University of North Dakota
UND Scholarly Commons

Theses and Dissertations | Theses, Dissertations, and Senior Projects

8-1-2015

Factors That Influence Pilot Usage of Flight Following

Jody Barbara Bulger

Follow this and additional works at: https://commons.und.edu/theses

Recommended Citation
Bulger, Jody Barbara, "Factors That Influence Pilot Usage of Flight Following" (2015). *Theses and Dissertations*. 372.
https://commons.und.edu/theses/372

This Thesis is brought to you for free and open access by the Theses, Dissertations, and Senior Projects at UND Scholarly Commons. It has been accepted for inclusion in Theses and Dissertations by an authorized administrator of UND Scholarly Commons. For more information, please contact zeineb.yousif@library.und.edu.

FACTORS THAT INFLUENCE PILOT USAGE OF FLIGHT FOLLOWING

by

Jody Barbara Bulger
Bachelor of Science, University of North Dakota, 2011

A Thesis
Submitted to the Graduate Faculty

of the

University of North Dakota

In partial fulfillment of the requirements

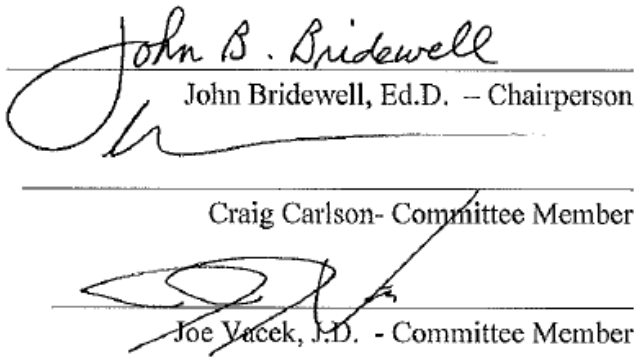
for the degree of

Master of Science

Grand Forks, North Dakota
August
2015

Copyright 2015 Jody Bulger

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



This thesis is being submitted by the appointed advisory committee as having met all of the requirements of the Graduate School at the University of North Dakota and is hereby approved.

_____

Wayne E. Swisher, Ph.D.
Dean of the Graduate School

_____

July 17, 2015

PERMISSION

Title Factors that Influence Pilot Usage of Flight Following

Department Aviation

Degree Master of Science

In presenting this thesis in partial fulfillment of the requirements for a graduate degree from the University of North Dakota, I agree that the library of this University shall make it freely available for inspection. I further agree that permission for extensive copying for scholarly purposes may be granted by the professor who supervised my thesis work or, in his absence, by the Chairperson of the department or the dean of the Graduate School. It is understood that any copying or publication or other use of this thesis or part thereof for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and to the University of North Dakota in any scholarly use which may be made of any material in my thesis.

Jody Bulger
July 17, 2015

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

Every year there are numerous reports of mid-air collisions across the United States, most of which occur in day time VFR conditions. Flight following, a free service to VFR aircraft, is a tool to help pilots with collision avoidance. This study used an interview process to investigate factors that influence pilot usage of flight following. The study was able to use a quantitative method to identify certain factors that influence pilot usage of flight following including: type of airport a pilot is based at or mainly flies out of, understanding of the air traffic control system, having a Seaplane Rating, Instrument and/or Commercial Rating, or Airline Transport Pilot Certificate, flying Weight-Shift Control or Multi-Engine aircraft, having ADS-B, TCAS, or a built in radio and purpose of flight.

Using a qualitative method, this study also discovered categories or themes that emerged from pilot definitions of flight following and factors that influence pilot usage of flight following. The themes that emerged from pilot definitions of flight following included: a procedure that similar to instrument flight rules, a service that provides information for situational awareness, a service for specific types of flights, a service that provides navigational help and traffic advisories, an optional workload-permitting service, and an aid in maintaining safety. Several themes emerged from factors that influence pilot usage of flight following which included the: characteristics of the flight, safety of flight, personal choice/opinion of the service, the pilot's situational awareness, requirement and/or recommendation to use the service, and the availability of other

technologies. Since these factors were determined and a target group of pilots was established as a result, a system to influence pilot usage of flight following can now be created, which will hopefully lead to more pilots using flight following and, in turn, create a safer National Airspace System.

CHAPTER I

INTRODUCTION

Communication in aviation is imperative. Communication, "the imparting or interchange of thoughts, opinions, or information by speech, writing, or signs" (Dictionary.com) is critical to almost every aspect of the flying world; pilot to copilot, maintenance crew to pilots, pilots to controllers and so forth. These are only a few examples of the extensive communication needed throughout the National Airspace System (NAS). It appears as though some pilots do not take full advantage of communication services provided, even though communication is crucial in order to sustain a safe and efficient airspace system. This study investigates the factors that influence general aviation (GA) pilots' use of flight following, with the desire to identify particular groups of pilots who regularly choose not to use flight following. If more pilots utilized flight following, it seems obvious that pilots would become more aware of impending traffic conflicts, potentially leading to a safer flying environment for all.

One of the most important channels of communication is the communication that exists between pilots and air traffic controllers commonly referred to as air traffic control (ATC). The air traffic control system was created in 1929 with Archie W. League as the first air traffic controller.

The need for an air traffic control system stemmed from “an increase in aircraft speed, traffic and capacity [which] led to safety concerns and delays” (NATCA). Due to these concerns, the “Air Commerce Act of 1926 charged the secretary of commerce with setting air traffic rules, certifying pilots and aircraft, establishing airways and operating aids to navigation” (NATCA). As the years progressed, two-way radios were developed which “allowed ground-to-air communications as radio equipped air traffic control towers sprouted around the country” (NATCA).

In 1938 the Civil Aeronautics Authority (CAA) was established. With the CAA in place, air route traffic control centers were developed to unite airport towers. The CAA adapted the use of World War II radar or radio detection and ranging, which revolutionized air traffic control. (NATCA)

The air traffic control system was greatly impacted “on June 30, 1956 [when] two planes collided over the Grand Canyon, killing all 128 aboard” (NATCA). This accident was an eye opener for The United States Congress; they appropriated $250 million to make major improvements to the system. At the same time, Congress passed the Federal Aviation Act of 1958, which created the Federal Aviation Agency, which later became the Federal Aviation Administration (FAA). In the late 1960s the FAA began to require the use of transponders in all aircraft operating within certain airspace. A transponder is “the airborne radar beacon receiver/transmitter portion of the Air Traffic Control Radar Beacon System (ATCRBS) which automatically receives radio signals from interrogators on the ground, and selectively replies with a specific reply pulse or pulse group only to those interrogations being received on the mode to which it is set to respond” (PCG T-8). This greatly enhanced controllers’ ability to control air traffic. (NATCA)

One important type of communication activity that is provided to pilots by air traffic control is a service called “flight following”. When requesting flight following, the pilot uses a radio to communicate with air traffic control, asks the controller to be a second set of eyes, and essentially asks for assistance in completing a safe flight from one point to another. Air Traffic Control will assist the pilot with navigation, awareness of other aircraft, terrain avoidance, and other aspects of flight that may affect the safety of flight. While this is a free service offered to pilots twenty-four hours a day, seven days a week, it is also optional. The potential problems that could result provide the rationale for this study. Will pilots use a free service to increase the safety of flight? Or, will pilots, because this service is optional, refuse to utilize the service even at the risk of making a flight that could be less safe than it otherwise would be?

