify existing policies, procedures and best practices. The instrument used to acquire data for this research was designed by the researcher. Its intent was to measure perception by asking questions which measured the topic from multiple perspectives that would allow the researcher to correlate and identify patterns which may not be apparent present using other methods.

Research Design

The instrument that was used for this study was a self-developed survey using the self-reported approach. The survey was designed to reflect the attitudes concerning level of concern, time in service, flight time and other pertinent factors which were

intended to yield valid data and reflect pilot perceptions. Questions were derived through collaboration with multiple subject matter experts in the area of agricultural aerial application. The data were interpreted by Likert scale responses and direct pilot input from a response questionnaire (Appendix B).

The survey contained a demographics section along with a total of 43 questions of significant relevance to the research topic. The purpose of the demographics section was to determine the experience and personal profiles of the survey population. Questions 11 through 18 related to the current level of threat agricultural aerial applicators felt that they were exposed to in regard to agroterrorism. Questions 19 through 24 were developed to infer how pilots felt about the current threat level they are exposed to with regard to bioterrorism. Questions 25 through 30 sought data on aerial applicator pilot's perception of their respective exposure to the chemicals they apply. Questions 31 through 37 were created to develop an understanding of the aerial applicators relationship with the FAA. The final set of questions, were designed to interpret the need for specific training materials that relate to the research topics. The survey concluded with a comments section which was designed to allow each participant to freely write in their own comments.

The demographics section contained variables such as gender, age, number of flight hours, and years in service. These questions sought to determine the relationship, if any, between age, experience and time of service. Gender was another important consideration, which was included in order to gain insight into the number of men and women currently operating in the state of Florida in this facet of industry.

Data from questions 11 through 42 were derived through the use of a Likert scale response system. The survey allowed participants to rate how strongly they felt about each statement by assigning a response, which varied from SA (Strongly Agree), through SD (Strongly Disagree).

Once the survey was completed, it was delivered to the University of Florida's Institutional Review Board (IRB) where it was reviewed for legalities and content. Once approval was obtained, the survey was recommended for dissemination to the research population.

Quantitative Research Methods

Quantitative methods involve the collection and analysis of numerical data obtained from tests, questionnaires, checklists, and surveys. An important assumption that underlines the quantitative approach is that the world in which we live and carry out our research is relatively stable, uniform, and coherent; therefore, it can be measured, understood, and classified (Gay, Mills, & Airasian, 2006). The data obtained from this research could graphically be depicted through the use of line graphs. This representation would allow the reader to develop insight into the relationships between responses to each question. The researcher also utilized descriptive statistics to include mean, standard deviation and variance calculations. These tests were chosen to determine the level of correlation between variables and also because of their reliability and validity.

The data collected from the surveys were tabulated twice to ensure accuracy, then implemented into a statistical database for interpretation. The device used for this process was SPSS 17, which is a standard statistical analysis program. The program

was chosen on the basis of validity and popularity amongst statisticians working with social science type projects.

Research Model

From the research presented in the Literature Review, it has been established that agroterrorism, bioterrorism, chemical exposure and FAA oversight are a cause for concern amongst agricultural aerial applicators in the state of Florida. Pilots who are improperly trained or not exposed to relevant material on a regular basis may impose a high level of concern for not only themselves, but the entire public. It is imperative that research be done in these areas of study in order to validate this cause for concern. It was important to collect data with an assurance of anonymity throughout the survey population since it allowed unbiased responses from each participant.

Since there were very little quantifiable data from current agricultural aerial applicators in the state of Florida, it was essential for the researcher to develop a reliable instrument to yield valid data. The survey developed by the researcher strived to look at the variables from multiple viewpoints and did not strive to illicit any given response from the participant. The direct input from people who are in the industry was found to be the best method to achieve the desired research objectives. Therefore, the purpose of this study was to obtain quantifiable data, which would give the researcher insight into whether or not the topics of study were valid concerns amongst the industry.

Description of Research Participants

The subjects for this research were current agricultural aerial applicator pilot's listed under the current Florida Department of Agriculture and Consumer Services (FDACS) registry. The subjects were qualified airplane, helicopter, airplane/helicopter pilots consisting of both genders with various levels of experience. This group was

intended to represent a sample of all agricultural aerial application pilot's who operate under the existing FAA infrastructure.

One hundred and fifty one surveys were distributed via internet survey techniques. The internet survey was deployed via http://www.surveymonkey.com, beginning on October 15th, 2010 and ending on February 23rd, 2011. Names, e-mail addresses, and phone numbers of participants were obtained from FDACS in August, 2010, with a total of 151 potential participants. Of the surveys sent out, 63 were returned as undeliverable with a total of 40 completed surveys by the research population, for a response rate of 46%.

Instrument Pretest

A pretest of the survey was conducted in order to assure comprehensives and accuracy for the data collection device being used. The survey was administered to 3 Professors of Agricultural and Biological Engineering, 1 Law Professor, and 1 Professor of Agronomy at the University of Florida in Gainesville, Florida. After the completion of the pretest, each subject was asked to assess the survey based on their previous knowledge and experience in research. The survey results from all participants were positive in nature, which led the researcher to make only minor changes to the original document.

Distribution Method

The survey was distributed via internet survey techniques. The researcher entered the data via a survey distribution tool: http://www.surveymonkey.com, which is a standard tool for disseminating surveys via the internet. Each participant received a link to the survey through their e-mail account, which allowed them to complete the survey with the highest level of anonymity. The researcher was unable to identify who had or

had not taken the survey. The internet was chosen as a distribution method because of its ability to reach out to each participant and allow them to accomplish the survey with no pressure or time frame constraints. In order to achieve the highest level of reliability the researcher e-mailed only those pilots who were listed under the current FDACS certified agricultural aerial applicator list.

Statement of Hypothesis

It is hypothesized, that the empirical data collected throughout this study and pilot surveys will graphically and qualitatively yield results which show a positive correlation between pilot perception and the need for more educational materials and Continuing Education Units (CEU's) in the areas of agroterrorism, bioterrorism, chemical exposure, and FAA oversight.

CHAPTER 4
RESEARCH RESULTS

The data for this research study was analyzed and depicted graphically using SPSS 17 for Windows. This research does not attempt to disprove a hypothesis; instead the researcher is attempting to gain insight into how pilots perceive research variables that affect their respective operations and industry as a whole. The researcher evaluated this data using percentages and raw scores from the surveys. The percentage of participants who answered each question is represented by a line graph.

The data was then analyzed using descriptive statistics to determine the mean, standard deviation and variance of each question.

The survey instrument was comprised of a demographic section followed by a 32 questions that directly relate to the opinions and input of the research participants.

Part I - Demographics

Question # 1 asks the gender of each participant. Figure 4-1 shows the percentage and number of males and females who accomplished the survey. Question # 2 asks each participant their age. Figure 4-2 shows the percentage and number of participants in each age group. Question # 3 asks each participant their number of flight hours. Figure 4-3 shows the percentage and number of participants who chose each category. Question # 4 asks each participant their number of flight hours in agricultural aircraft. Figure 4-4 shows the percentage and number of participants who chose each category.

Question # 5 asks each participant to indicate their years in service as an agricultural aerial applicator. Figure 4-5 shows the percentage and number of participants who chose each answer. Question # 6 asks each participant to indicate how

many pilots are currently employed by their respective companies. Figure 4-6 indicates the percentage and number of participants who chose each category. Question # 7 asks each participant what Federal Aviation Administration (FAA) ratings they currently possess. They were instructed to check all that apply. Figure 4-7 shows the percentage and number of participants who chose each answer. Question # 8 asks each participant the primary type of aircraft they fly in their respective operations. The participants were instructed to check all that apply. Figure 4-8 indicates the percentage and number of participants who chose each answer.

Question # 9 asks each participant to classify their role as an aerial applicator. The participants were instructed to check all that apply. Figure 4-9 indicates the percentage and number of participants who chose each answer. Question # 10 is the final question contained within the demographics section and asks each participant whether or not the company they primarily work for has a pre-employment screening program. Figure 4-10 indicates the percentage and number of participants who chose each answer.

Part II - Perceptions on Agroterrorism

Questions # 11 through # 18 were designed to develop an understanding of how each survey participant felt about the perceived level of threat in the agricultural aerial application industry with regard to agroterrorism. The questions relate to both Florida and their perceptions on the rest of the country. The participants were provided a Likert scale with a five response range from Strongly Agree to Strongly Disagree.

Question # 11 asks the participant how highly they would rate the threat level of agroterrorism among aerial applicators. Figure 4-11 indicates the percentage and number of participants who chose each response. Question # 12 asks the participants how well they would agree that their own personal education in the area of agroterroism

is substantial enough to deal with the threat. Figure 4-12 indicates the percentage and number of participants who chose each response. Question # 13 asks the participants to rate how confident they feel that they could personally identify or “stave off” an event related to agroterrorism. Figure 4-13 indicates the percentage and number of participants who chose each response.

Question # 14 asks the participants how much they would agree that Florida is more susceptible to an agroterrorism attack than other states in the U.S. Figure 4-14 indicates the percentage and number of participants who chose each response. Question # 15 asks the participants to rate how they perceive their companies current protocols and procedures to mitigate the threat of agroterrorism. Figure 4-15 indicates the percentage and number of participants who chose each response. Question # 16 asks each participant to rate how they perceive the threat level of agroterrorism in the company they currently work for. Figure 4-16 indicates the percentage and number of participants who chose each response.

Question # 17 asks each participant to rate how they feel about the susceptibility of an agroterrorism event somewhere in the U.S. Figure 4-17 indicates the percentage and number of participants who chose each response. Question # 18 is the final question contained within the agroterrorism component of the survey and asks participants to rate how they feel about the likelihood of an agroterrorism event happening somewhere in the state of Florida. Figure 4-18 indicates the percentage and number of participants who chose each response.

Part III - Bioterrorism

Questions # 19 through # 24 were designed to develop an understanding of how each survey participant felt about the perceived level of threat with regard to

bioterrorism in the agricultural aerial application industry. The questions relate to both Florida and their perceptions on the rest of the country. The participants were provided a Likert scale with a five response range from Strongly Agree to Strongly Disagree.

Question # 19 asks the participant how highly they would rate the threat level of bioterrorism among aerial applicators. Figure 4-19 indicates the percentage and number of participants who chose each response. Question # 20 asks the participants how well they would agree that their own personal education in the area of bioterrorism is substantial enough to deal with the threat. Figure 4-20 indicates the percentage and number of participants who chose each response. Question # 21 asks the participants to rate how confident they feel that they could personally identify or “stave off” an event related to bioterrorism. Figure 4-21 indicates the percentage and number of participants who chose each response.

Question # 22 asks the participant to rank their perception on the relationship between bioterrorism and agroterrorism by asking them if bioterrorism is more of a current threat among aerial applicators. Figure 4-22 indicates the percentage and number of participants who chose each response. Question # 23 asks the participant to rank how well they feel bioterrorism and agroterrorism are covered by “in-house” training and trade publications. Figure 4-23 indicates the percentage and number of participants who chose each response. Question # 24 asks the participant to rank how well government issued advisory circulars and other publications cover the potential threats associated with bioterrorism and agroterrorism. Figure 4-24 indicates the percentage and number of participants who chose each response.

Part IV – Chemical Exposure

Questions # 25 through # 30 were designed to develop an understanding of how each survey participant felt about their levels of chemical exposure and the Personal Protective Equipment (PPE) that they are required to use during each application. The participants were provided a Likert scale with a five response range from Strongly Agree to Strongly Disagree.

Question # 25 asks the participant to rate how often they use the proper PPE for every job. Figure 4-25 indicates the percentage and number of participants who chose each response. Question # 26 asks the participant to rate how often, if ever, they have become sick or disabled from coming into contact with a toxic chemical while working as an aerial pesticide applicator. Figure 4-26 indicates the percentage and number of participants who chose each response. Question # 27 asks the participant if they feel that the current level of PPE required for each application is acceptable to prevent exposure to toxic chemicals. Figure 4-27 indicates the percentage and number of participants who chose each response. Question # 28 asks the participant to rate how effective they feel the ventilation systems in the aircraft they use are in preventing exposure to toxic chemicals during applications. Figure 4-28 indicates the percentage and number of participants who chose each response.

Question # 29 asks the participant to rate how often they feel that they can correctly identify the proper PPE for each application without referring to the approved chemical label. Figure 4-29 indicates the percentage and number of participants who chose each response. Question # 30 asks each participant to classify what types of PPE they use on a regular basis. The participants were instructed to check all that apply and a comment box was left in the bottom of the question for input outside of the

researchers answer selection. Figure 4-30 indicates the percentage and number of participants who chose each answer.

Part V – Federal Aviation Administration Oversight

Questions # 31 through # 37 were designed to develop an understanding of how each survey participant felt about the current level of involvement the FAA has in day-to-day operations of agricultural aerial application operations. The participants were provided a Likert scale with a five response range from Strongly Agree to Strongly Disagree.

Question # 31 asks each participant to classify how they feel about the current regulation enforcement by the FAA in regard to aerial applicators. Figure 4-31 indicates the percentage and number of participants who chose each answer. Question # 32 asks each participant to rate how concerned they are about being “ramp checked” by an FAA inspector while operating an agricultural aircraft. Figure 4-32 indicates the percentage and number of participants who chose each answer. Question # 33 asks each participant to rate how they feel the FAA places emphasis on other commercial aviation operations in comparison to how much is placed on agricultural aircraft operators. Figure 4-33 indicates the percentage and number of participants who chose each answer.

Question # 34 asks each participant to rate how they would feel about the implementation of an incident reporting system which would be used for educational and safety purposes in the aerial application industry. Figure 4-34 indicates the percentage and number of participants who chose each answer. Question # 35 asks each participant how they feel about the FAA being more involved in day to day operations and oversight within the aerial applicator industry. Figure 4-35 indicates the

percentage and number of participants who chose each answer. Question # 36 asks each participant to rate their respective level of concern for receiving a violation by the FAA while operating an aerial application aircraft. Figure 4-36 indicates the percentage and number of participants who chose each answer. Question # 37 asks each participant how they would rate their own knowledge about the safety of their respective operations compared to that of the FAA. Figure 4-37 indicates the percentage and number of participants who chose each answer.

Part VI – Training

Questions # 38 through # 43 were designed to develop an understanding of how each survey participant felt about the level of training and education they have attained since becoming a licensed aerial applicator and resources they may use for developmental purposes. The participants were provided a Likert scale with a five response range from Strongly Agree to Strongly Disagree.

Question # 38 asks each participant to rate how well they feel accredited schools or colleges who offer aerial applicator certification programs rank in regard to other training methods. Figure 4-38 indicates the percentage and number of participants who chose each answer. Question # 39 asks each participant to rank whether or not they have gained most of their experience as an aerial applicator while on the job. Figure 4-39 indicates the percentage and number of participants who chose each answer. Question # 40 asks each participant to rank how often they attend outside training events that keep them up to date on innovation and technology throughout the aerial application industry. Figure 4-40 indicates the percentage and number of participants who chose each answer.

Question # 41 asks each participant to rate how often they would like to attend re-current training on a bi-annual basis to keep up with industry standards. Figure 4-41 indicates the percentage and number of participants who chose each answer. Question # 42 asks each participant to rate how they feel about the level of training and materials their respective company puts out to allow them to do their jobs safely. Figure 4-42 indicates the percentage and number of participants who chose each answer. Question # 43 asks each participant to classify what sources of information they use on a regular basis for training and re-currency. The participants were instructed to check all that apply and a comment box was left in the bottom of the question for input outside of the researchers answer selection. Figure 4-43 indicates the percentage and number of participants who chose each answer. The final part of the survey left room for individual comment. It was designed to allow the participant to write freely about any concerns or general comment about the survey.

Descriptive Statistics

SPSS 17 was utilized to infer mean, standard deviation, and variance calculations from the data set. Table 4-1 shows the output data collected. The data was found to be normally distributed utilizing the Shapiro-Wilk method (Gay, Mills, & Airasian, 2006). This method was chosen for its appropriateness with small sample sizes and is considered to be a valid and reliable statistical test for normality.