Flight following is referred to as “traffic advisories” in the Aeronautical Information Manual (AIM). The AIM defines traffic advisories as:

> Advisories issued to alert pilots to other known or observed air traffic which may be in such proximity to the position or intended route of flight of their aircraft to warrant their attention. Such advisories may be based on: a.) Visual observation. b.) Observation of radar identified and nonidentified aircraft targets on an ATC radar display, or c.) Verbal reports from pilots or other facilities. (PCG T−6)

It is important to keep in mind that "traffic advisory service will be provided to the extent possible depending on higher priority duties of the controller or other limitations; e.g., radar limitations, volume of traffic, frequency congestion, or controller workload [and that they] do not relieve the pilot of his/her responsibility to see and avoid other aircraft" (AIM, PCG T-6). Flight following is a unique form of communication between pilot and controller which has the potential to increase a pilot's safety while flying under VFR. However, since the ultimate responsibility for operation of an aircraft remains with the pilot, maybe this is a reason that pilots choose not use the service. This study seeks to determine the factors that influence pilot usage of flight following and seeks clarification of why some pilots use the service and why others do not.

Statement of the Problem

Over a six-year period, from 2005 to 2010, there were seventy-six mid-air collisions in the United States, twenty-nine of which were fatal (AOPA Air Safety Foundation). According to the AOPA Air Safety Foundation, "most [mid-air collisions] happen in day VFR conditions" (2007). VFR stands for Visual Flight Rules, which defines a time where the weather conditions in which an aircraft is flown is good weather with good visibility and appropriate cloud clearances. This would be the time when flight following is (probably) most appropriate and important. Although mid-air collisions do not account for a large percentage of aviation accidents, they are still occurring year after year. According to the AOPA Air Safety Foundation (2009), flight following "can help pilots avoid conflicting traffic…[by] provid[ing] another set of watchful eyes to assist the pilot", which in turn increases the chance of collision avoidance. It would be easy to conclude that some pilots are not utilizing flight

following, but if they did so then there is the potential to reduce mid-air collisions. Therefore, it seems logical that more VFR pilots should communicate by utilizing flight following, and this would then create a safer National Airspace System.

Purpose Statement

The purpose of this study is to identify different groups of general aviation VFR pilots and their use of flight following to help determine what factors influence their use or lack of use of flight following. According to an article written by Snow, VFR Traffic Advisories (2015), "VFR flight following offers a number of advantages that will make your flying more enjoyable — and safer". If specific groups of pilots and their reasoning for not using flight following can be identified, then the specific groups of pilots can be targeted to encourage them to request flight following.

Importance of the Study

Every pilot and passenger who flies in an aircraft wants to reach his or her destination alive and in good health. The purpose of this study is to find one means to help accomplish that result. If a group of pilots can be identified who do not use flight following, then it would be important to also identify the reasons this group of pilots do not use flight following. As a result, since the lack of flight following could affect the safety of flight for everyone who flies, it would also then make sense to identify some technique or program that could encourage them to utilize this important service to support aviation safety. The results of this study are important because they could ultimately be used to increase the safety of the NAS, especially by reducing the potential for mid-air collisions. The FAA's mission is "to provide the safest, most efficient aerospace system in the world", while at the same time, its vision is to "strive to reach the

next level of safety, efficiency, environmental responsibility and global leadership". I believe this study will assist the FAA with their mission of safety to the benefit of everyone who flies in an airplane.

Research Questions

The research questions to be answered in this study are as follows:

1. Is there a statistical significance between the type of airport at which pilots keep their aircraft or typically conduct their flights and their use of flight following?
2. Is there a statistical significance between pilots' perceptions of their understanding of the Air Traffic Control System and their use of flight following?
3. What factors influence the use of flight following?
4. How do pilots define flight following?

Review of Literature

Aviation, when compared to other industries, is a young and growing travel related industry, and within that paradigm lies the need to expand research to enhance its effectiveness as a travel medium. The aviation industry has conducted research on communication issues within the industry, mostly related to crew interactions or the technological resources to facilitate those communications. However, this researcher could discover nothing specific to the use of flight following.

When communication in the field of aviation breaks down or is missing all together, it presents a safety concern. A lack of communication between air traffic controllers and pilots is a safety concern and can be related to communication issues in other aspects of aviation. Communication issues between pilots and flight attendants can be compared to controller-pilot communication because they are both interpersonal communications and exist in the aviation environment. Analyzing pilot-controller communication issues in general can be related to a lack in communication between air traffic controllers and pilots by the mere fact that these communications are happening between the same people.

Research in other disciplines, such as education, have examined help-seeking tendencies; these studies are relatable to the use of flight following. Help-seeking can be related to flight following because a pilot's request for flight following is essentially asking an air traffic controller for assistance. Using these past studies to set a foundation for research one can specifically expand on the knowledge of help-seeking in aviation.

Help-Seeking

Requesting flight following is help-seeking. Ryan, Gheen, and Midgley's (1998) study analyzed why some students avoid seeking help in the classroom by researching students' self-efficacy, and classroom structures. The study utilized sixth grade math classes where students and teachers completed a survey. The study revealed that "20% of the variance in student-reported help-seeking was due to classroom effects" (Ryan, Gheen & Midgley 1998, p. 531). The classroom effects taken into consideration by Ryan, Gheen and Midgley included "variables that related to the academic goal structure as well as to the social or interpersonal realm of the classroom" (p. 528). Because of the study they completed, one can infer that these same types of relationships could affect pilots and their use or lack of use of flight following. For example, the specific goal or reason for a flight may have an effect on whether or not the pilot chooses to seek help from air traffic control by using flight following.

The study also concluded that "students who felt less efficacious regarding their school work were more likely to report avoiding seeking help when needed"(p. 531). This relates to aviators because there is a possibility that pilots who feel less efficacious regarding the use of the Air Traffic Control (ATC) system may be less likely to request flight following.

Lastly, Ryan, Gheen and Midgley's (1998) study determined that a task-focused classroom goal structure, where there is an emphasis on effort and understanding, was associated with a lower level of help avoidance. On the other hand, perceptions of a relative-ability classroom goal structure, where the focus is on demonstrating ability, were associated with a higher level of help avoidance. (p. 533) By introducing those

findings into this study, one is able to see that a pilot's perception of flight following, as well as his or her perception of the controller's attitude, may play a role in deciding whether or not to use flight following. This research established a base line for studying how pilots view flight following in relationship to whether or not they use it, as well as a pilot's confidence in understanding how the ATC system works and their subsequent level of comfort in flying in that environment.

Steinfeldt (2012) conducted a study to "provide a greater understanding of the relationship between traditional masculine norms and help-seeking attitudes within the unique context of football" (p. 58). His study used 245 college football players and administered a four point likert-type survey. The results of this survey "demonstrated that greater conformity to traditional masculine norms was related to higher levels of stigma toward seeking professional psychological help" (p. 66). In contrast, the survey showed that "not conforming to these traditional norms of masculinity was significantly related to lower levels of stigma toward seeking professional psychological help" (p. 66).

Steinfeldt's study can be related to the current study on flight following due to the fact that aviation is a male dominated field. The findings could suggest that the pilots who conform to traditional masculine norms may be less likely to seek help and not use flight following, whereas pilots who do not conform to the traditional masculine norms may be more likely to seek help and use flight following. This study on flight following can expand this research by reviewing help-seeking tendencies in relation to pilots.

Cockpit-Cabin Communications

Cockpit-cabin communication is a form of interpersonal communication that exists within the aviation environment. In 1995, Chute and Wiener conducted a study to look at flight attendant and pilot communication. This study surveyed 177 flight attendants and 125 pilots from two different airlines. (Chute, Wiener, p. 263) The "research indicates that the basic problem is that these two crews represent two distinct and separate cultures, and that this separation serves to inhibit satisfactory teamwork" (Chute & Wiener, p. 257). Chute and Wiener's study helps to develop the idea that a difference in culture could provide a worthwhile examination as a part of a study related to flight following and pilot-controller communications.

In 1996 Chute conducted a study to examine "the dilemma facing the cabin crew when they feel that they have safety-critical information and must decide whether to take it to the cockpit" (p. 211). This research conducted an "examination of accident and incident reports and data from questionnaires submitted by pilots and flight attendants at two airlines" (p. 211). The results determined that some barriers to communication between cabin crews and pilots included different cultures, a lack of understanding of the sterile cockpit rule and a lack of training in cockpit-cabin communication. These two cultures are so different because "one [is] dedicated to a high proficien[cy] in technical matters, particularly the operation on complex machinery, [while] the other [is] well-versed in sociability and public service" (p. 213). The main idea of the sterile cockpit rule is, essentially, that there can be no distractions in the cockpit during critical phases of flight and that "non-essential communications between the cabin and cockpit crews are prohibited" (p. 217). As simple as it may sound, this concept has caused much

confusion. All of these findings by Chute could also provide reasons why there is a lack in communication between VFR pilots and controllers. Different cultures tend to play a role in a wide variety of communications but for purposes of this research, a lack in understanding and training could be one possible reason for pilots not utilizing flight following services.

A similar study by Brown and Rantz was done in 2010 to "investigate recent crew interactions and evaluate a.) flight attendant/pilot relations, b.) the effects of lack of joint Crew Resource Management (CRM) training exercises, c.) flight attendant reluctance to contact the flight deck, d.) the impact of the mandated cockpit door strengthening requirement, and e.) if traditional CRM programs adequately address communication issues between the pilots and flight attendants" (Brown & Rantz, p. 230). The study was conducted through the use of a five point likert-type scale survey that was imbedded as a link in emails and on airline websites in an effort to collect information and data for analysis. (Brown & Rantz, 232)

Brown and Rantz's findings suggest that barriers influencing effective communication between pilots and flight attendants include; job understanding, organizational structure, procedures, and a misunderstanding of the sterile cockpit rule (Brown & Rantz, p. 234). Fifty-five percent of flight attendants reported that they had been hesitant to report a problem to a pilot because of fear of being reprimanded, or lack of understanding of a problem or system. Sixty-eight percent of flight attendants said that allowing flight attendants to jump seat (to ride in an observer seat in a cockpit) would be very helpful in improving their understanding of CRM (Brown & Rantz, p. 236). The results of this study provide impetus for this project as to why certain factors influence

VFR pilots' use of flight following. The results of the pilot-flight attendant communication study can now be used to examine pilot-controller communications. This study on flight following expands former research by exploring the same concept between different groups of people. While pilot-cabin communication has been previously examined, this study will now examine pilot-controller communications.

Pilot-controller Communications

In recent years there have been many studies completed on pilot-controller communications including Morrow, Lee and Rodvold (1993), Howard (2008) and Prinzo and Morrow (2002). These studies explored the communication that already exists between pilot and controller in the normal course of a flight and the errors or miscommunication that occur every day in that environment. Because of the importance of clear communication in aviation, these studies set out to determine the cause of miscommunication. This research on flight following delves into a different sphere of pilot-controller communications and will add to previous research by exploring a new question regarding whether or not there is a lack of communication between pilots and controllers, and if so, why?

Morrow, Lee and Rodvold (1993) investigated routine pilot-controller communication and the problems that disrupt them. The study was conducted by analyzing tapes of routine pilot-controller communications from various Terminal Radar Approach Control (TRACON) facilities (Morrow, Lee & Rodvold, 1993, p. 289). The results suggested that the frequency of procedural deviations, also known as not following recommended procedures, was rare and occurred 3% to 13% of the time. Length, composition, non-routine transmissions and radio and task factors were all said to

be contributing factors to procedural deviations (pp. 291-297). The study also suggested that call sign confusion occurred in only 0.2% of transmissions. Morrow, Lee and Rodvold's study validated the importance of researching pilot-controller communications. In examining the flight following aspect of pilot-controller communications, this research project expands on Morrow, Lee and Rodvold's contribution to this field of research.

Howard (2008) examined communications from an air traffic control tower environment as opposed to TRACON. The data for this study was collected from 15 control towers located in the Midwest where the researcher collected tape recordings (Howard, p. 378). Tape recordings were coded for analysis by three different flight instructors who were trained in three two-hour sessions (p.378, 2008). Howard's study found that "procedural deviations were an antecedent factor in problematic communications for pilots and ATCs [Air Traffic Controllers]" (p. 370). The research also indicated that "communication problematics manifested in pilot turns more than [Air Traffic Controller] turns, higher amounts of information led to increased problematic communications in the subsequent turn, and linguistic violations of ATC protocol increased problematic communication in the subsequent turn" (p. 370). This research study expands on Howard's study by examining another unique aspect of pilot-controller communications, flight following.

A study completed by Prinzo and Morrow (2002), analyzed pilot and controller voice communications in general aviation. Twenty-four adults with pilot certificates were asked to fly a simulator pattern and researchers observed how the pilots read back (repeated) and understood ATC instructions, including altitude assignments and

frequencies, in both grouped (stating "forty-five hundred") and non-grouped (stating "four thousand five hundred") forms (Prinzo & Morrow, 2002). In the past, studies showed that a grouped format does not improve memory. In contrast, Prinzo and Morrow's study showed that a grouped format does benefit pilot memory (Prinzo & Morrow, 2002). This study not only demonstrated that there is a research interest in pilot-controller communications, but also introduced an aspect of pilot-controller communications that has been previously neglected; the aspect of examining general aviation as it relates to pilot-controller communications. General aviation (GA) is "all civilian flying except scheduled passenger airlines" (AOPA). This study on flight following will expand upon Prinzo and Morrow's study by examining communication between a pilot and a controller in general aviation.

It appears as though existing research has not explored pilot usage of flight following, an optional service of communication between GA pilots and controllers, but has merely examined the required communications of IFR pilots and controllers, and issues that already exist in that flight environment. This study will investigate pilot usage of flight following within different groups of VFR pilots. It will examine a different aspect of pilot-controller communications encompassing optional VFR pilot communications with air traffic control.

Definition of Terms

AUTOMATIC DEPENDENT SURVEILLANCE− BROADCAST (ADS-B)− A surveillance system in which an aircraft or vehicle to be detected is fitted with cooperative equipment in the form of a data link transmitter. The aircraft or vehicle periodically broadcasts its GPS−derived position and other information such as velocity over the data link, which is received by a ground−based transmitter/receiver (transceiver) for processing and display at an air traffic control facility. (PCG A-15, 2014)

Air Traffic Control - A service provided for the purpose of: a.) Preventing collisions: 1- between aircraft; and 2- on the maneuvering area between aircraft and obstructions. b.) Expediting and maintaining an orderly flow of air traffic. (PCG A-5, 2014)

Class B Airspace - Generally, that airspace from the surface to 10,000 feet MSL surrounding the nation's busiest airports in terms of airport operations or passenger enplanements. The configuration of each Class B airspace area is individually tailored and consists of a surface area and two or more layers (some Class B airspaces areas resemble upside-down wedding cakes), and is designed to contain all published instrument procedures once an aircraft enters the airspace. An ATC clearance is required for all aircraft to operate in the area, and all aircraft that are so cleared receive separation services within the airspace. The cloud clearance requirement for VFR operations is "clear of clouds." (PCG C-6, 2014)

Class C Airspace - Generally, that airspace from the surface to 4,000 feet above the

airport elevation (charted in MSL) surrounding those airports that have an operational control tower, are serviced by a radar approach control, and that have a certain number of IFR operations or passenger enplanements. Although the configuration of each Class C area is individually tailored, the airspace usually consists of a surface area with a 5 nautical mile (NM) radius, a circle with a 10NM radius that extends no lower than 1,200 feet up to 4,000 feet above the airport elevation and an outer area that is not charted. Each person must establish two-way radio communications with the ATC facility providing air traffic services prior to entering the airspace and thereafter maintain those communications while within the airspace. VFR aircraft are only separated from IFR aircraft within the airspace. (PCG C-6, 2014)