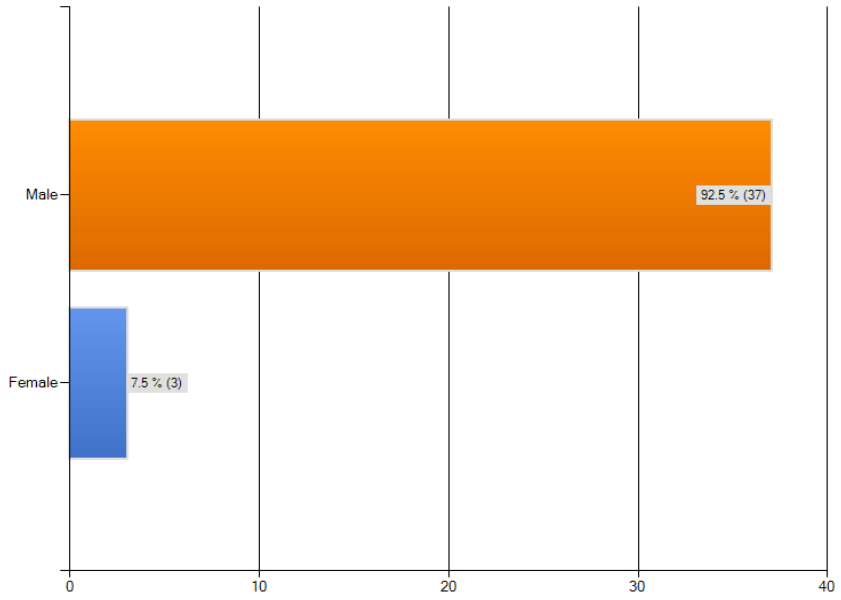


Figure 4-1. Percentage and number of participants who indicated gender. (N=40)

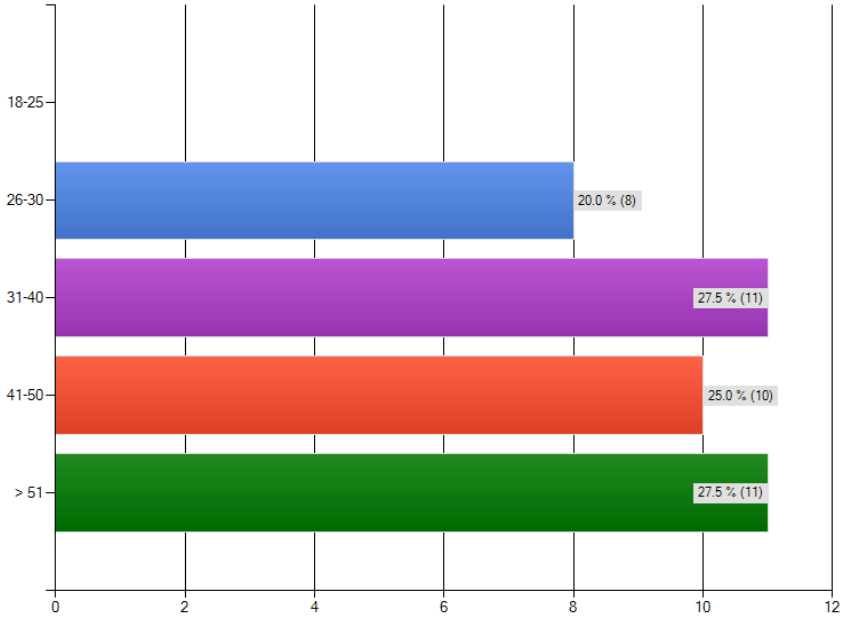


Figure 4-2. Percentage and number of participants in each age group. (N=40)

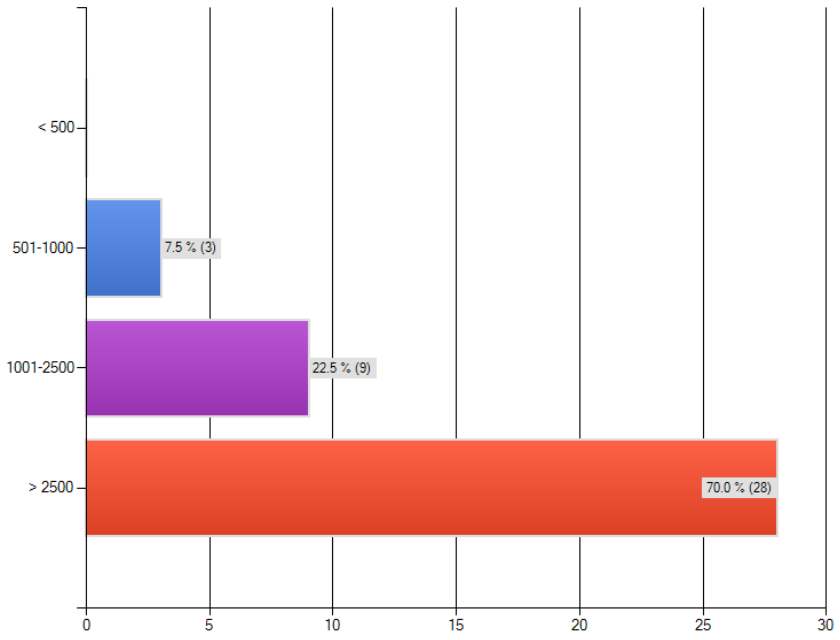


Figure 4-3. Number of Flight Hours: (N=40)

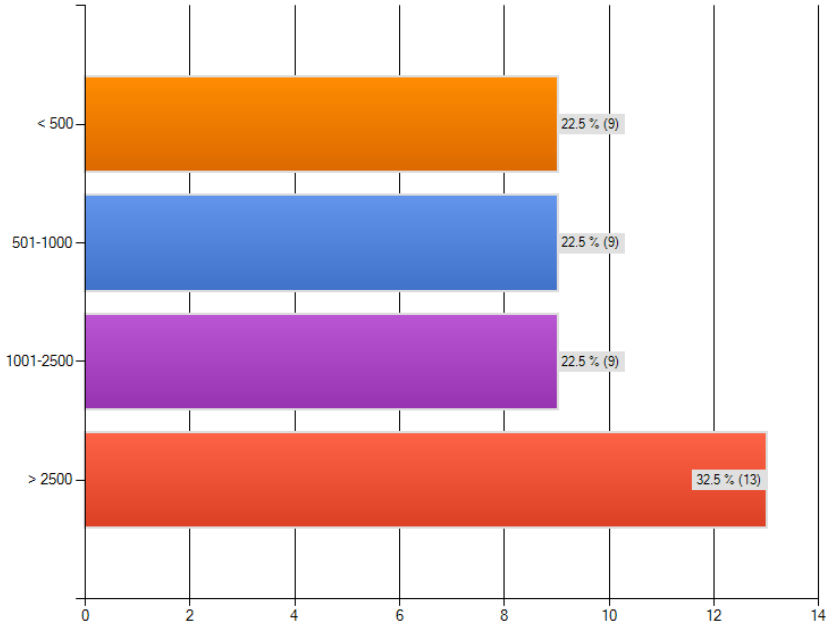


Figure 4-4. Number of Flight Hours in Agricultural Aircraft: (N=40)

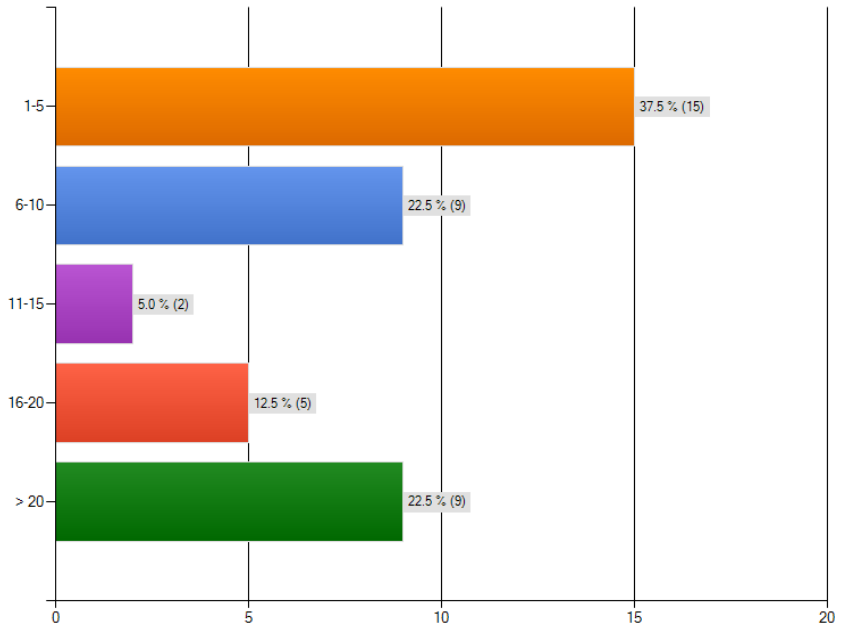


Figure 4-5. Years in Service as an Aerial Applicator: (N=40)

Figure 4-6. How many pilots are employed by your company? (N=40)

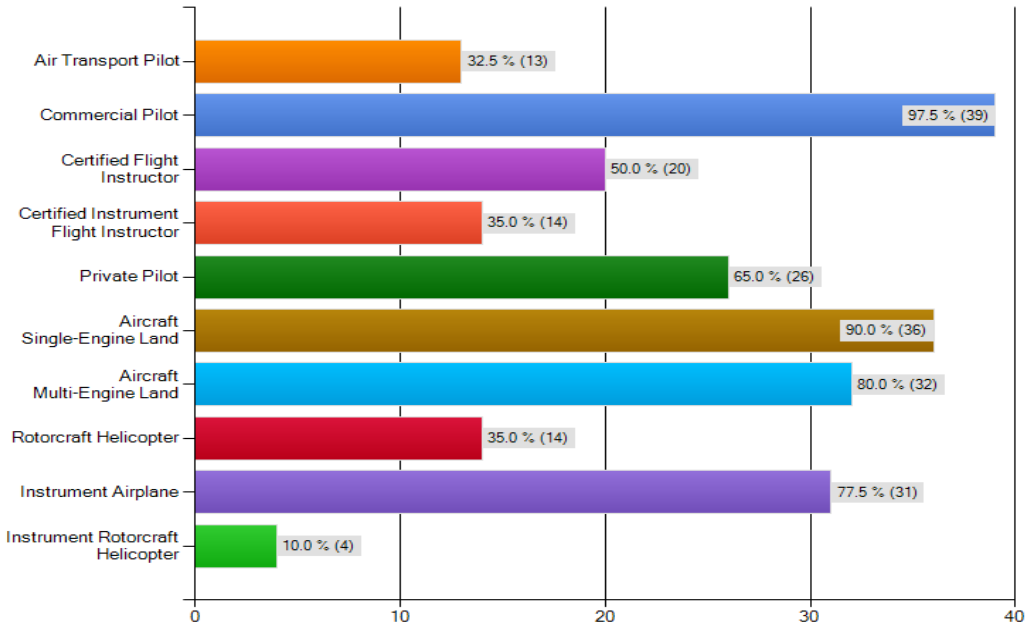


Figure 4-7. What FAA ratings do you currently possess? (N=40)

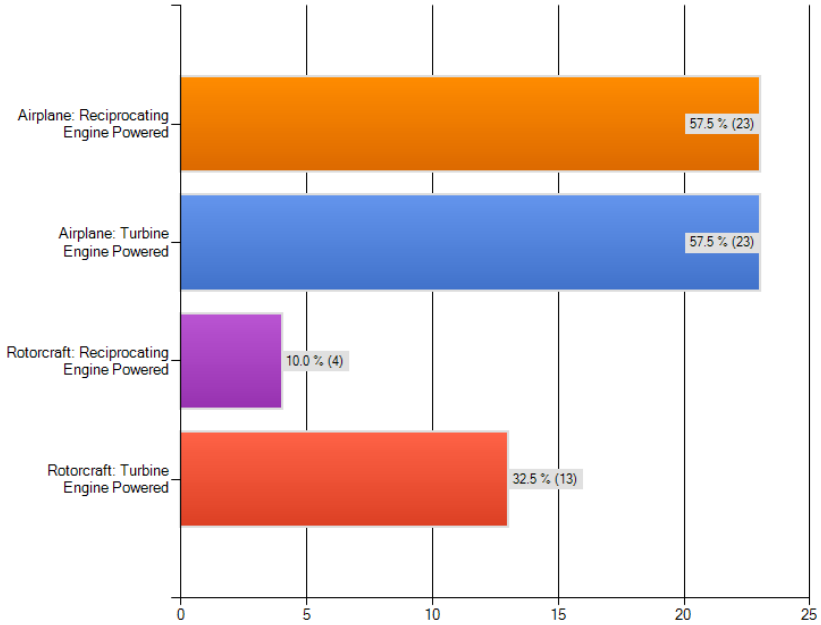


Figure 4-8. Type of aircraft you primarily fly for the purpose of aerial application: (N=40)

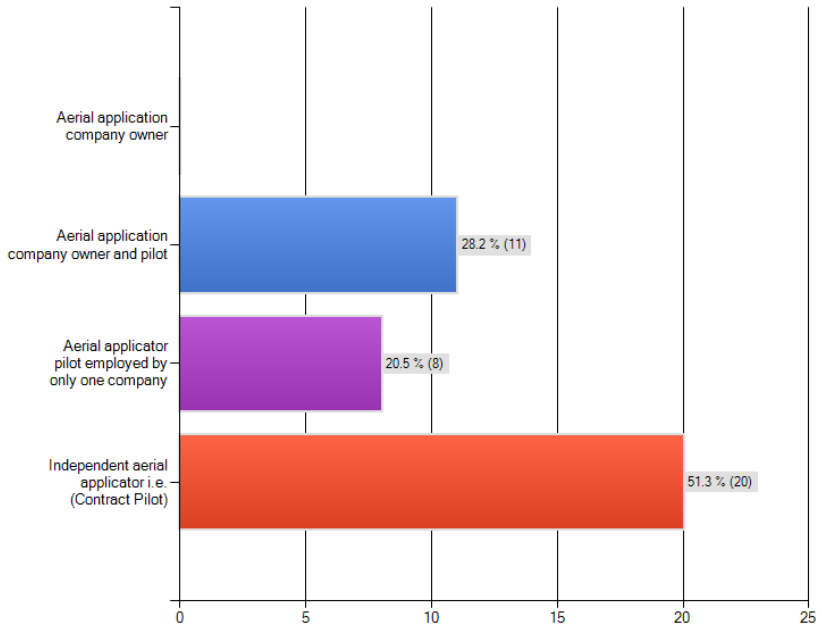


Figure 4-9. Which best classifies your role as an aerial applicator? (N=40)

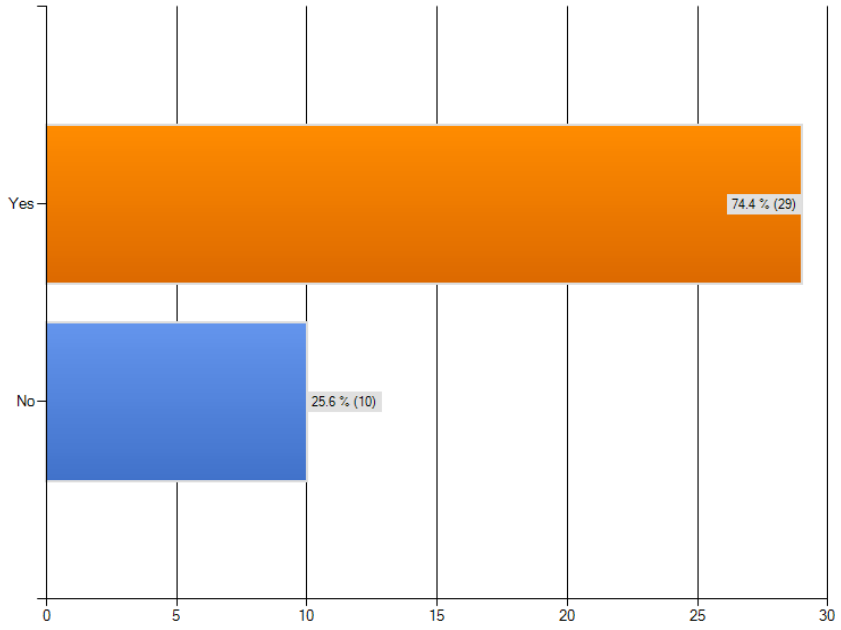


Figure 4-10. Does the company who employs you require a background check in their pre-employment screening? (N=40)

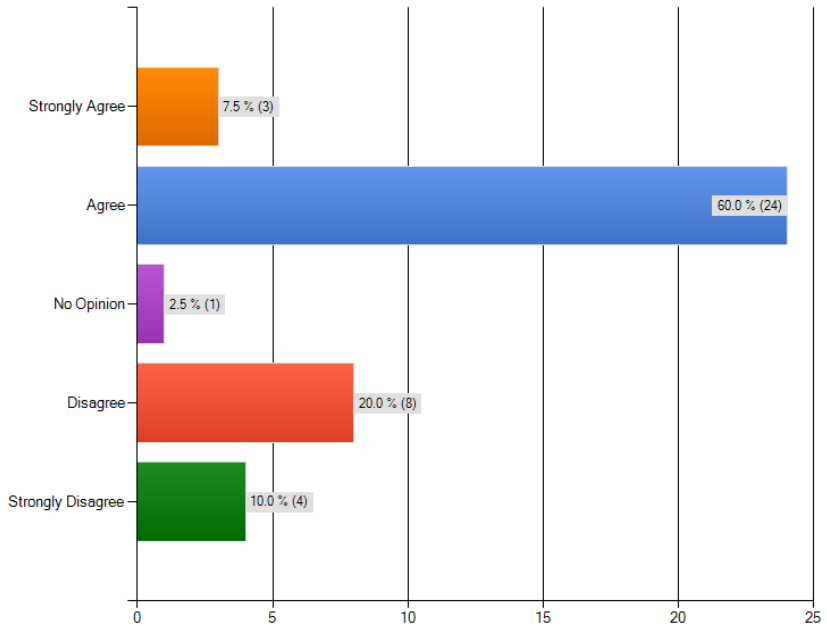


Figure 4-11. I feel that the threat level as it relates to agroterrorism is high amongst aerial applicators. (N=40)