Class D Airspace - Generally, that airspace from the surface to 2,500 feet above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower. The configuration of each Class D airspace area is individually tailored and when instrument procedures are published, the airspace will normally be designed to contain the procedures. Arrival extensions for instrument approach procedures may be Class D or Class E airspace. Unless otherwise authorized, each person must establish two-way radio communications with the ATC facility providing air traffic services prior to entering the airspace and thereafter maintain those communications while in the airspace. No separation services are provided to VFR aircraft. (PCG C-7, 2014)

Class E Airspace - Generally, if the airspace is not Class A, Class B, Class C, or Class D,

and it is controlled airspace, it is Class E airspace. Class E airspace extends upward from either the surface or a designated altitude to the overlying or adjacent controlled airspace. When designated as a surface area, the airspace will be configured to contain all instrument procedures. Also in this class are Federal airways, airspace beginning at either 700 or 1,200 feet AGL used to transition to/from the terminal or en route environment, en route domestic, and offshore airspace areas designated below 18,000 feet MSL. Unless designated at a lower altitude, Class E airspace begins at 14,500 MSL over the United States, including that airspace overlying the waters within 12 nautical miles of the coast of the 48 contiguous States and Alaska, up to, but not including 18,000 feet MSL, and the airspace above FL 600. (PCG C-7, 2014)

Class G Airspace - That airspace not designated as Class A, B, C, D or E. (PCG C-2, 2014)

Crew Resource Management (CRM) - is the effective use of all available resources for flight crew personnel to assure a safe and efficient operation, reducing error, avoiding stress and increasing efficiency.

(Retrieved: http://www.skybrary.aero/index.php/Crew_Resource_Management)

General Aviation (GA) - all civilian flying except scheduled passenger airlines. (AOPA)

Instrument Flight Rules (IFR) - Rules governing the procedures for conducting instrument flight. Also a term used by pilots and controllers to indicate type of flight plan. (PCG I-4, 2014)

National Airspace System (NAS) - The common network of U.S. airspace; air navigation

facilities, equipment and services, airports or landing areas; aeronautical charts, information and services; rules, regulations and procedures, technical information, and manpower and material. Included are system components shared jointly with the military. (PCG N-1, 2014)

National Air Traffic Controller Association (NATCA) –NATCA serves as the exclusive bargaining representative for FAA air traffic controllers, engineers, architects and many other aviation safety professionals– representing the concerns of all in the field, not just their members. (NATCA)

Terminal Radar Approach Control (TRACON) - A terminal ATC facility that uses radar and non-radar capabilities to provide approach control services to aircraft arriving, departing, or transiting airspace controlled by the facility. a. Provides radar ATC services to aircraft operating in the vicinity of one or more civil and/or military airports in a terminal area. The facility may provide services of a ground controlled approach (GCA); i.e., ASR and PAR approaches. (PCG R-1)

Traffic Alert and Collision Avoidance System (T-CAS) - an airborne collision avoidance system based on radar beacon signals which operates independent of ground-based equipment. TCAS-I generates traffic advisories only. TCAS-II generates traffic advisories, and resolution (collision avoidance) advisories in the vertical plane. (PCG T-6, 2014)

Visual Flight Rules (VFR) - Rules that govern the procedures for conducting flight under visual conditions. The term "VFR" is also used in the United States to indicate weather conditions that are equal to or greater than minimum VFR requirements.

In addition, it is used by pilots and controllers to indicate type of flight plan. (PCG V-3, 2014)

CHAPTER II

METHODOLOGY

This study examines the use of flight following within different groups of pilots: those who mainly fly at controlled airports; those who mainly fly out of uncontrolled, paved airports; and those who primarily fly out of uncontrolled airports. These groups of pilots were asked to participate in the research for this study and the data were analyzed using a mixed-methods statistical approach. The instrument used to collect data was a survey and the methodology employed a personal interview with each participant. The majority of the research utilized a quantitative statistical approach, with a smaller portion representing a qualitative approach. This mixed-methods approach allowed for more in-depth answers and enabled the researcher to better determine the viewpoints held by pilots.

Setting and Participants

The study was conducted at different airports within a 75 nautical mile (NM) radius of Little Brook Airpark (3B4) in Eliot, ME. This location was chosen because it is within reasonable distance of the researcher and because the location is typical of many locations across the country that would contain all three groups of pilots as outlined for this study. All of the airports within a 75 NM radius of 3B4 were divided into three lists delineating the three groups of pilots of the study using a sectional aeronautical chart with a 75 NM radius drawn around the airpark. If the representative airport symbol was close

to the radius, then skyvector.com (an online aeronautical mapping tool) was used to determine the exact distance from 3B4. The three lists were categorized by controlled airports, uncontrolled paved airports or uncontrolled other airports.

Controlled airports were defined as airports in which there is an operating air traffic control tower. This would include Class C and D airports. Class B airports were eliminated due to the fact that it is required that a pilot establish two-way radio communication with approach control and be cleared into Class B airspace. Uncontrolled paved airports were defined as airports in which there is no operating air traffic control tower and all runway surfaces are paved. These airports are found within Class E or G airspace. Uncontrolled other airports were defined as airports in which one or more runway surface was something other than pavement. These could be categorized as grass strips, sea-plane bases or any additional surface other than pavement. For example, if an airport had a paved runway but also a grass strip, it was put in the uncontrolled other category. These airports were also in Class E and G airspace. Private and Restricted airports were not included in the list.

These specific groups were created in order to obtain data from a wide variety of pilots. It is generally assumed that pilots who fly out of these different types of airports will 1.) fly aircraft that are significantly diverse from one another and 2.) have different experience levels of using a two-way communications radio. As a result, one could assume that there will be a noticeable difference in the use of flight following between the groups. Once the three lists were compiled, a random generator was used to select two airports from each category as a starting point for conducting pilot interviews.

Table 1. Airports Selected for Study

Identifier	Airport	Controlled	Uncontrolled Paved	Uncontrolled Other
3B5	**Twitchell Airport, Turner Maine, USA**			**x**
BVY	**Beverly Municipal Airport, Beverly, Massachusetts, USA**	**x**		
GHG	**Marshfield Municipal Airport - George Harlow Field, Marshfield, Massachusetts, USA**		**x**	
DAW	**Skyhaven Airport, Rochester, New Hampshire, USA**		**x**	
2B2	**Plum Island Airport, Newburyport, Massachusetts, USA**			**x**
ASH	**Boire Field Airport, Nashua, New Hampshire, USA**	**x**		

The participants for this study were required to have a minimum Federal Aviation Administration pilot certificate as a Light Sport or Private Pilot Certificate. The pilot sample was selectively discriminated based mainly upon the selected airport destinations. Instead of sending out a survey to a large amount of randomly selected pilots, which tends to have a low return rate, this study selected pilots who would fill a wide range of backgrounds by visiting specific airports as a place to start collecting data. A data gathering technique referred to as the "snowball effect" was then used in order to gain more participation, by asking pilots if they could refer other pilots to take the survey.

This researcher visited each selected airport over a one-month period and approached pilots with a request for volunteers to participate in an interview. This researcher approached pilots in airport businesses known as Fixed Based Operators (FBO) as well as any observed pilots conducting business around the airport or in their hangars. If pilots were willing to volunteer, an interview was then conducted. Pilots

were subsequently asked if they were able to refer other pilots the researcher for an interview. If pilots were referred, they were contacted by phone to conduct the interview.

Table 2. Number of Participants per Airport Type

	Controlled	Uncontrolled Paved	Uncontrolled Other
Number of Participants	55	33	17

Protection of Human Subjects

Participation in this research was strictly voluntary; no one was forced to be interviewed. The research protocol and the interview form was approved by the Institutional Review Board at the University of North Dakota prior to being conducted. There were minimal foreseen risks to the participants. The participants' identification was kept confidential. Although the researcher conducted some interviews in person, there was no personally identifiable information collected. The data was stored in a safe place where it will remain for a three-year period, after which it will be shredded.

Data Collection

The data for this study was collected using both qualitative and quantitative research methods. The instrument used to collect data was an interview conducted with pilots either in person or on the phone.

The first few questions were related to the participants' demographic characteristics, including gender, age and amount of flight hours they had accumulated. Gender was a multiple-choice single-answer question with the choice of male or female. Age and the approximate number of flight hours were an open response question so that the participant could give an exact number for each.

The next group of interview questions asked pilots about their pilot certificates and ratings held, type of aircraft flown and type of airport they are based at or out of which they mainly fly. The options a pilot could select for ratings were multiple-choice multi-answer responses, including Light Sport Certificate, Private Pilot Certificate, Instrument Rating, Commercial Certificate, Certified Flight Instructor, Certified Flight Instructor-Instrument, Seaplane Rating or Airline Transport Pilot Certificate. The type aircraft was also multiple-choice multi-answer response which included Helicopter, Weight-Shift Control, Single-Engine Land, Single-Engine Sea, Multi-Engine Land and Multi-Engine Sea. The options to choose from for the type of airport were multiple-choice single-answer, and included three choices of towered, uncontrolled paved and uncontrolled other.

The next group of questions asked whether or not the aircraft that the pilot normally flies had certain electronic equipment installed in the aircraft or available as a portable electronic device. Participants were first asked whether or not the aircraft had a two-way communications radio. The responses were multiple-choice single-answer questions including Yes, No and No but I use a hand-held radio. The interview also asked two yes or no questions regarding whether or not the aircraft was equipped with ADB-S or T-CAS.

After the questions regarding the pilot's aircraft, the participants were then asked for what reason they normally fly and, in their opinion, how well they understood the air traffic control system. Both questions required multiple-choice, single-answer responses. The question, "For what reason do you normally fly?" included the following responses; for enjoyment (to fly for fun/a hobby), for work, to flight instruct, or other. If the

participant choose "other" as their response, they were then asked the specific reason they normally fly. The question "In your opinion, how well is your understanding of the Air Traffic Control System?" included the following responses; poor, fair, good, very good and excellent.

The next two questions allowed for an open response. The researcher asked the participants to define flight following in their own words and also to explain what factors influenced their use of flight following. When these questions were asked the researcher took notes as the participants responded.

Instrument Reliability and Validity

The instrument used in this study was a survey conducted by means of an interview. Before the interviews were conducted, the survey questions were given to five subject matter experts, who were all pilots. They read the questions to check for an understanding of what was being asked and for clarity in the way the questions were asked. All data from the interviews was collected via paper and then double-checked while being entered into the computer, to reduce human error in recording the information. To ensure validity of qualitative data, categories were built containing a minimum of five participant responses for each one. Responses that did not fit into a category were reported in a category labeled "other". To ensure the researcher's categories were reliable, two subject matter experts each took ten percent of the data and found themes which were similar to those of the researcher.

Data Analysis

Since the data is both qualitative and quantitative it needed to be analyzed in two different ways. The quantitative data was analyzed using SPSS software including t-

tests, correlations and ANOVA's, while the qualitative data was analyzed by looking for trends or themes that developed as a result of the discussion with the participants. All quantitative data was analyzed to find significance at the .05 alpha-level. The study used two-tailed tests with a non-directional hypothesis because there is not an abundant amount of previous research on this specific topic, if any at all.

Quantitative

The first of two research questions examined whether there was a significant difference between the type of airport a pilot is based at or out of which he or she mainly flies and the use of flight following. The second research question examined whether there was a difference of significance between a pilot's perception of their understanding of the air traffic control system and his or her use of flight following. Both were analyzed using a one-way ANOVA statistical test.

Table 3. Variables and Statistical Tests

Independent Variable	Dependent Variable	Statistical Test
Airport Type	Use of Flight Following	One Way ANOVA
Understand of ATC	Use of Flight Following	One Way ANOVA
Age	Use of Flight Following	Correlation
Flight Hours	Use of Flight Following	Correlation
Ratings	Use of Flight Following	T-test
Type Aircraft	Use of Flight Following	T-test
Electronics	Use of Flight Following	T-test
Purpose of Flight	Use of Flight Following	One Way ANOVA

The third research question, which asked what factors influence pilot usage of flight following, had numerous parts to it. First, two correlations were run to determine if there was any significance between age and accumulated flight hours and pilot's usage of flight following. Next, a total of ten t-tests were run on the data collected about ratings, aircraft and aircraft electronics. Four t-tests examined the difference in pilot usage of flight following and certain ratings, including Instrument Rating and/or Commercial Pilot Certificate, Certified Flight Instructor and/or Certified Flight Instructor- Instrument, Sea-plane Rating and Airline Transport Pilot Rating.

Three t-tests examined the difference in pilot usage of flight following and certain aircraft types being flown including helicopter, Weight-Shift control , Single-Engine Land and/or Single-Engine Sea and Multi-Engine Land and/or Multi-Engine Sea. Three t-tests reviewed the difference in pilot usage of flight following and different electronics in the aircraft including radio, ADS-B and TACS. Lastly, a one-way ANOVA was run to compare purpose of flight with pilot usage of flight following.

Qualitative

There were two research questions that were used to examine the qualitative method of statistical analysis. These questions were, "In your own words define flight following" and "What factors influence your use of flight following." The data from both of these questions were gathered in a similar manner using the technique of in-depth interviewing. According to Crossman, the seven steps in this process included thematizing, designing, interviewing, transcribing, analyzing, verifying and reporting. Thematizing is the first step where the researcher clarifies with the subject what the purpose of the interview will be and the concepts that will be explored. Designing is the second step where the researcher lays out the process of how he or she will accomplish the stated purpose. The next two steps include the actual interview where the researcher conducts a question and answer session with the subject, and transcribing which consists of writing down the answers to interview questions.

After conducting the interview, the researcher must analyze the data. This consists of determining the meaning of the information gathered in the interviews in relation to the purpose of the study. This is performed by sorting the data into common themes and grouping the information into categories. The last two steps include

verifying, where the data are examined for reliability, and validity where the data are reported. In order to improve reliability and validity, the researcher gave a random ten percent of the data from each question to two other subject matter experts to look for trends and compare results. The results of this data were reported as trends and categories that had emerged.

Limitations

There are a few known limitations and assumptions to the research. The first limitation is that the pilots interviewed were mainly from a 75 NM radius of Little Brook Airpark. This could make a difference because of the geographic terrain that limits ATC radar coverage. Another limitation is that there was no personal identifiable information on the surveys. This means that there is no way to conduct any follow up questions if the results warrant it or for further research with this particular group of research subjects. Also, some of the interviews were conducted in person while others were conducted over the phone. Although this could have an effect on the results, the researcher kept conversations with participants to a minimum both in person and over the phone to reduce the chance of influencing the participant's response in any way.

CHAPTER III

RESULTS

Introduction

This study was conducted utilizing an interview format. Pilots were interviewed either in person or over the phone and their responses were recorded on paper. After completing all of the interviews, the responses were then entered into the computer using Qualtrics software. The interview contained both qualitative and quantitative data.

One hundred and five (N=105) pilots were interviewed. Results indicated that all pilots held as least a Light Sport Certificate and/or Private Pilot Certificate. All one hundred and five pilots completed the interview in its entirety.