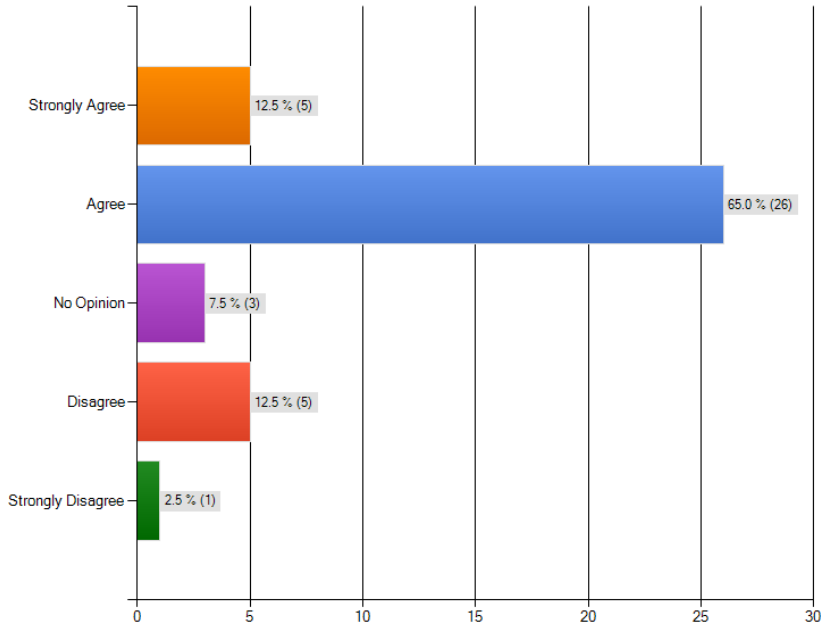


Figure 4-12. I feel that I have been properly educated to deal with the threat of agroterrorism. (N=40)

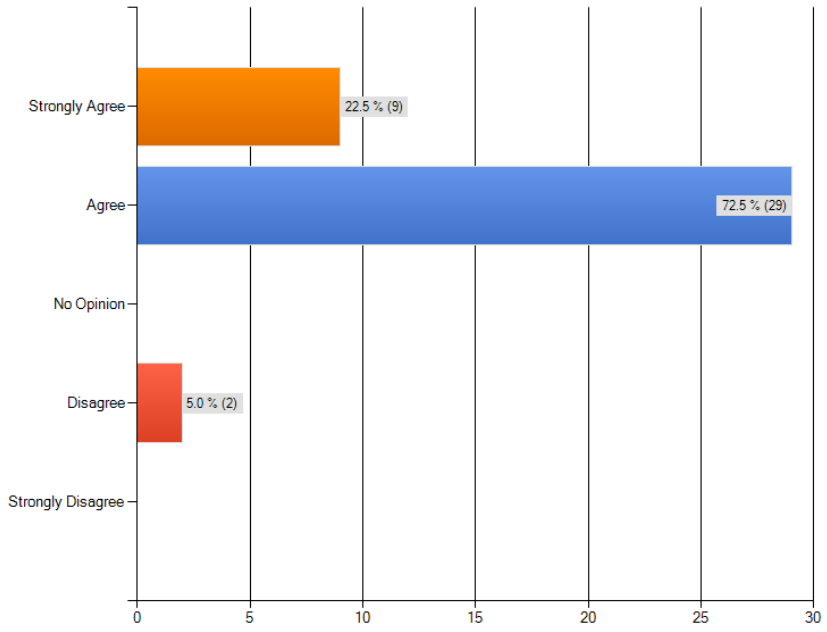


Figure 4-13. I feel confident that I could identify or "stave off" an event related to agroterrorism. (N=40)

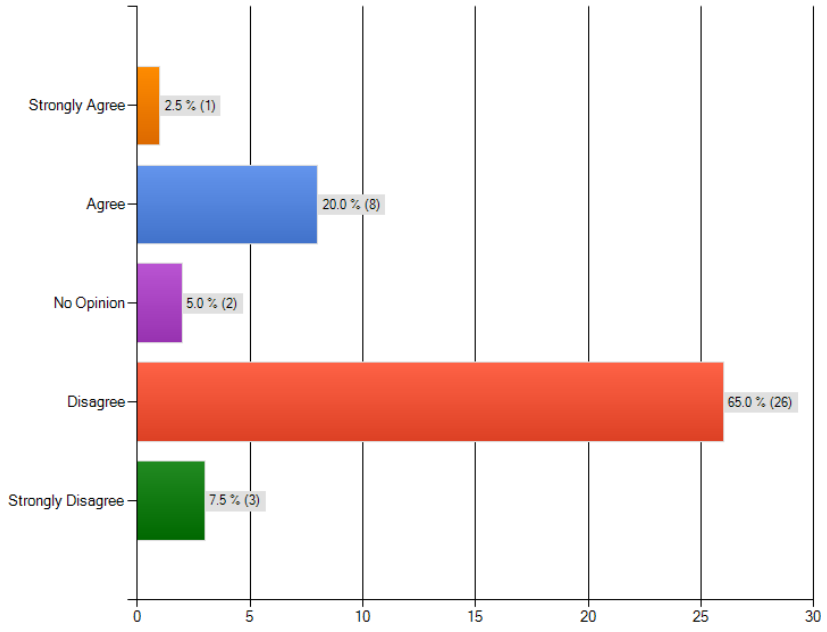


Figure 4-14. I feel that Florida is more susceptible to an agroterrorism attack than other states in the U.S. (N=40)

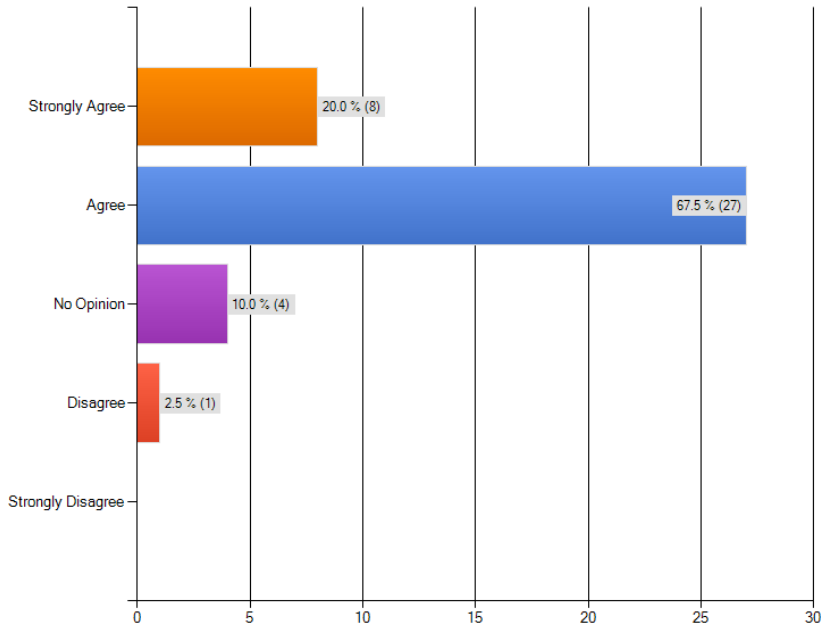


Figure 4-15. I feel that my company has the proper protocols in place to mitigate the threat of agroterrorism. (N=40)

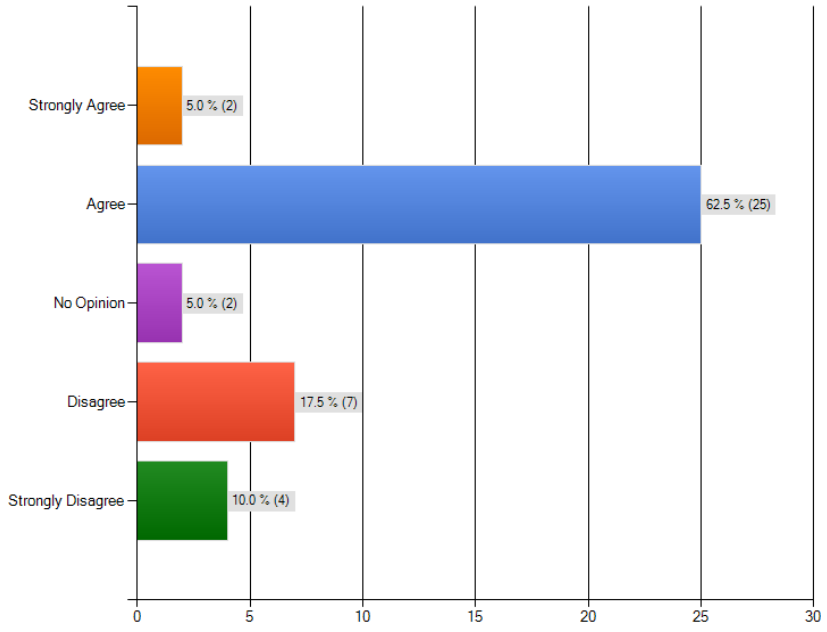


Figure 4-16. I think that I or my company is susceptible to agroterrorism. (N=40)

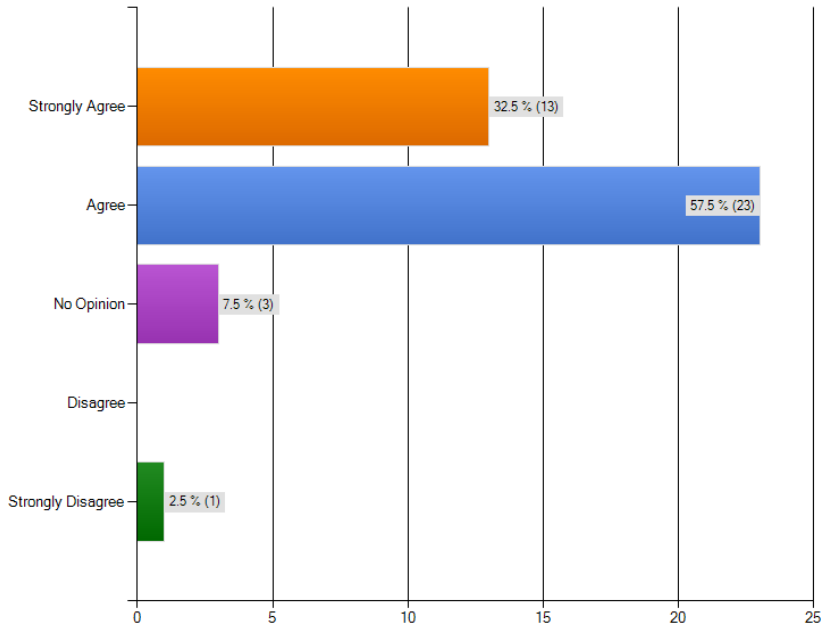


Figure 4-17. I think that an act of agroterrorism could happen somewhere in the U.S. (N=40)

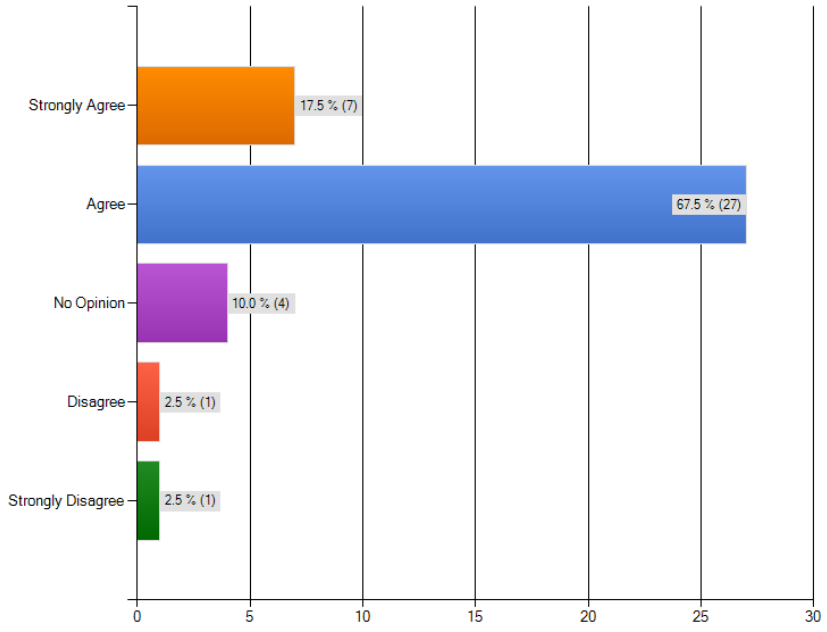


Figure 4-18. I think that an act of agroterrorism could happen somewhere in the state of Florida. (N=40)

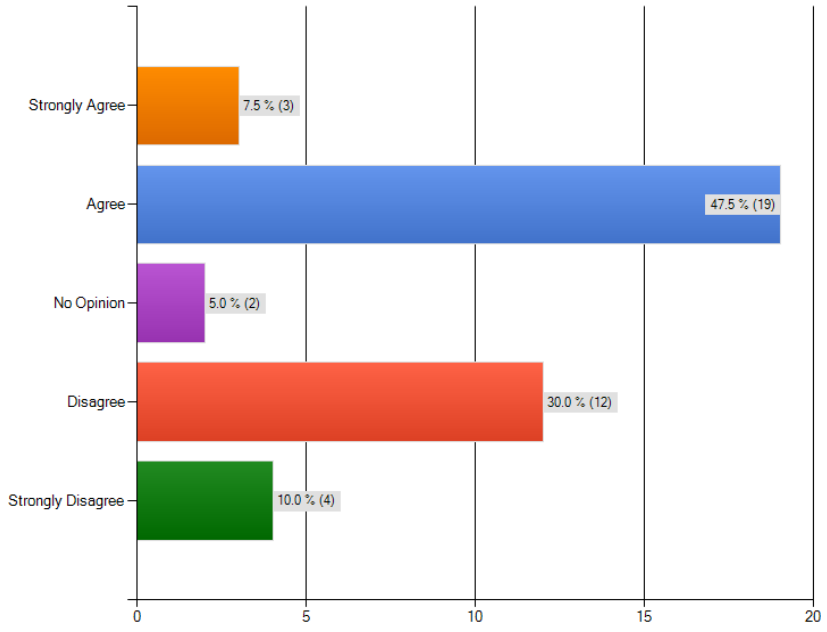


Figure 4-19. I feel that the threat level as it relates to bioterrorism is high amongst aerial applicators. (N=40)

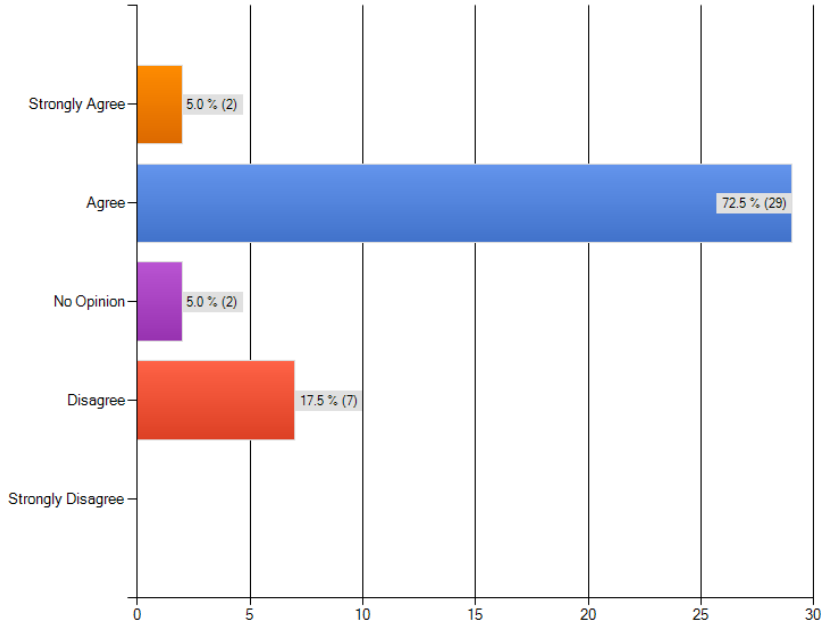


Figure 4-20. I feel that I have been properly educated to deal with the threat of bioterrorism. (N=40)