Demographics

Participants' Gender

The first interview question was to determine each participant's gender. Out of the one hundred and five pilots, ninety-six (N=96) or 91% were male and nine (N=9) or 9% were female. Figure 1 shows a bar graph of the number of male participants versus the number of female participants, while Figure 2 shows a pie chart of the percentages.

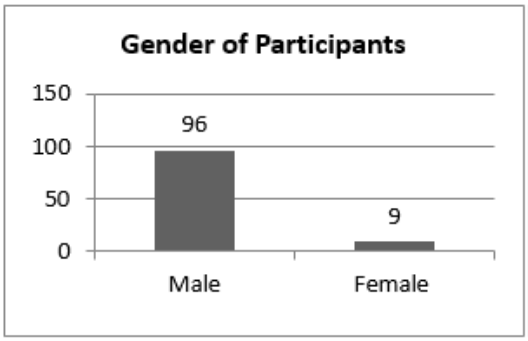


Figure 1. Gender of Participants

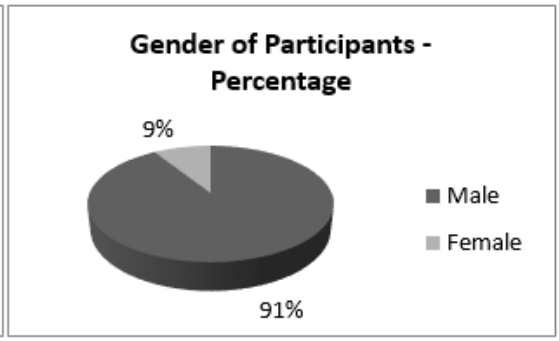


Figure 2. Gender of Participants - Percentage

Participants' Ages

The second question asked participants their ages, but also gave them the option to not answer. One hundred and three (N=103) participants reported their age. Two (N=2) participants preferred not to answer this question. The minimum age was seventeen and the maximum age was seventy-nine. The range of the ages was sixty-two years with a mean age of 48.2 and a standard deviation of 17.649 (SD = 17.649). Figure 3 depicts a frequency chart of participants' ages, while Table 4 shows the descriptive statistics.

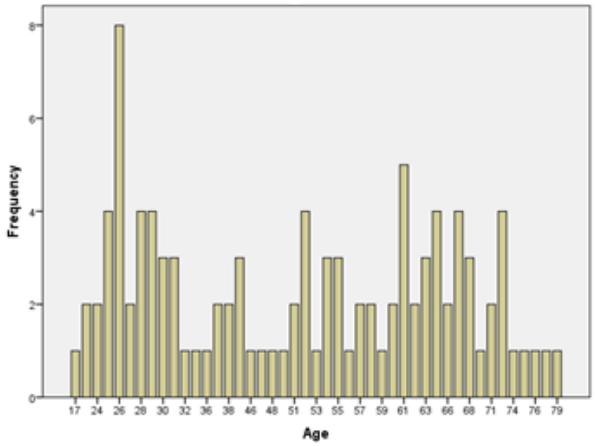


Figure 3. Age Frequency

Table 4. Age Statistics

Statistics

Age

N	Valid	103
	Missing	2
Mean		48.21
Median		52.00
Std. Deviation		17.649
Range		62
Minimum		17
Maximum		79

Participants' Flight Hours

The next question asked determined approximately how many flight hours each participant had accumulated. After reporting the number of hours accrued, the minimum number of flight hours was sixty and the maximum was determined to be 35,000. The range was 34,940 with a mean of 3817.8 and a standard deviation of 6179.955 (SD=6179.955). Table 5 shows the descriptive statistics of participant flight hours while Figure 4 shows a frequency of participant flight hours.

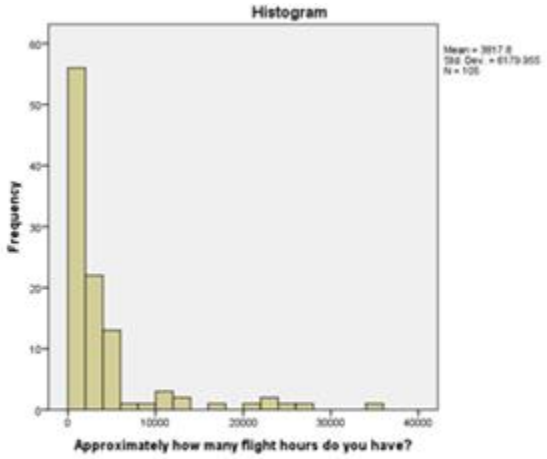


Figure 4. Flight Hours

Table 5. Participant Flight Hours

Participant Flight Hours	
N	105
Minimum	60
Maximum	35000
Mean	3817.80
Standard Deviation	6179.955

Quantitative Questions

Certificates and Ratings

The next question asked pilots what ratings they held. Since the only requirement to participate in the interview was to have a minimum of either a Light Sport Certificate or Private Pilot Certificate, all one hundred and five (N=105) participants, or 100% of the subjects, had the equivalent or better of one of these ratings. Sixty seven (N=67) or 64% of participants reported having an Instrument Rating and/or Commercial Pilot Certificate.

Forty nine (N=49) or 47% of participants reported having obtained a Certified Flight Instructor Certificate and/or a Certified Flight Instructor with an Instrument Rating. Thirty (N=30) or 29% of participants reported having a Single-Engine and/or Multi-Engine Seaplane rating. Nineteen (N=19) or 18% of participants reported having an Airline Transport Pilot Certificate. Figure 5 depicts how many participants had each certificate/rating while Figure 6 displays the percentages of participants who held each certificate/rating.

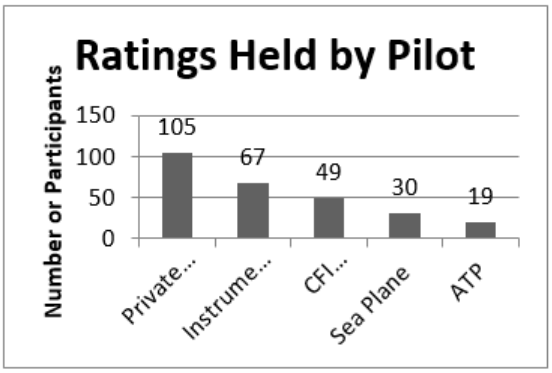


Figure 5. Ratings Held by Pilot

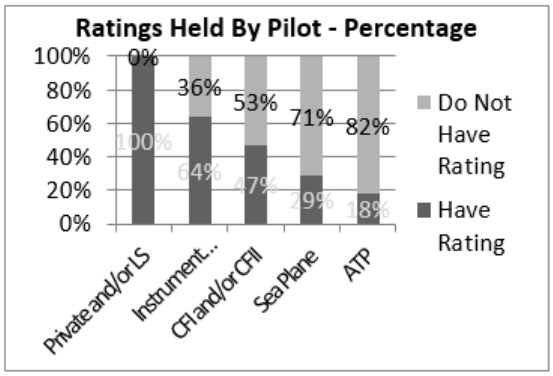


Figure 6. Ratings Held by Pilot - Percentage

Type Aircraft

The next question asked participants to list what type of aircraft they fly. Four pilots (N=4) or 4% of pilots reported that they fly helicopters. Nine pilots (N=9) or 9% of pilots reported that they fly Weight-Shift Control aircraft. All one hundred and five (N=105) or 100% of pilots reported that they fly Single-Engine aircraft. Fifty-two pilots (N=52) or 50% of pilots reported that they fly Multi-Engine aircraft. Figure 7 displays a bar graph of how many pilots fly each type of aircraft, while Figure 8 depicts the percentages.

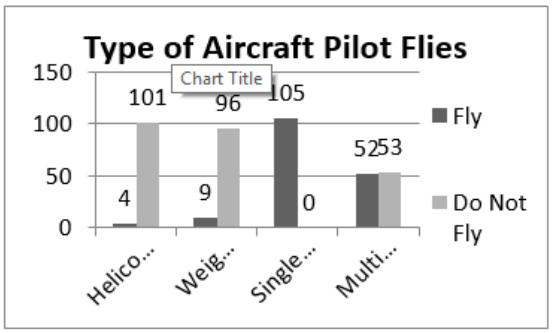


Figure 7. Type of Aircraft Pilot Flies

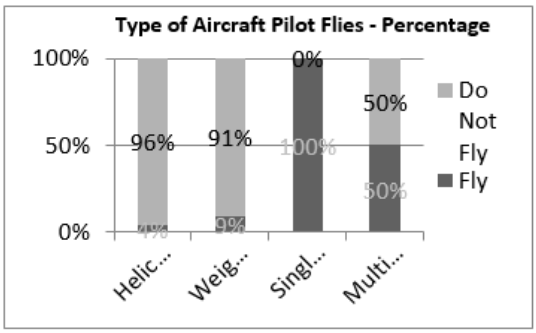


Figure 8. Type of Aircraft Pilot Flies - Percentage

Type of Airport

The next question asked participants what type of airport they typically fly out of or where they base their aircraft; Towered, Uncontrolled Paved or Uncontrolled Other. Fifty five (N=55) or 52% of participants reported being based at or mainly flying out of a towered airport, thirty-three (N=33) or 31% reported an uncontrolled paved airport and seventeen (N=17) or 16% reported an uncontrolled other airport. Figure 9 illustrates how many participants reported being based at or mainly flying out of each type of airport while Figure 10 shows the percentages in a pie chart.

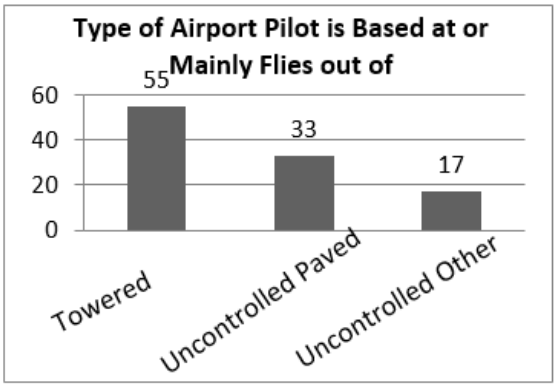


Figure 9. Type of Airport Pilot is Based at or Mainly Flies out of

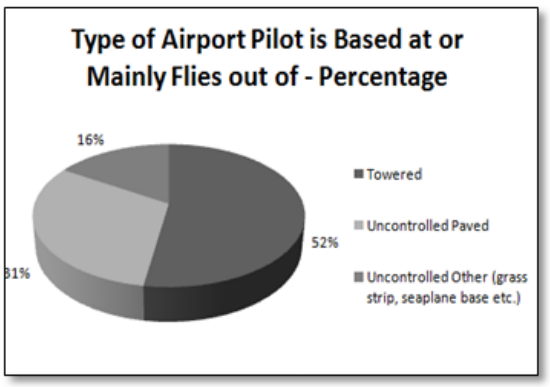


Figure 10. Type of Airport Pilot is Based at or Mainly Flies out of - Percentage

Radio, ADS-B, T-CAS

The next three questions inquired about different types of equipment in the aircraft that the participant normally flies. The first question asked whether or not the aircraft had a two-way communications radio. If it did not have a radio, did the pilot use a hand-held radio? Ninety participants (N=90) or 86% reported that the aircraft they normally fly has a radio. None of the participants (N=0) reported having no radio at all, while fifteen (N=15) or 14% of participants reported their aircraft was not equipped with a radio, but that they used a hand-held radio. Figure 11 shows the number of participants who reported each type of radio and Figure 12 shows the percentages.

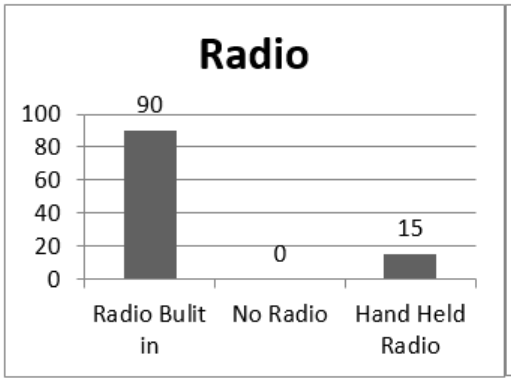


Figure 11. Radio

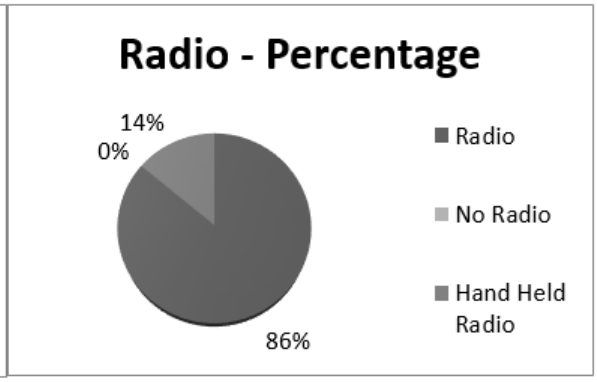


Figure 12. Radio - Percantage

The second question asked whether or not the aircraft that the pilot normally flies is equipped with ADS-B. Twenty three (N=23) or 22% of participants reported that the aircraft they normally fly has ADS-B, while eighty two (N=82) or 78% of participants reported not having it on board. Figure 13 shows the number of pilots who reported having ADS-B versus thenumber of pilots who did not report having it, while Figure 14

shows the percentages.

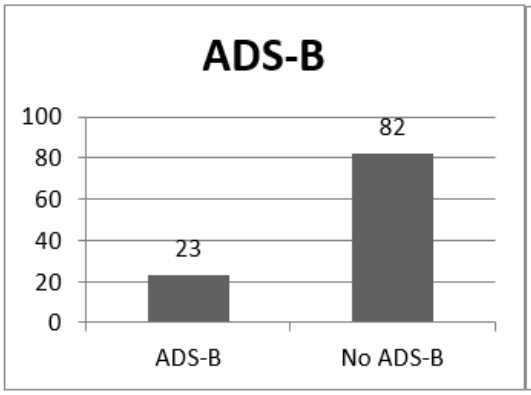


Figure 13. ADS-B

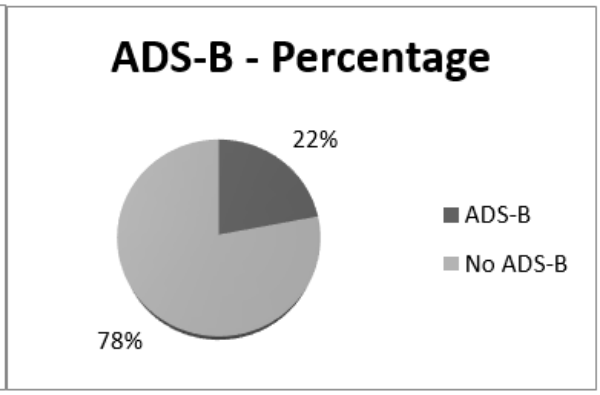


Figure 14. ADS-B - Percentage

The third question asked regarding aircraft equiptment was whether or not the aircraft each pilot normally flies has T-CAS. Thirty-one (N=31) pilots or 30% reported having T-CAS, while seventy-four (N=74) or 70% reported not having it. Figure 15 shows the number of participants who reported having T-CAS versus those who reported they did not. Figure 16 shows the percentages.