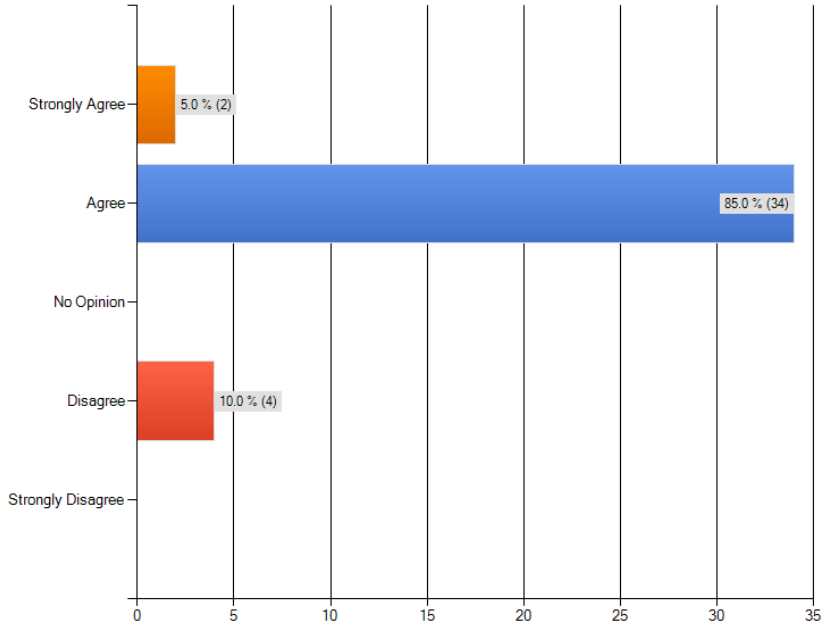


Figure 4-21. I feel confident that I could identify or "stave off" an event related to bioterrorism. (N=40)

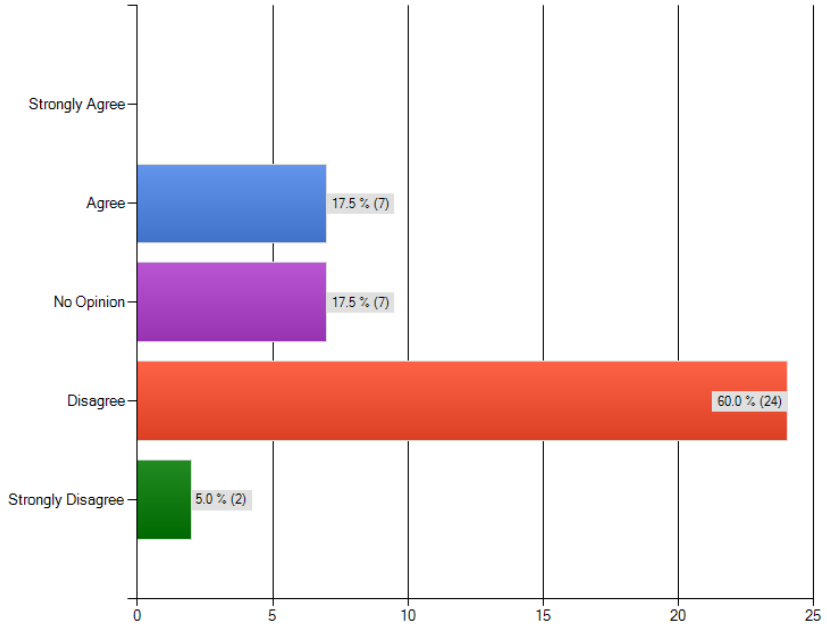


Figure 4-22. My profession is more susceptible to bioterrorism, than it is agroterrorism. (N=40)

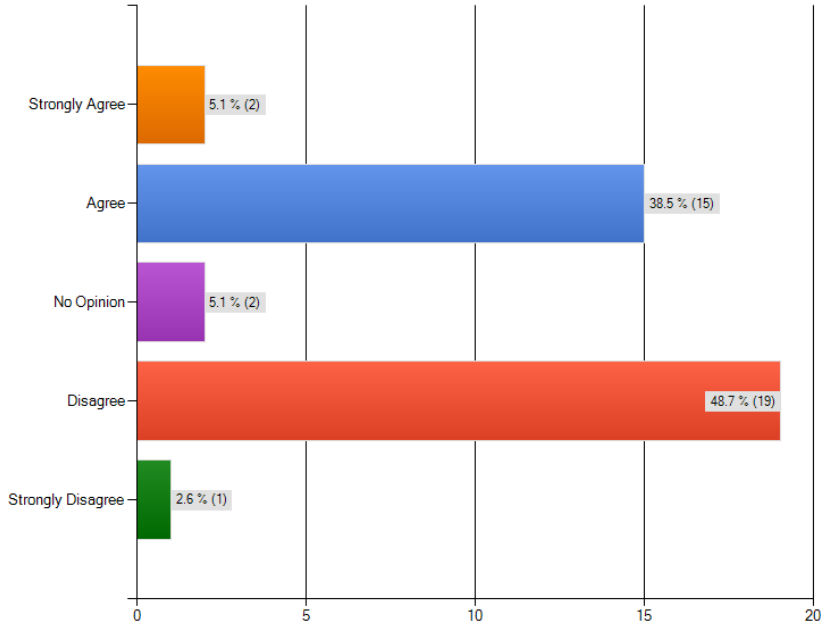


Figure 4-23. Bioterrorism and agroterrorism are covered well by "in-house" training and trade publications. (N=40)

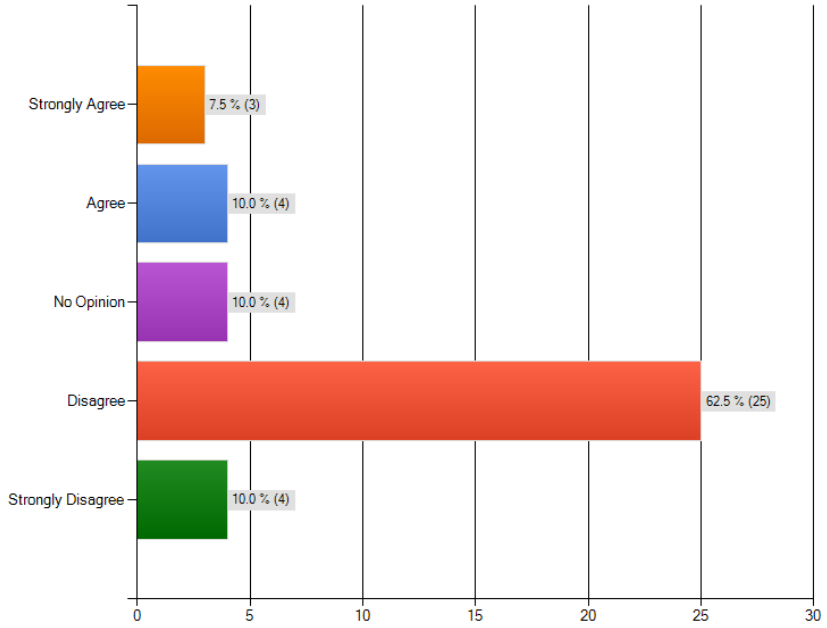


Figure 4-24. Government agencies, such as the FAA and Department of Homeland Security, provide adequate information and advisory circulars on the potential threats associated with bioterrorism and agroterrorsm. (N=40)

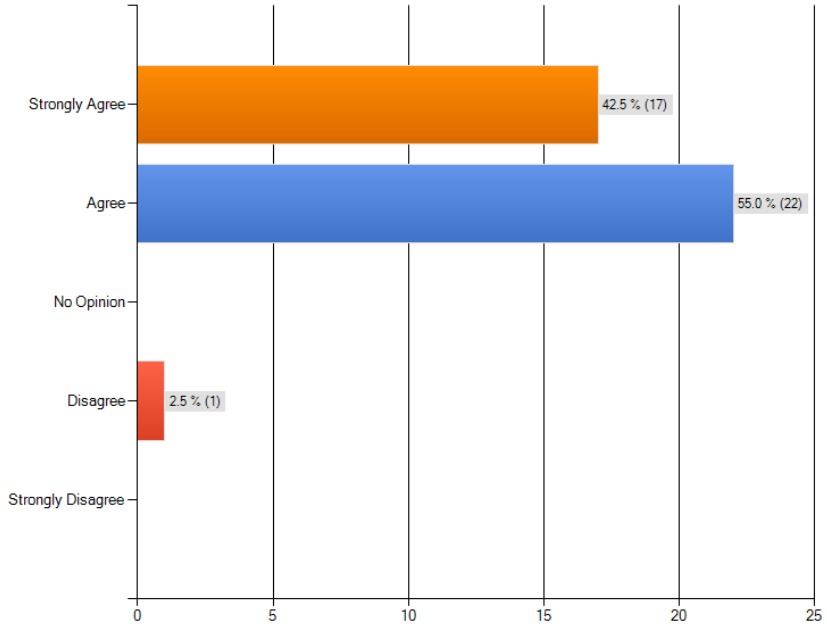


Figure 4-25. I use the proper Personal Protective Equipment, (PPE), for <u>every</u> job. (N=40)

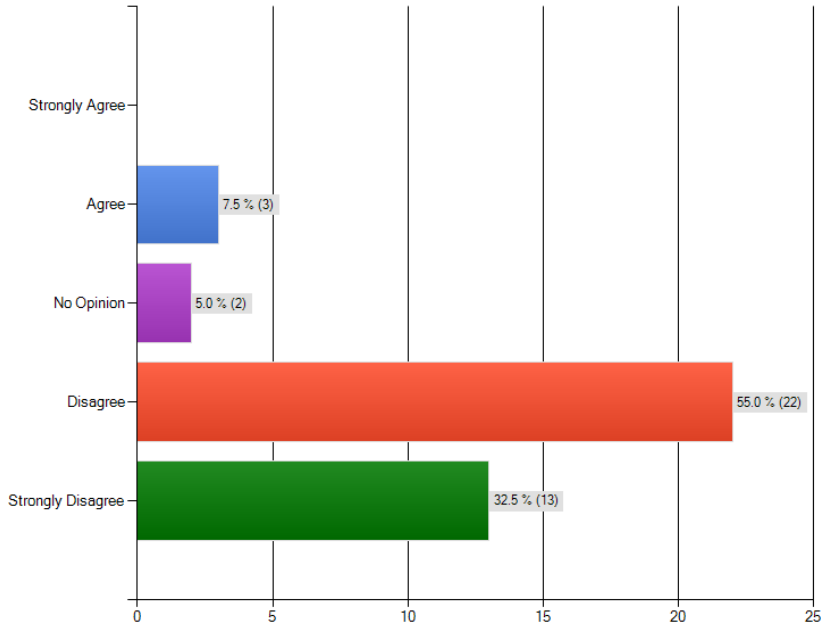


Figure 4-26. I have become sick or disabled from coming in contact with a toxic chemical while working as an aerial pesticide applicator. (N=40)

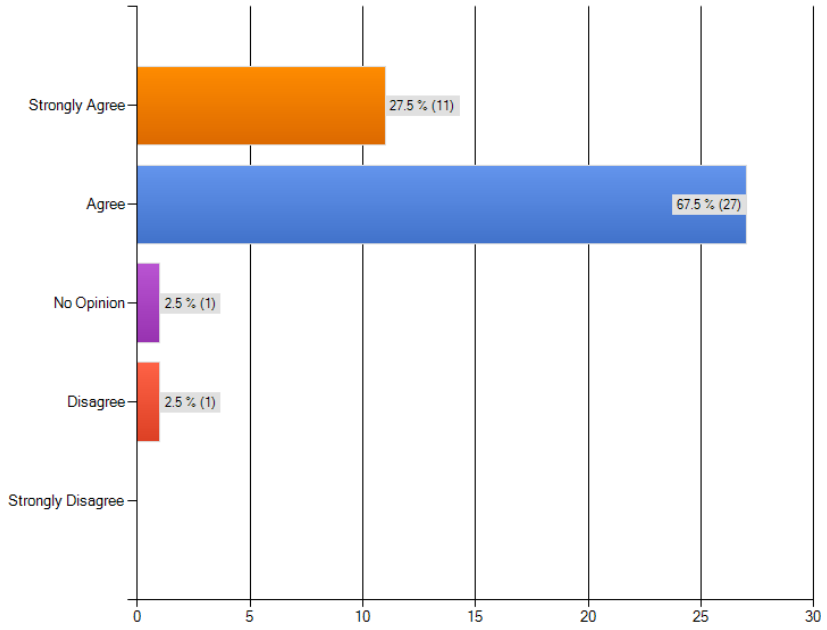


Figure 4-27. I feel that the PPE required for each application is acceptable to prevent exposure to toxic chemicals. (N=40)

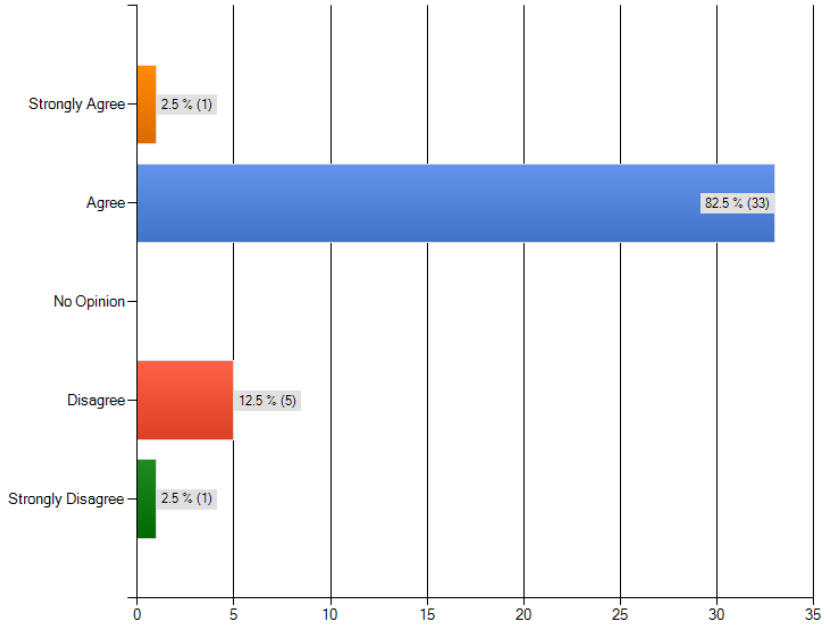


Figure 4-28. I feel that the ventilation systems in the aircraft I or my company utilize are acceptable to prevent exposure to toxic chemicals. (N=40)

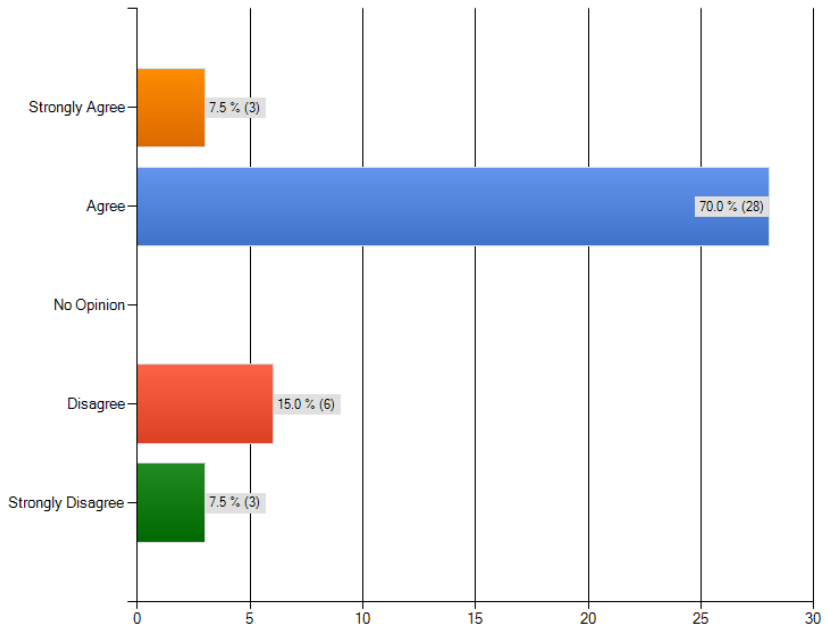


Figure 4-29. I often feel that I know what PPE to use to prevent exposure to toxic chemicals without referring to the chemical label. (N=40)

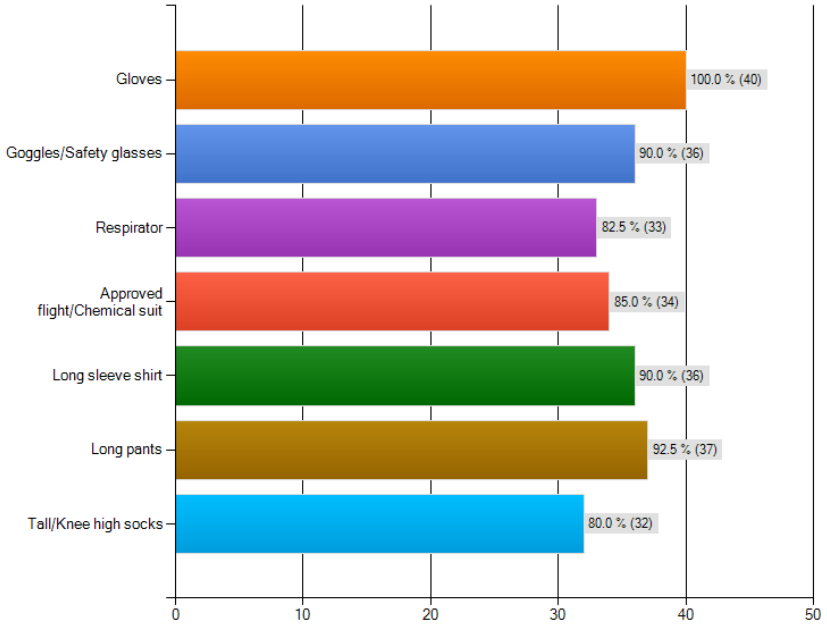


Figure 4-30. The PPE that I use on a regular basis are: (N=40)

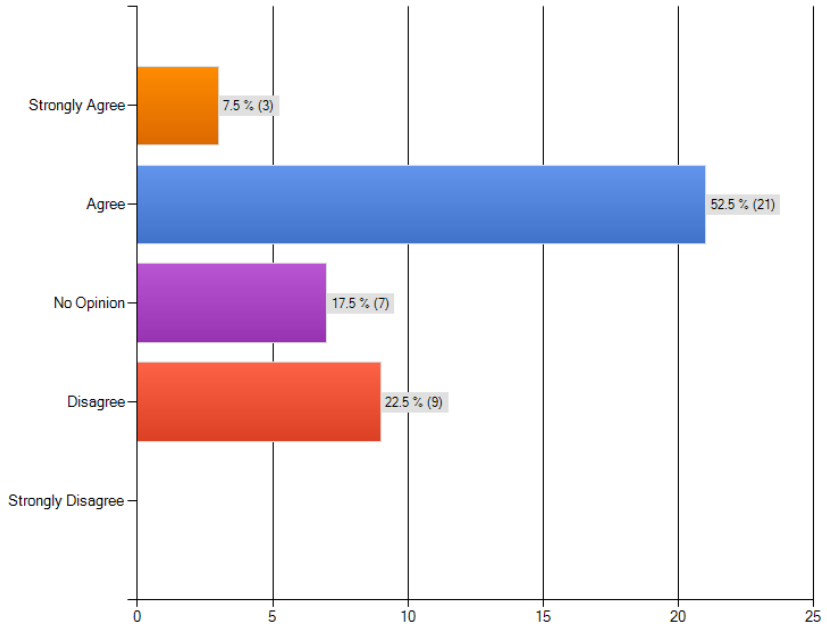


Figure 4-31. I feel that the FAA places too much regulation on aerial applicators. (N=40)

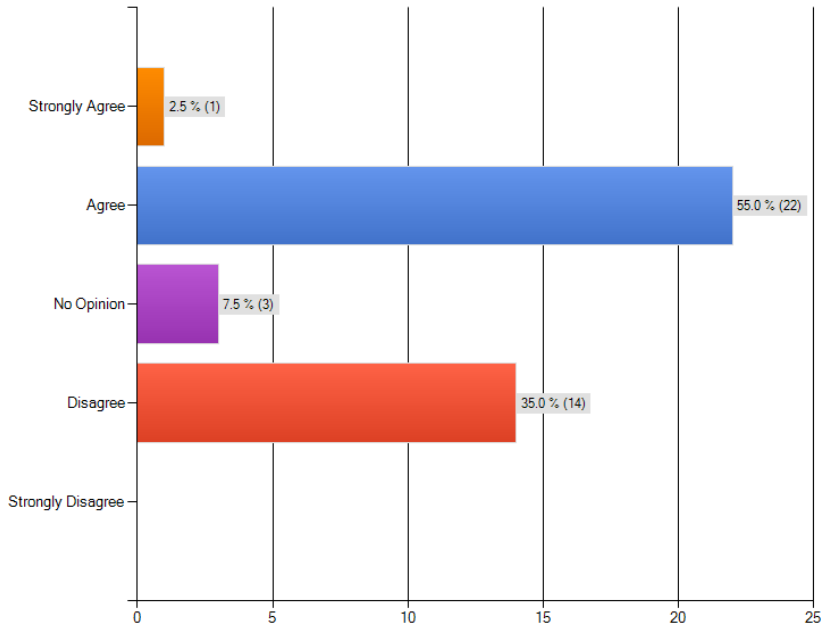


Figure 4-32. I have had concerns of being "ramp checked" by an FAA inspector while operating agricultural aircraft. (N=40)

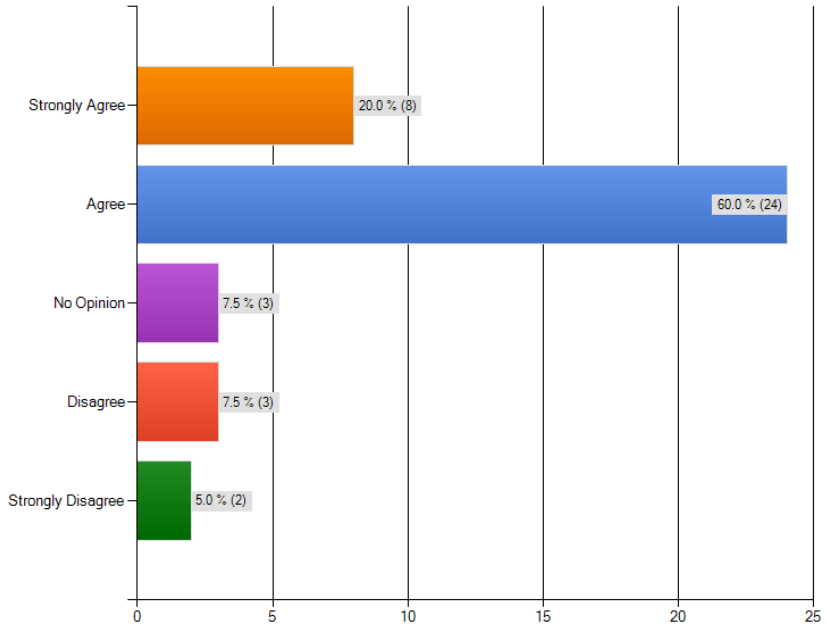


Figure 4-33. I feel that the FAA places more emphasis on the safety of other commercial operators than they do on operators of agricultural aircraft. (N=40)

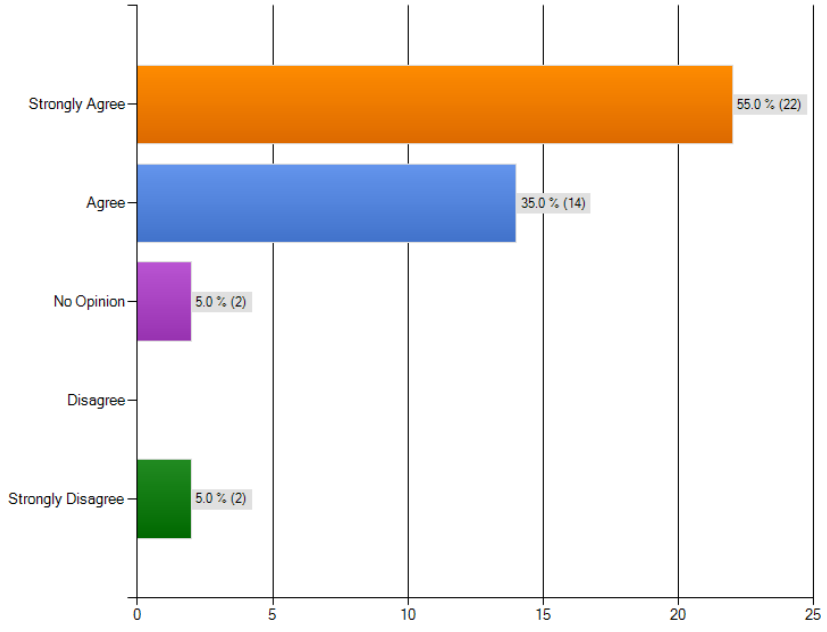


Figure 4-34. I would approve of an anonymous incident reporting system which would be used for educational and safety purposes and would not be used for the admission of a violation. (N=40)

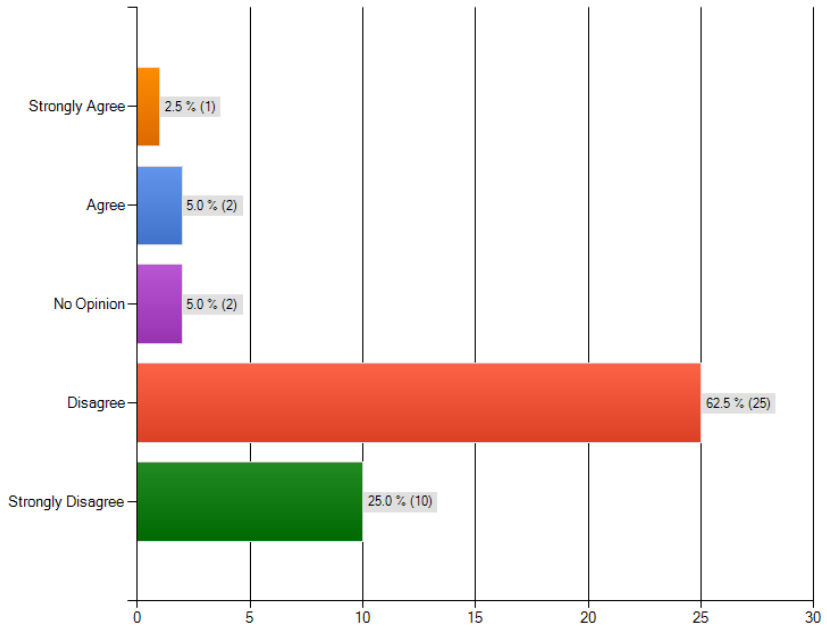


Figure 4-35. I feel that the FAA should be more involved in day to day operations and oversight within the aerial applicator. (N=40)

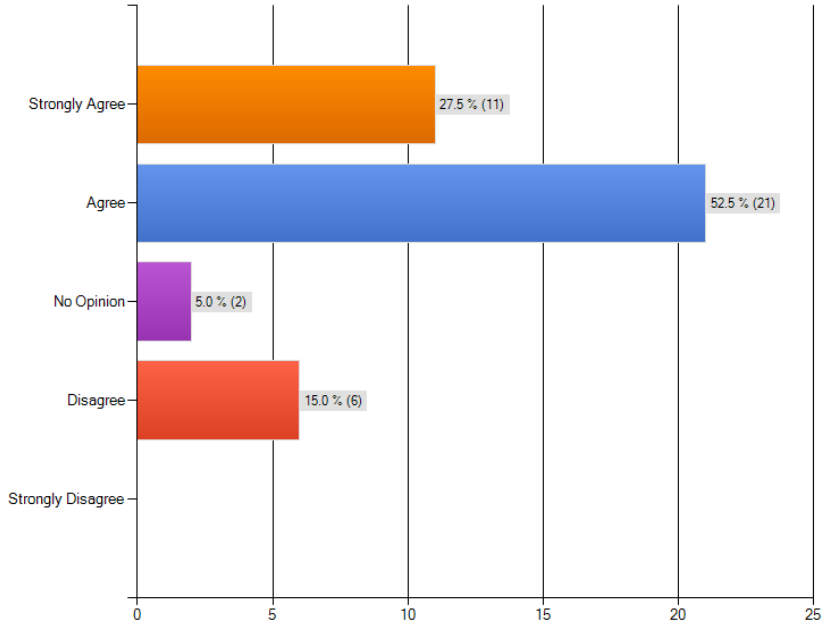


Figure 4-36. I am concerned about the consequences of receiving a violation by the FAA while operating aerial application aircraft. (N=40)

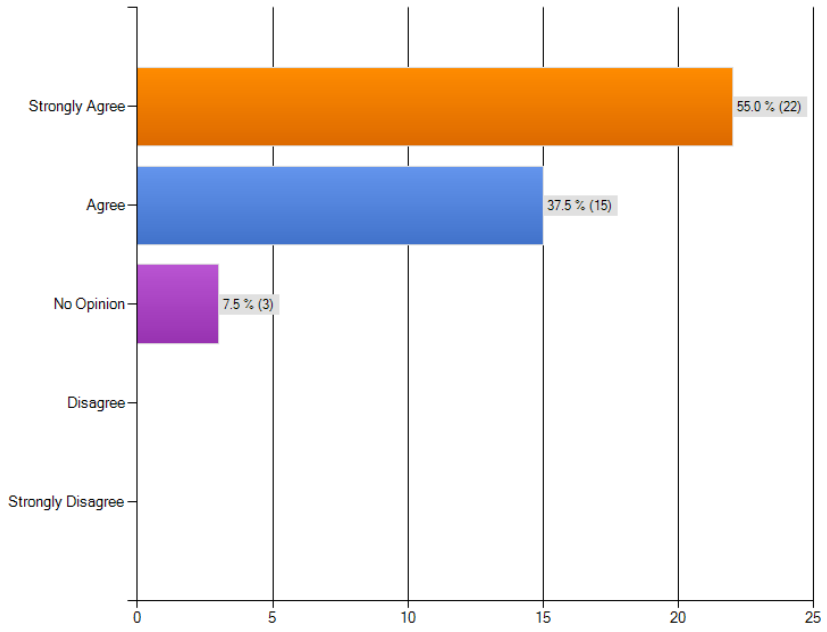


Figure 4-37. I feel that I or my company have more knowledge about the safety of our operation, than that of the FAA. (N=40)

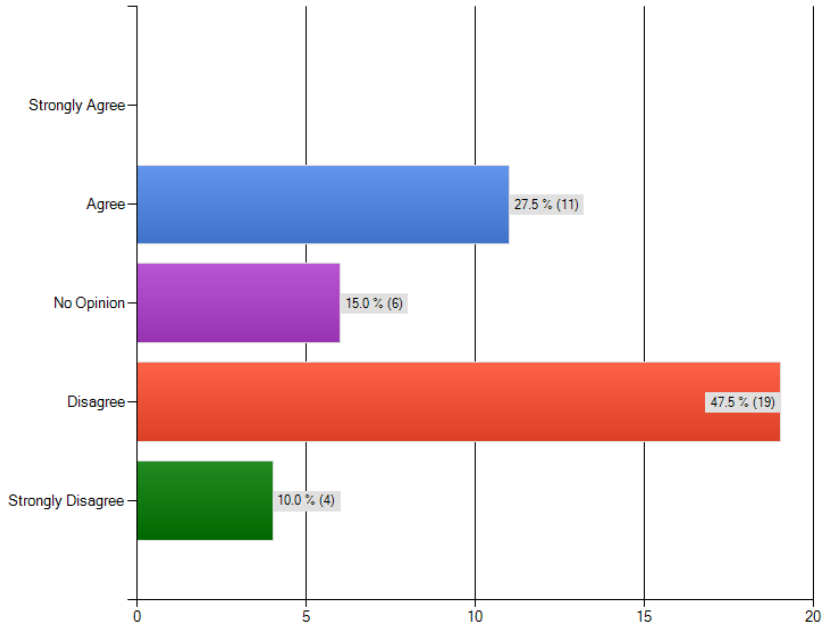


Figure 4-38. I feel that accredited schools or colleges who offer an aerial applicator certification program provide superior training in comparison to other methods of certification. (N=40)

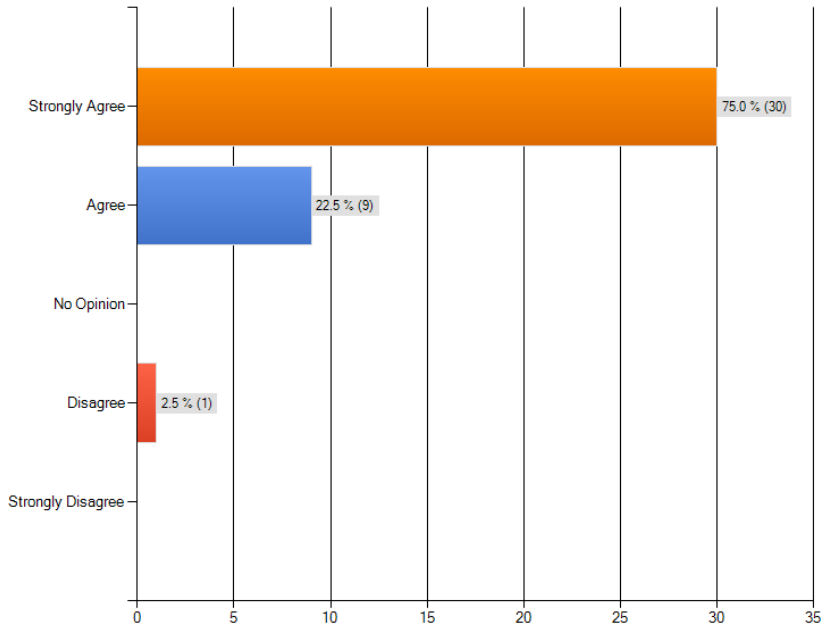


Figure 4-39. I feel that I have gained most of my experience and knowledge while performing on the job. (N=40)

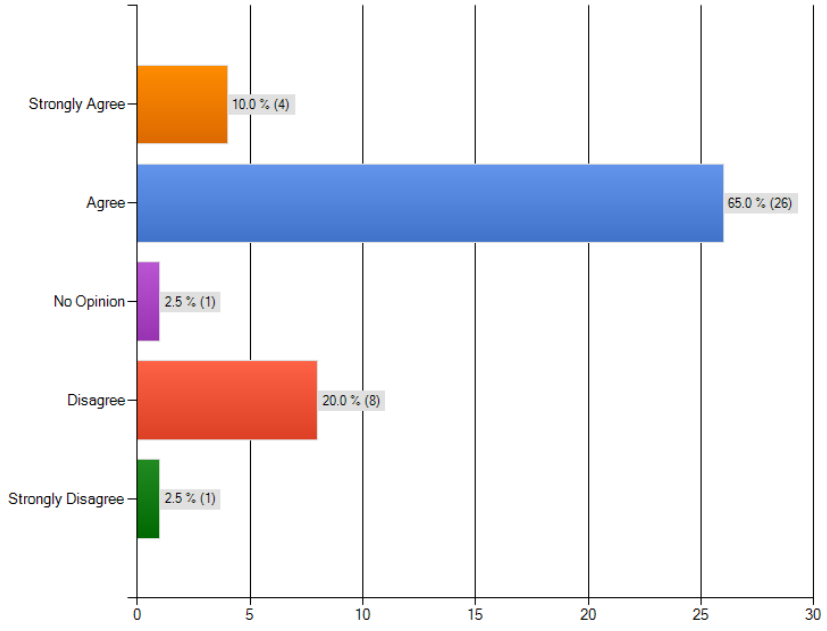


Figure 4-40. I regularly attend outside training events that keep me up to date on innovative methods and technologies in my profession. (N=40)

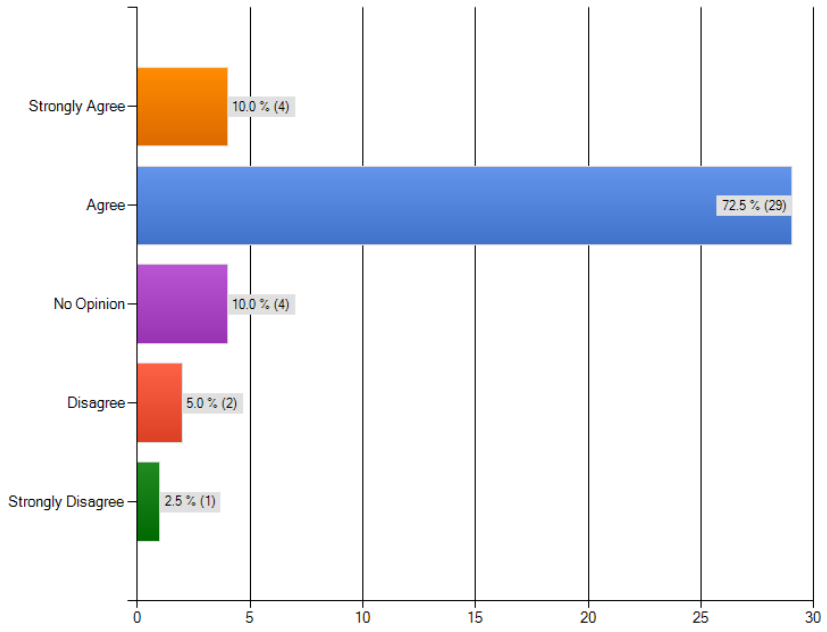


Figure 4-41. I would like to regularly attend re-current training on a bi-annual basis to keep up with industry standards and new policies. (N=40)

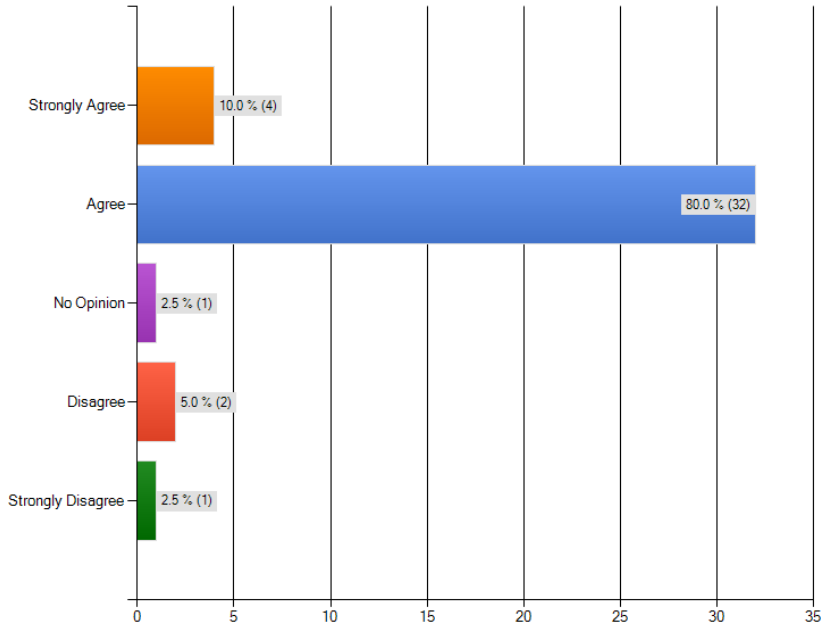


Figure 4-42. I feel that the company I work for provides adequate training and materials on a regular basis to allow me to do my job safely. (N=40)

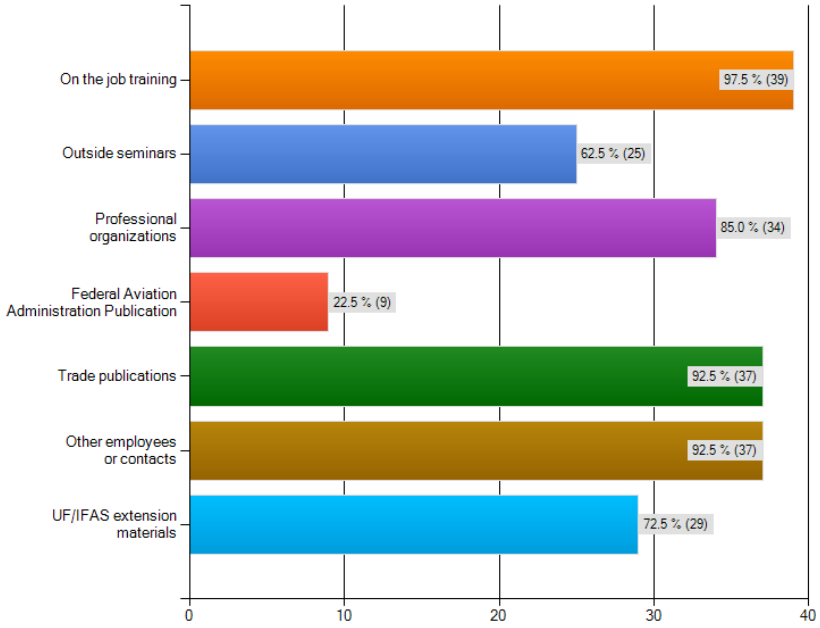


Figure 4-43. I feel that I gain the most training and re-currency from the following sources. (N=40)

Table 4-1. Descriptive Statistics for the data collection.

	N	Mean		Std. Deviation	Variance
	Statistic	Statistic	Std. Error	Statistic	Statistic
Gender	40	1.0750	.04218	.26675	.071
Age	40	3.6000	.17468	1.10477	1.221
Number of Flight Hours	40	3.6250	.09928	.62788	.394
Number of Flight Hours in Agricultural Aircraft	40	2.6500	.18450	1.16685	1.362
Years in Service as an Aerial Applicator	40	2.6000	.25770	1.62985	2.656
How many pilots are employed by your company?	40	1.1000	.05991	.37893	.144
Does the company who employs you require a background check in their pre-employment screening?	40	1.2750	.07150	.45220	.204
I feel that the threat level as it relates to agroterrorism is high among aerial applicators	40	2.6500	.18794	1.18862	1.413
I feel that I have been properly educated to deal with the threat of agroterrorism	40	2.2750	.14758	.93336	.871

Table 4-1. Continued

I feel confident that I could identify or "stave off" an event related to agroterrorism	40	1.8750	.10245	.64798	.420
I feel that Florida is more susceptible to an agroterrorism attack than other states in the U.S.	40	3.5500	.15587	.98580	.972
I feel that my company has the proper protocols in place to mitigate the threat of agroterrorism	40	1.9500	.10096	.63851	.408
I think that I or my company is susceptible to agroterrorism	40	2.6500	.18099	1.14466	1.310
I think that an act of agroterrorism could happen somewhere in the U.S.	40	1.8250	.12345	.78078	.610
I think that an act of agroterrorism could happen somewhere in the state of Florida	40	2.0500	.12378	.78283	.613
I feel that the threat level as it relates to bioterrorism is high among aerial applicators	40	2.8750	.19344	1.22344	1.497
I feel that I have been properly educated to deal with the threat of bioterrorism	40	2.3500	.13180	.83359	.695
I feel confident that I could identify or "stave off" an event related to bioterrorism	40	2.1500	.10470	.66216	.438
My profession is more susceptible to bioterrorism, than it is agroterrorism	40	3.5250	.13391	.84694	.717
Bioterrorism and agroterrorism are covered well by "in-house" training and trade publications	40	3.0750	.17316	1.09515	1.199
Government agencies, such as the FAA and Department of Homeland Security, provide adequate information and advisory circulars on the potential threats associated with bioterrorism and agroterrorism	40	3.5750	.16751	1.05945	1.122
I use the proper Personal Protective Equipment, (PPE), for every job	40	1.6250	.09928	.62788	.394
I have become sick or disabled from coming into contact with a toxic chemical while working as an aerial pesticide applicator	40	4.1250	.13003	.82236	.676
I feel that the PPE required for each application is acceptable to prevent exposure to toxic chemicals	40	1.8000	.09608	.60764	.369
I feel that the ventilation systems in the aircraft I or my company utilize are acceptable to prevent exposure to toxic chemicals	40	2.3000	.13009	.82275	.677
I often feel that I know what PPE to use to prevent exposure to toxic chemicals without referring to the chemical label	40	2.4500	.17153	1.08486	1.177
The PPE that I use on a regular basis are	40	2.5500	.14741	.93233	.869
I feel that the FAA places too much regulation on aerial applicators	40	2.6000	.15106	.95542	.913

Table 4-1. Continued

I have had concerns of being "ramp checked" by an FAA inspector while operating agricultural aircraft	40	2.7500	.15504	.98058	.962
I feel that the FAA places more emphasis on the safety of other commercial operators than they do on operators of agricultural aircraft	40	2.1750	.15968	1.00989	1.020
I would approve of an anonymous incident reporting system which would be used for educational and safety purposes and would not be used for the admission of a violation	40	1.6750	.15354	.97106	.943
I feel that the FAA should be more involved in day to day operations and oversight with the aerial applicator industry	40	4.0250	.13629	.86194	.743
I am concerned about the consequences of receiving a violation by the FAA while operating aerial application aircraft	40	2.0750	.15354	.97106	.943
I feel that I or my company have more knowledge about the safety of our operation, than the FAA	40	1.5250	.10119	.64001	.410
I feel that accredited schools or colleges who offer an aerial applicator certification program provide superior training in comparison to other methods of certification	40	3.4000	.15933	1.00766	1.015
I feel that I have gained most of my experience and knowledge while performing on the job	40	1.3000	.09608	.60764	.369
I regularly attend outside training events that keep me up to date on innovative methods and technologies in my profession	40	2.4000	.15933	1.00766	1.015
I would like to regularly attend re-current training on a bi-annual basis to keep up with industry standards and new policies	40	2.1750	.12345	.78078	.610
I feel that the company I work for provides adequate training and materials on a regular basis to allow me to do my job safely	40	2.1000	.11767	.74421	.554

CHAPTER 5
RESULTS & DISCUSSION

Demographics

The first variable within the demographics section was gender, (Figure 4-1). The survey group was comprised of 93% males and only 7% female. This result is consistent with the industry, because at this time the workforce predominately consists of males. However, with decreasing gender bias and more programs which enlist women, there is a steady increase in the amount of female entrants in this industry.

The second variable was age, (Figure 4-2), which indicated a fairly normal distribution of survey participants. The highest reported groups were in the age ranges of 31-40 and >51. Both groups were comprised of 11 people, totaling 56% of the survey population or 22 participants. Twenty-five percent of the survey participants were between the ages of 41-50 with the least amount indicating 26-30 as their current age, 20%. The data suggest that many of the current aerial applicators in the state of Florida have been in the industry for some time, therefore representing a very high experience level.

The third demographic question was number of flight hours, (Figure 4-3) and showed that the greatest number, 70% of participants, had more than 2,500 flight hours. The second highest group, at 23%, had between 1,001 and 2,500 flight hours. Pilots with 501 to 1,000 hours comprised 7% of the survey population, while no one reported having less than 500 hours. These results show that the majority of participants had a high level of experience in aviation.

The fourth question, (Figure 4-4), was a follow-up to question 3 and was derived to determine the number of flight hours each participant held solely in agricultural aircraft.

The results showed that the highest percentage of participants had a considerable amount of time in agricultural aircraft. The highest group, 33% reported having greater than 2500 hours with the remaining groups having an equal number of people, each representing 22% of the participants. The researcher feels that the results from this question showed a vast amount of knowledge in industry, which yielded valid perception data.

The fifth variable, (Figure 4-5), asks the participants their number of years in service as an aerial applicator. The highest number of participants indicated that they had only flown 1-5 years and represented 38% of the sample. The remaining groups were widely distributed with 6-10 years yielding 22%, 11-15 years, 5%, 16-20 years, 13%, with the remaining group of greater than 20 years service, indicating 22% of the survey population. The results were indicative of the widespread nature of the aviation industry, since many pilots have moved into other areas of aviation stemming from the after effects of September 11th 2001.

The sixth variable, (Figure 4-6), asks how many pilots are currently employed by the company each participant works for. Ninety-two point five percent of the participants answered 1-5, while 5% indicated 6-10. The remaining 2.5% employed between 11 and 15 pilots.

Question 7, (Figure 4-7), asked participants to list the current ratings they hold as a commercial pilot. Thirty-three percent of the participants held an Air Transport Rating which is the highest level of licensure that may be obtained through the Federal Aviation Administration (FAA). All of the participants held a commercial pilot license while 50% were listed as Certified Flight Instructors. Thirty-five held a Certified Instrument Flight

Instructor Rating. Ninety of the survey population held an Aircraft Single-Engine Land rating with 80% holding a multi-engine rating in this category. Thirty-five of the participants were rated in helicopters with 10% indicating they held an instrument rating in this category of aircraft. Seventy-eight of the participants were instrument rated in airplanes. These results indicate that the level of experience in the survey population is very high.

Question 8, (Figure 4-8), sought to measure what type of aircraft the participants currently fly for aerial applications. Fifty-eight of the population indicated that they fly both reciprocating and turbine powered airplanes with 10% flying reciprocating engine helicopter and 33% flying turbine powered helicopters. Many of the aircraft currently in use are relatively older which accounts for the large number of pilots who are flying reciprocating engine powered airplanes. Most of the participants indicated that they flew both, indicating that many companies are utilizing older equipment, while also flying newer turbine powered aircraft for many applications.

Question 9, (Figure 4-9), asked the participant to indicate what type of operation they typically work for as an aerial applicator. The highest number of participants, 51%, indicated that they were independent aerial applicators, while 21% were employed by only one aerial application company. The remaining pilots, 28%, indicated that they were an aerial application company owner and pilot. These data show that many of the survey participants work wherever they can in order to fly as much as possible. Contract flying is common throughout the entire aviation community and is a means for pilots to maximize the utilization of their professional knowledge, skills and abilities.

Question 10, (Figure 4-10), asked the participant whether or not the company they work for requires a background check in their pre-employment screening. Seventy-five indicated that their respective companies require a background check, with the remaining 25% indicating that they do not. This result is consistent with the industry regulated outside of the major Part 121 and Part 135 carriers. The cost associated with background checks for each employee may not be a valid expenditure for some operators, however this is an important area of concern to the public.

Perceptions on Agroterrrorism

Question 11, (Figure 4-11), asks the participant their perception of the current threat level is in regard to agroterrorism and aerial applicators. The participants were given a set of answers ranging from Strongly Agree to Strongly Disagree. Those who strongly agreed indicated that they felt that the threat level was extremely high as were those who strongly disagreed indicated it was extremely low. The highest range of participants chose agree, 60%, while only 7.5% strongly agreed. Twenty percent disagreed, while 10% strongly disagreed. The remaining 2.5% had no opinion. The results of this question indicate that the ratio of participants who think agroterrorism is a current threat to agricultural aviation is much higher than those who do not.

Question 12, (Figure 4-12), asks each participant about their level of education in regard to dealing with the threat of agroterrorism. Sixty-five percent Agreed that they have enough education to properly deal with the threat of agroterrorism while 12.5% strongly agreed. Twelve point five percent of the research population indicated that they disagreed, while 2.5% strongly disagreed. The remaining number of participants, 7.5%, indicated no opinion. The majority of participants felt that they had a high level of

educational background in regard to agroterrorism with only a minority of participants indicating that they did not.

Question 13, (Figure 4-13), asks the participant how well they agree with the perception that they would be able to identify or “stave off” an event related to agroterrorism. Seventy- two point five percent of the participants agreed that they would be able to perform these functions, while 22.5% indicated that they strongly agreed. The remaining 5% of the research participants indicated that they disagreed. The results from this question indicate that aerial applicator pilots feel very confident about their abilities to effectively identify or stop an agroterrorism event from occurring in the event they were exposed to it.

Question 14, (Figure 4-14), asks the participant to indicate how well they agree with Florida being more susceptible to an attack of agroterrorism than other states in the U.S. Sixty-five percent of the research population disagreed, while 7.5% strongly disagreed. Twenty-percent agreed, with 2.5% indicating that they strongly agree. The remaining 5% had no opinion. The results from this question indicate that the majority of aerial applicators do not perceive Florida to be at a greater risk to agroterrorism than aerial applicators operating in other states in the U.S.

Question 15, (Figure 4-15), asks the participant to rate the level they perceive their respective company protocols to mitigate the threat of agroterrorism. Sixty-seven point five percent of the participants agreed that their company had the proper protocols, with 20% strongly agreeing. 2.5% of the population disagreed with the remaining 10% indicating no opinion. The results of this question infer that the majority

of the survey participants agree that their companies have the proper protocols in place to mitigate the threat of agroterrorism.

Question 16, (Figure 4-16), asks the participant to indicate how well they agree that either they or their company are susceptible to agroterrorism. The majority of research participants 62.5%, indicated that they agreed, while 5% indicated they strongly agreed. Seventeen point five percent of the research participants disagreed with 10% strongly disagreeing. The remaining 5% indicated no opinion. This result indicates that most aerial applicators feel that they are under some level of threat in regard to agroterrorism.

Question 17, (Figure 4-17), asks the participant to indicate whether or not an attack of agroterrorism could happen somewhere in the United States Fifty-seven point five percent of the participants agreed that they feel an attack could take place, while 32.5% indicated that they strongly agreed. Two point five percent strongly disagreed, while the remaining 7.5% indicated no opinion. The majority of aerial applicators who were given the survey indicate that they feel an attack could take place, which shows a correlation toward the perception that it is a relevant concern.

Question 18, (Figure 4-18), is the final question dealing with agroterrorism individually and asks the participant to indicate whether or not they agree with the idea that an act of agroterrorism could occur somewhere in the state of Florida. Sixty-seven point five percent of the research population agreed, while 17.5% strongly agreed. Two point five percent of the participants either disagreed and strongly disagreed, with 10% indicating no opinion. This question represents the opinion that Florida is considered to be susceptible to an agroterrorism event.

Bioterrorism

Question 19, (Figure 4-19), asks the participant how high they feel the current threat level is in regard to bioterrorism and aerial applicators. The participants were given a set of answers ranging from strongly agree to disagree. Strongly agree indicated that they felt that the threat level was extremely high, as where strongly disagree indicated it was extremely low. The highest range of participants selected, agree, 47.5%, while only 7.5 % strongly agreed, 30% disagreed, while 10% strongly disagreed. The remaining 5% had no opinion. The results of this question indicate that the ratio of participants who consider bioterrorism a current threat to agricultural aviation is higher than those who do not.

Question 20, (Figure 4-20), asks each participant about their level of education in regard to dealing with the threat of bioterrorism. Seventy-two point five percent agreed that they have enough education to properly address the threat of bioterrorism while 5% strongly agreed. Seventeen point five percent of the research population indicated that they disagreed, with the remaining number of participants, 5%, indicating no opinion. The majority of participants felt that they were highly educated in regard to bioterrorism.

Question 21, (Figure 4-21), asks the participant how well they agree with the perception that they would be able to identify or “stave off” an event related to bioterrorism. Eighty-five percent of the participants agreed that they would be able to perform these functions, while 5% indicated that they strongly agreed. The remaining 10% of the research participants indicated that they disagreed. The results from this question indicate that aerial applicator pilots feel very confident about their abilities to effectively identify or mitigate the occurrence of a bioterrorism event from happening in the event they were exposed to it.

Question 22, (Figure 4-22), relates to how aerial applicators feel in the comparison of bioterrorism to agroterrorism. They were asked to indicate how strongly they agreed or disagreed with the susceptibility of bioterrorism being more of a threat than agroterrorism. The majority of participants disagreed, 60%, while 5% strongly disagreed, 17.5% of the participants agreed, while 17.5% had indicated no opinion. The results of this question indicate that aerial applicators do not perceive bioterrorism as more of a threat than agroterrorism in the agricultural aerial application industry.

Question 23, (Figure 4-23), was derived to measure how well both bioterrorism and agroterrorism have been made aware of by “in-house” training and trade publications. The majority of participants disagreed, 48.7%, with 2.6% indicating that they strongly disagreed, 38.5% of the participants agreed, while 5.1% disagreed. The remaining 5.1% indicated no opinion. The results of this question indicate that aerial applicators feel that more training is necessary in these two subject areas.

Question 24, (Figure 4-24), was the final question in the bioterrorism section and asked participants to rate how well they feel government agencies such as the FAA and Department of Homeland Security (DHS) provide information in relation to bioterrorism and agroterrorism. Sixty-two point five percent of the research population indicated that they disagreed, with 10% indicating that they strongly disagreed, 10% agreed, with 7.5% strongly agreeing. The remaining 10% indicated no opinion. The results of this question infer that the level of support via advisory circulars and other government issued documents are insufficient in regard to the dissemination of relevant materials to aerial applicators.

Chemical Exposure

Question 25, (Figure 4-25), begins the chemical exposure section of the survey. It asks if the participant uses the proper PPE for every job. Ninety-seven point five percent of the participants indicated that they did. The remaining 2.5% of the participants indicated that they do not use the proper Personal Protective Equipment (PPE) for each application. The results from this question indicate that the majority of participants take the use of PPE seriously and regularly follow the proper protocols for chemical safety.

Question 26, (Figure 4-26), asks the participant whether or not they have become sick or disabled from coming in contact with a toxic chemical while working as an aerial applicator. The majority of participants, 55%, indicated that they disagreed, or had not become sick or disabled, with 32.5% strongly disagreeing. Only 7.5% indicated that they agreed, while the remaining 5% indicated no opinion. This shows that a high level of the research participants properly use PPE and follow chemical label restrictions for their personal health and well-being.

Question 27, (Figure 4-27), asks the participant how they perceive the level of PPE required for each application in regard to acceptability. Sixty-seven point five percent of the research participants indicated that they agree chemical manufacturers put in place the proper protocols for PPE with respect to the chemical applied, while 27.5% strongly agreed, 2.5% disagreed with 2.5% indicating no opinion. The results of this question infer that aerial applicators feel that they are properly protected from chemical exposure based on the manufacturers recommendation for required PPE.

Question 28, (Figure 4-28), asks the participant to rate how they feel about ventilation systems in the aircraft either they or their company utilize for preventing

chemical exposure. Eighty-two point five percent of the research participants indicated that they agree that the ventilation systems are adequate, with 2.5% strongly agreeing. 12.5% of the participants disagreed, while 2.5% strongly disagreed. This indicates that the ventilation systems in most aircraft used for aerial application in the state of Florida are perceived to be sufficient to protect pilots from chemical exposure.

Question 29, (Figure 4-29), asks the participant to rate how often they know the correct PPE to use in order to prevent exposure to toxic chemicals without referring to the chemical label. Seventy percent of the research participants indicated that they agree, while 7.5% indicated that they strongly agree. 15% of the survey population disagreed, while the remaining 7.5% strongly disagreed. The results from this question infer that aerial applicators often use the same product for a number of applications, so they are familiar with label directions and know the proper PPE to wear during an application.

The final question regarding chemical exposure, (Figure 4-30), asks the participant to list what types of PPE they use on a regular basis from the selected responses. All of the survey population use gloves regularly. Ninety percent utilize both goggles/safety glasses and long sleeve shirts. Eighty-two point five percent use an approved respirator, while 85% use an approved flight/chemical suit. The remaining two categories, long pants and tall/knee high socks are utilized 92.5% and 80% of the time respectively. This indicates that aerial applicators are meeting best practice standards and maximizing protection from chemical exposure.

Federal Aviation Administration Oversight

Question 31, (Figure 4-31), begins the section of FAA oversight. It asks how strongly the participants feel about the regulation scrutinized by the FAA on aerial

applicators. The majority of participants, 52.5%, of the research population agree that the FAA places an excessive amount of regulation on aerial applicators, while 7.5% strongly agree. Twenty-two point five percent disagree, while the remaining 17.5% had no opinion. The response to this question indicates that the majority of aerial applicators feel the FAA takes excessively conservative measures to regulate the industry.

Question 32, (Figure 4-32), asks if the participant has had concerns with the probability of being “ramp checked” by an FAA inspector while operating an agricultural aircraft. Fifty-five percent of the population agreed that they had concern while 2.5% strongly agreed, 35% of the research participants disagreed, while 7.5% had no opinion. The results of this question are consistent with industry in regard that the FAA has a high level of jurisdiction in aviation. There is always a level of concern with compliance since the industry in question is a component of the applicators livelihood.

Question 33, (Figure 4-33), asks participants to rank how they feel the FAA views the safety of other commercial operators to that of agricultural operators. Sixty percent of the research participants agree that the FAA places more emphasis on other commercial operations, while 20% strongly agree, 7.5% of the research participants disagree, while 5% strongly disagree. The remaining 7.5% had no opinion. The results of this question infer that aerial applicators feel as though the FAA places more importance on other commercial operations such as Part 121 or Part 135 operators. With a finite number of FAA inspectors, this result was found to be representative of smaller facets of the aviation industry.

Question 34, (Figure 4-34), asks the participants to rate how they would agree with the implementation of an anonymous incident reporting system in their industry.

This system would be used for educational and safety purposes and would not be used for the admission of a violation. The majority of participants, 55%, strongly agreed that this would be a useful tool for the aerial application industry, 35% agreed, while only 5% disagreed. The remaining 5% had no opinion. This indicates that the majority of participants would agree on the creation and implementation of an anonymous incident reporting system relevant to their industry, indicating a premium placed on safety.

Question 35, (Figure 4-35), asks the participant to rate their agreement with the FAA having more day-to-day involvement in their operation. The majority of participants, 62.5%, indicated that they disagreed, while 25% strongly disagreed. A minority of participants agreed, 5%, with 2.5% strongly agreeing. The remaining 5% had no opinion. This indicates that the aerial application industry does not perceive more FAA involvement as a viable solution to the issues confronted by the industry.

Question 36, (Figure 4-36), asks the participant to rank their concern of the consequences of receiving a violation by the FAA while operating aerial application aircraft. Fifty-two point five percent of the research participants agreed that they did have concern, while 27.5% indicated that they had strong concerns. 15% disagreed, with the remaining 5% indicating no opinion. The results of this question infer that the majority of aerial applicators are concerned with the consequences of a violation by the FAA.

Question 37, (Figure 4-37), is the final question of the section and asks the participant to compare the amount of safety knowledge they have with respect to their operation in comparison to the FAA. Fifty-five percent of the participants strongly agreed that they or their company had more than adequate knowledge, while 37.5% agreed,

7.5% indicated no opinion. The results from this question indicate that aerial applicators feel as though they have more industry specific knowledge and background in regard to their industry than that of the FAA.

Training

Question 38, (Figure 4-38), begins the final section of the survey and evaluates at training. It asks the research participant to rate their perception of accredited schools or colleges offering aerial application training programs in comparison to traditional methods. The majority of participants disagreed, 47.5%, that accredited school or college programs offer superior training while 10% strongly disagreed, 27.5% of the participants agreed, with the remaining 15% indicating no opinion. The results of this question indicate that the training paradigm with schools who offer aerial application is not as effective as other methods.

Question 39, (Figure 4-39), asks the participant to rate their experience gained while on the job. 75% of the participants strongly agreed, while 22.5% agreed. The remaining 2.5% disagreed. The results of this question are comparable to the other sectors of the aviation industry because it is highly experience based. Many pilots gain their experience on the job, after the minimum certification requirements have been met.

Question 40, (Figure 4-40), asks the participant to indicate how well outside training events keep them up to date on innovative methods and technologies within the aerial application community. Sixty-five percent of the research participant agreed that outside training is effective, while 10% strongly agreed, 20% disagreed with 2.5% indicating that they strongly disagree. The remaining 2.5% indicated no opinion. The results of this question indicate that outside training events are a viable option for aerial

applicators to learn and implement new procedures and products into their respective organizations according to the majority of particpants.

Question 41, (Figure 4-41), rates how regularly aerial applicators would like to attend re-current training on a bi-annual basis in order to stay current with industry standards and new policies. Seventy-three percent of the participants indicated that they agree, with 10% strongly agreeing, 5% disagreed with 2.5% strongly disagreeing. The remaining 10% of participants chose no opinion. The results of this question show that the aerial application community is very receptive to training and professional development.

Question 42, (Figure 4-42), asks the participant to rate how well training materials are disseminated through their respective companies. Eighty percent of the participants agreed that the dissemination of educational materials was effective, with 10% strongly agreeing. 5% disagreed, while 2.5% strongly disagreed. The remaining 2.5% indicated no opinion. This response infers that the majority of aerial application companies do a favorable job at disseminating relevant materials to their employees.

The final question, (Figure 4-43), of the survey and seeks to determine the sources of training and re-currency materials. Ninety- seven and a half percent of the participants indicated that they receive a high level of re-currency from on the job training. Sixty-two and a half percent indicated that they attend outside seminars on a regular basis. Eighty-five percent indicated that they utilize professional organizations. Twenty-two and a half percent indicated that the FAA publication database was a viable source. Ninety-two and a half percent of the participants indicated that they utilize both trade publications and their peers for information. Seventy two and a half percent

indicated that they extensively use UF/IFAS extension materials. This question infers that there is a lot of information to be disseminated and that aerial applicators use the resources available efficiently.

General Comment

The final component of the survey, left room for individual comments (Appendix C). It was designed to allow the participant to write freely about any concerns or general comment about the survey. Two responses were recorded, which both discussed a general concern for the aerial application industry. They focused more on regulatory issues, by inferring that aerial application companies would not be able to operate efficiently or effectively with the implementation of more regulation. They cite the FAA primarily, by discussing how regional Flight Standards District Offices (FSDO's) do not have any conformity between regions. They feel as though they have a much higher experience level in the art of applying chemicals by air than that of state or federal agencies. The concerns listed vary, but both of the participants indicated that increases in regulation would cause a disparity in the price of food, clothing and other commodities, if aerial applicators were over-regulated.

CHAPTER 6
CONCLUSIONS

Aerial applicators perceive the overall key future success of their industry lies within in their hands. Their mission is a vital component of the protection of our nation's resources. Without the industry, the economy, food and fiber source other aspects of society would considerably be affected. The industry strives to ensure safety and for that they should be commended. The occurrences of aerial application incidents are negligible in comparison to the other issues currently faced. The industry requires the type of individual who is motivated to work individually and who is educated, by experience, to implement the proper procedures in regard to such issues as safety, security and drift. The concerns that the participants identified are valid issues with agency mandates. The FAA is a highly regarded organization that promotes the longevity of aviation, however, they are not well equipped to ensure the proper management of aerial applicators in regard to the issues applicators face in their daily work. From the areas of security, certification and regulation enforcement, the results indicate that the FAA provides a valuable service; however it does not have the proper workgroups or time to devote the proper level of service to aerial applicators, in regard to consistently implementing and enforcing new regulation.

With regard to agroterrorism and bioterrorism, results are consistent with the industry having a high level of intrinsic knowledge about these issues. This high level of knowledge is due to experience, resources and employee-to-employee contact. The majority of aerial applicators perceive they know enough to identify or “stave off” an act of terrorism; however, they also indicated that the threat level with regard to these two areas is considered to be high. The use of educational materials is a very effective tool

for disseminating information in relevant research areas. The researcher believes that the data collected from the study infers that aerial applicators are very insightful about new trends and technology in their industry. They consistently seek for resources and information that assist them with their job for a higher level of efficiency and safety. These qualities make them very receptive to the implementation of new resources that deal with industry issues. The requirements for continuing education have the potential to create new materials that address agroterrorism and bioterrorism. These tools will provide a higher level of knowledge and conformity throughout the industry.

Chemical exposure is another issue that aerial applicators are confronted with on a daily basis. The majority of aerial applicators feel that the ventilation systems and use of PPE are effective within the industry, for exposure protection. The research indicates that they are concerned with personal chemical exposure and have a low probability of becoming sick or disabled from the use of their products.

Aerial application has been established in its current status since the 1920's. Pilots have proven a high level of initiative in their experience and development, which indicates the industry is healthy and viable. The aviation industry, as a whole, is comprised of a fairly small percentage of professionals. This is conducive for keeping current of trends and issues affecting their industry. Alternatively, it also makes it difficult, at times, to gain the proper perceptions. Fear of reprisal from government or state agencies may bias opinion if the issues are introduced without proper industry input. The assurance of anonymity is a key factor in gaining the trust of aviation professionals. Since September 11th, 2001, the entire aviation industry has faced a number of perilous events, however they have done an exemplary job of ensuring the

safety of all who use the nation's airspace. Likewise, aerial applicators offer the services and utility to ensure the well-being of our food and commodity resources. Without them, it would be difficult to assume a sustainable agriculture with a potential for loss of a viable component of both the luxuries and necessities we are so accustomed to today.

CHAPTER 7
RECOMENDATIONS FOR FUTURE RESEARCH

Aviation is constantly evolving to stay current with the demands of industry. It is important that all facets of industry look forward to develop a safer and better future. The use of Unmanned Aerial Vehicles, (UAV's), have become a very viable solution for a number of issues, especially with their prospective applications in regard to agriculture. They can be flown from confined areas to obtain vast amounts of information. Development is currently underway to develop and perfect the use of UAV's equipped with Light Detection and Ranging systems, (LIDAR), to provide the industry with many innovative new technologies. They are capable of an array of applications including geology, agriculture and geography. The use of this type of aircraft may address many of the concerns that the agriculture industry faces and may prove to be a viable resource.

APPENDIX A
REGULATORY TABLE

LICENSE TYPE	LICENSE PERIOD	LICENSE/ RENEWAL FEE	EXAM FEE	CATEGORIES AVAILABLE	EXAMS REQUIRED FOR INITIAL CERTIFICATION	RECERTIFICATION REQUIREMENTS*	
						Category CEUs	Core CEUs
Private RUP	4 yrs	$100	None	Private Applicator Agriculture	Core + Private Applicator Agriculture	4	4
Public RUP or Commercial RUP	4 yrs	Public $100 Commercial $250	None	Aerial Application	Core + Aerial	16	4 per licensee
				Agricultural Animal	Core + Ag Animal	4	
				Agricultural Row Crop	Core + Ag Row Crop	8	
				Agricultural Tree Crop	Core + Ag Tree Crop	8	
				Aquatic Pest Control	Core + Aquatic Pest Control	16	
				Chlorine Gas Infusion	Chlorine Gas Infusion	4	
				Demonstration & Research**	Demonstration & Research	4	
				Forest Pest Control	Core + Forest Pest Control	8	
				Natural Areas Weed Management	Core + Natural Areas Weed Management	16	
				Organotin Antifouling Paint	Organotin Antifouling Paint	4	
				Ornamental & Turf	Core + Ommental & Turf	12	
				Raw Agricultural Commodity Fumigation	Core + Raw Ag Commodity Fumigation	4	
				Regulatory Inspection & Sampling	Core + Regulatory Inspection & Sampling	4	
				Regulatory Pest Control	Core + Regulatory Pest Control	12	
				Right-of-Way Pest Control	Core + Right-of-Way Pest Control	8	
				Seed Treatment	Core + Seed Treatment	4	
				Sewer Root Control	Sewer Root Control	4	
				Soil & Greenhouse Fumigation	Core + Soil & Greenhouse Fumigation	4	
				Wood Treament	Core + Wood Treatment	4	

* CEUs = FDACS-approved Continuing Education Units.
Private applicators must earn 4 Core CEUs plus 4 Private Applicator Agriculture CEUs (total 8 CEUs) to recertify.
Commercial & Public applicators must earn 4 Core CEUs per license (not per category), plus the number of CEUs shown above for each category being renewed.
All applicators have the option of recertifying by taking the initial certification exams again.

** Demonstration and Research is a secondary category issued only in combination with another category.

http://pested.ifas.ufl.edu/pdfs/Certification_Manual_9-06_website_version.pdf

APPENDIX B
SURVEY

Risk and Safety Analysis Survey for Florida Commercial Aerial Application Operations

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Purpose of the Study

The purpose of this study is to gain insight into self–reported safety and risk factors that pertain to commercial operators and pilots who fly for agricultural aerial applicator operations. As a commercially rated pilot in both fixed-wing and rotor-wing aircraft with a total of 5,400 hours flight time, I am interested in obtaining industry data to help better understand deficiencies or areas of concern in the aerial application industry. The benefits of your cooperation are not regulatory in nature, but educational. With a better understanding of issues that may affect your industry, more materials may be developed to implement more focused training and programs for Continuing Education Units (CEU's), to sustain state licensure requirements.

The survey focuses on concerns of Agroterrorism, Bioterrorism, Chemical Exposure, and Federal Aviation Administration (FAA), regulations, protocols, and requirements. The answers to the survey will be utilized solely for the purpose of industry research and your answers will remain anonymous, so there is no personal risk associated with your participation. The results will be reviewed only by the researcher and will not be distributed to any third-party sources. They will be used to determine areas of concern and will provide the basis of a final report that will address best practices and procedures to serve as suggestions for increased safety and efficiency within your industry. There is no compensation for your participation, however your input is greatly appreciated. For information about your rights as a research participant, you may contact the University of Florida's Institutional Review Board (IRB), at (352) 392-0433.

The questionnaire should take about 15 minutes to complete. Please take a few moments to answer the questions to the best of your knowledge. If you feel conflicted or uncomfortable with any question, please feel free to refrain from answering it. Your participation is voluntary and you may revoke your consent without penalty. If you would like further information or clarification of any of the material listed within the survey, feel free to contact either myself or Dr. James Leary, drleary@ufl.edu, with your questions or concerns. Once again, I assure you that the responses you provide will not relay any personal information about you or your company and your anonymity is of paramount concern.

Thank you for your cooperation and efforts

Sincerely,

John M. Robbins
M.S.A. Ed./Mgmt.
Ph.D. Candidate: Agricultural and Biological Engineering
University of Florida
Tel: (352) 494-1321
E-mail: Johnrobb@ufl.edu

PART 1- Demographics

Please circle one of the following options for questions 1-6:

1. Gender:

   Male Female

2. Age:

   18-25 26-30 31-40 41-50 > 51

3. Number of Flight Hours:

   < 500 501-1000 1001-2500 > 2500

4. Number of Flight Hours in Agricultural Aircraft:

   < 500 501-1000 1001-2500 > 2500

5. Years in Service as an Aerial Applicator:

   1-5 6-10 11-15 16-20 > 20

6. How many pilots are employed by your company?

   1-5 6-10 11-15 16-20 > 20

Please check the appropriate responses for questions 7-10:

7. What FAA ratings do you currently possess? (Check all that apply)

   _____ Air Transport Pilot _____ Aircraft Single-Engine Land
   _____ Commercial Pilot _____ Aircraft Multi-Engine Land
   _____ Certified Flight instructor _____ Rotorcraft Helicopter
   _____ Certified Instrument Flight Instructor _____ Instrument Airplane
   _____ Private Pilot_____ Instrument Rotorcraft Helicopter
   Other:_____

8. Type of aircraft you primarily fly for the purpose of aerial application: (Check all that apply)

   _____ Airplane: Reciprocating Engine Powered
   _____ Airplane: Turbine Engine Powered

_____ Rotorcraft: Reciprocating Engine Powered
_____ Rotorcraft: Turbine Engine Powered

9. Which best classifies your role as an aerial applicator?

_____ Aerial application company owner
_____ Aerial application company owner and pilot
_____ Aerial applicator pilot employed by only one company
_____ Independent aerial applicator i.e. (Contract Pilot)

10. Does the company who employs you require a background check in their pre-employment screening?

_____ Yes
_____ No

PART II- Perceptions on Agroterrorism

Agroterrorism is the intentional act of mishandling agricultural chemicals, aircraft, implements, or personnel to cause harm to persons or property. The following questions in Part II, are designed to gain perception on how much you agree with each question. Please circle the most appropriate answer for the following questions. The rating scale is as follows:

Responses: SA=Strongly Agree, A=Agree, N=No Opinion, D-Disagree, SD=Strongly Disagree

11. I feel that the threat level as it relates to agroterrorism is high among aerial applicators.

SA A N D SD

12. I feel that I have been properly educated to deal with the threat of agroterrorism.

SA A N D SD

13. I feel confident that I could identify or "stave off" an event related to agroterrorism.

SA A N D SD

14. I feel that Florida is more susceptible to an agroterrorism attack than other states in the U.S.

SA A N D SD

15. I feel that my company has the proper protocols in place to mitigate the threat of agroterrorism.

SA A N D SD

16. I think that I or my company is susceptible to agroterrorism.

SA A N D SD

17. I think that an act of agroterrorism could happen somewhere in the U.S.

SA A N D SD

18. I think that an act of agroterrorism could happen somewhere in the state of Florida.

SA A N D SD

PART III- Bioterrorism

Bioterrorism is defined as an act of any person knowingly or maliciously introducing disease-causing agents or organisms to animal, plant or human population, thus threatening food and water resources as well as human and animal life. The following questions in Part III, are designed to gain perception on how much you agree with each question. Please circle the most appropriate answer for the following questions. The rating scale is as follows:

Responses: SA=Strongly Agree, A=Agree, N=No Opinion, D-Disagree, SD=Strongly Disagree

19. I feel that the threat level as it relates to bioterrorism is high among aerial applicators.

SA A N D SD

20. I feel that I have been properly educated to deal with the threat of bioterrorism.

SA A N D SD

21. I feel confident that I could identify or "stave off" an event related to bioterrorism.

SA A N D SD

22. My profession is more susceptible to bioterrorism, than it is agroterrorism.

SA A N D SD

23. Bioterrorism and agroterrorism are covered well by "in-house" training and trade publications.

SA A N D SD

24. Government agencies, such as the FAA and Department of Homeland Security, provide adequate information and advisory circulars on the potential threats associated with bioterrorism and agroterrorism.

SA A N D SD

PART IV- Chemical Exposure

Chemical exposure relates to the amount of products regulated by the Federal Insecticide, Fungicide, Rodenticide Act (FIFRA), or any other potent chemical that you could come into contact with. Ways that the chemical can be absorbed by your body are dermal, inhalation, ocular, or orally. The following questions in Part IV, are designed to gain perception on how much you agree with each question. Please circle the most appropriate answer for the following questions. The rating scale is as follows:

Responses: SA=Strongly Agree, A=Agree, N=No Opinion, D-Disagree, SD=Strongly Disagree

25. I use the proper Personal Protective Equipment, (PPE), for <u>every</u> job.

SA A N D SD

26. I have become sick or disabled from coming in contact with a toxic chemical while working as an aerial pesticide applicator.

SA A N D SD

27. I feel that the PPE required for each application is acceptable to prevent exposure to toxic chemicals.

SA A N D SD

28. I feel that the ventilation systems in the aircraft I or my company utilize are acceptable to prevent exposure to toxic chemicals.

SA A N D SD

29. I often feel that I know what PPE to use to prevent exposure to toxic chemicals without referring to the chemical label.

SA A N D SD

Please check or fill in the appropriate responses for question 30:

30. The PPE that I use on a regular basis are: (Check all that apply)

_____ Gloves
_____ Goggles/Safety glasses
_____ Respirator
_____ Approved flight/chemical suit_____
_____ Long sleeve shirt_____
_____ Long pants
_____ Tall/Knee high socks
Other:_____

PART V- Federal Aviation Administration Oversight

The questions in Part V are designed to gain perception on how much the FAA is involved with you or your operation in general. It is in no way an attempt to change regulation, however, your input will be useful in determining how interactions with the FAA affect your operations. Please circle the most appropriate answer for the following questions. The rating scale is as follows:

Responses: SA=Strongly Agree, A=Agree, N=No Opinion, D-Disagree, SD=Strongly Disagree

31. I feel that the FAA places too much regulation on aerial applicators.

SA A N D SD

32. I have had concerns of being "ramp checked" by an FAA inspector while operating agricultural aircraft.

SA A N D SD

33. I feel that the FAA places more emphasis on the safety of other commercial operators than they do on operators of agricultural aircraft.

SA A N D SD

34. I would approve of an anonymous incident reporting system which would be used for educational and safety purposes and would not be used for the admission of a violation.

SA A N D SD

35. I feel that the FAA should be more involved in day to day operations and oversight within the aerial applicator industry.

SA A N D SD

36. I am concerned about the consequences of receiving a violation by the FAA while operating aerial application aircraft.

SA A N D SD

37. I feel that I or my company have more knowledge about the safety of our operation, than the FAA.

SA A N D SD

PART VI- Training

The questions in part VI have been designed to gain insight into how training is implemented and reinforced within the agricultural aerial application industry. Please circle the most appropriate answer for the following questions. The rating scale is as follows:

Responses: SA=Strongly Agree, A=Agree, N=No Opinion, D-Disagree, SD=Strongly Disagree

38. I feel that accredited schools or colleges who offer an aerial applicator certification program provide superior training in comparison to other methods of certification.

SA A N D SD

39. I feel that I have gained most of my experience and knowledge while performing on the job.

SA A N D SD

40. I regularly attend outside training events that keep me up to date on innovative methods and technologies in my profession.

SA A N D SD

41. I would like to regularly attend re-current training on a bi-annual basis to keep up with industry standards and new policies.

SA A N D SD

42. I feel that the company I work for provides adequate training and materials on a regular basis to allow me to do my job safely.

SA A N D SD

43. I feel that I gain the most training and re-currency from the following sources. (Check all that apply)

_____ On the job training
_____ Outside Seminars
_____ Professional Organizations
_____ FAA
_____ Trade Publications
_____ Other employees or contacts
_____ UF/IFAS Extension Materials
Other_____
_____
_____

Thank you for your cooperation!

Your participation in this questionnaire is appreciated and the information collected will be used to observe and recommend solutions to issues that have been derived from this research.

If you have any further comments I would greatly appreciate your input in the space below:

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APPENDIX C
SURVEY COMMENTS

The following is a listing of survey comments that were included on the instrument by the participants.

- "The aerial applicator is a vanishing breed. The FAA, and State Ag Departments put more pressure on the pilots and make it harder to do our job. I have sprayed for 23 years and only in the last 5 have I had any issues with drift. In the past a little drift was acceptable and expected, people used common sense and knew if they moved to a farming area that they WOULD be exposed to farming and Ag Aircraft. Now it's like I shouldn't have sprayed that field. People think there food comes from the grocery store and the cotton clothes on their backs come from the mall. The Ag Pilot will soon be regulated out of business, and the farming industry will suffer because of it. If you travel to Rice country or to a place that if not for the aircraft, farming would greatly suffer & you will find the attitude of the people and the government to be different and better. The Ag operators need your help, don't kick us just because you can. Thank you."

- "It is my opinion based on experience that the majority of all FAA personnel have no working knowledge of aerial application practices. The simple fact is that if every aerial application company had to conform to every FAA regulation or rule (which by the way change with every FSDO. There is no set pattern) 95% of all operations would close due to this. The price of food would rise to a level that would cause a panic within the public sector. Aerial application is so important to modern farming practices without this option the farmers in this country would be unable to produce on the scale that they are now. It needs to be recognized by the FAA that the aerial applications are 99% of the time single pilot operations and such these aircraft and systems should be given greater leeway as to field approvals of spray systems, etc. There is a lot wrong with all governernment operations and the FAA is no exception to this rule."

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BIOGRAPHICAL SKETCH

John Robbins is a Doctor of Philosophy candidate in the Department of Agricultural and Biological Engineering at the University of Florida. His research interests include risk management, safety, and current issues affecting the aviation community.

John completed a Bachelor of Arts degree in geology from the University of Florida, while at the same time flying professionally. He is a commercially rated pilot in both airplanes and helicopters with a total flight time of 6,000 hours. He has worked professionally for multiple companies to include skydiving operations, air-ambulance, biological census collection and airline organizations.

In late 2007, he decided to return to the academic sector and received a Master of Science in aeronautical science with specializations in education and management from Embry-Riddle Aeronautical University. After graduating from Embry-Riddle, he returned to the University of Florida and currently works as an adjunct professor and consultant, delivering safety and security seminars to aviation professionals around the country.