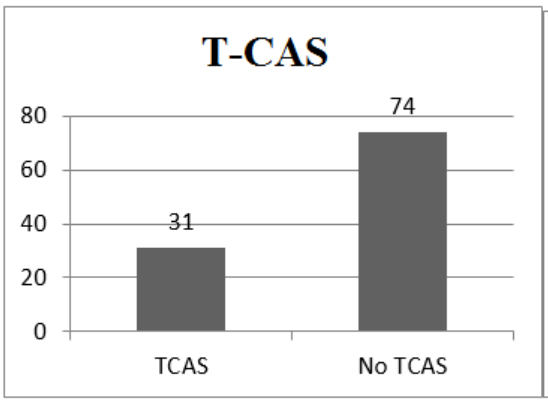


Figure 15. T-CAS

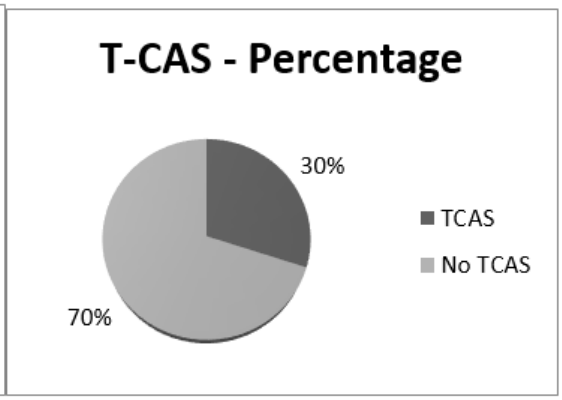


Figure 16. T-CAS Percentage

Purpose of Flight

The next question asked participants to report the purpose for which they mainly fly. The categories to choose from were; Enjoyment, Work, Flight Instructing or Other.

Sixty-five participants (N=65) or 62% reported enjoyment as their main purpose of flight. Twenty one participants (N=21) or 20% reported work as their reason of flight. Sixteen participants (N=16) or 15% reported flight instruction as their main purpose of flight. Three participants (N=3) or 3% reported something other than enjoyment, work or flight instruction as their main purpose of flight. The other reasons given were for currency and for school. Figure 17 shows how many participants fly for each reason, while Figure 18 shows the percentages.

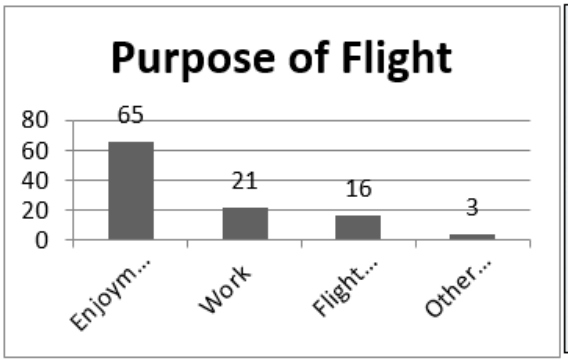


Figure 17. Purpose of Fight

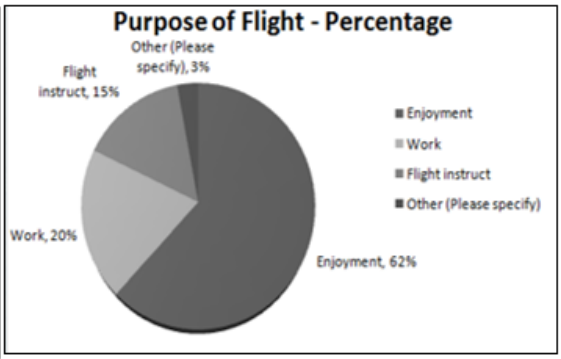


Figure 18. Purpose of Flight - Percentage

Understanding of Air Traffic Control System

The next question asked participants their opinion on how well they understand the air traffic control system. The participants had to choose either Poor, Fair, Good, Very Good or Excellent. One participant (N=1) or 1% reported their understanding as Poor, nine (N=9) or 9% reported Fair, twenty-six (N=26) or 25% reported Good, Thirty four (N=34) or 32% reported Very Good and thirty-five (N=35) or 33% reported Excellent. Figure 19 shows a bar graph of the participants' level of understanding of the air traffic control system. Figure 20 shows the percentages of their responses.

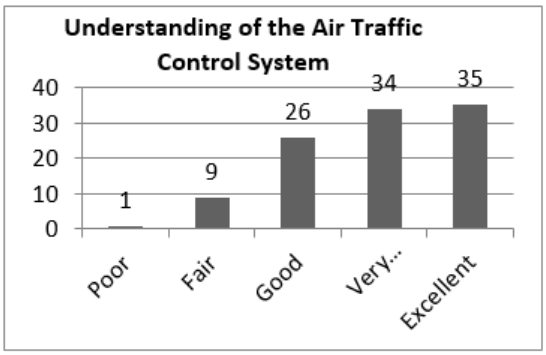


Figure 19. Understanding of the Air Traffic Control System

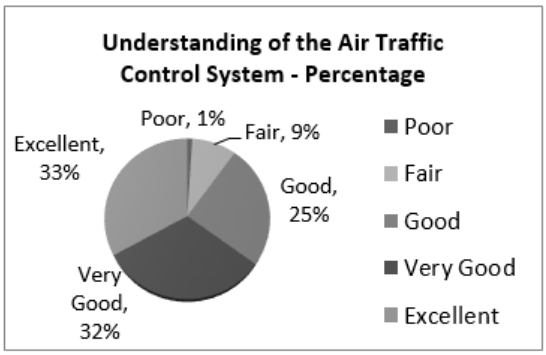


Figure 20. Understanding of the Air Traffic Control System - Percentage

How Often Flight Following is Requested

The last quantitative question asked participants how often they request flight following on a scale of Never, Rarely, Sometimes, Often or All the Time. Eleven participants (N=11) or 10% reported requesting flight following Never, twenty-three participants (N=23) or 22% reported requesting it Rarely, seventeen participants (N=17) or 16% reported requesting it Sometimes, thirty-four participants (N=34) or 32% reported using it Often, and Twenty participants (N=20) or 19% reported using it All of the Time. Figure 21 shows the amount of participant responses to each category, while Figure 22 shows the percentages.

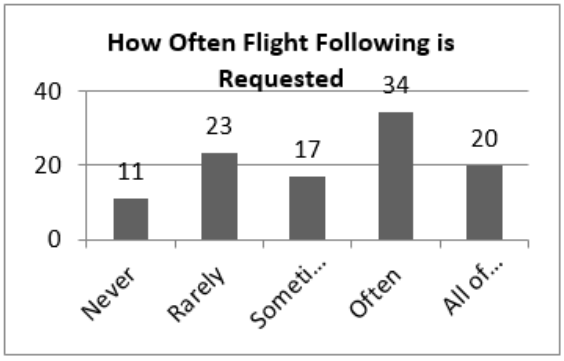


Figure 21. How Often Flight Following is Requested

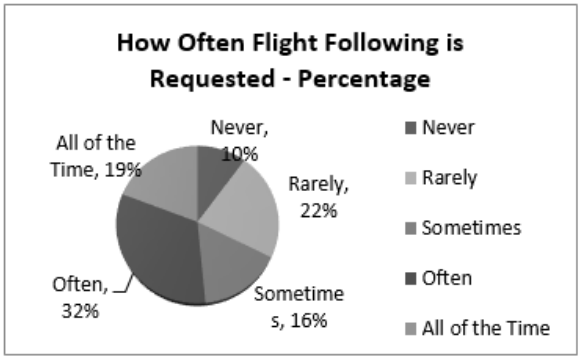


Figure 22. How Often Flight Following is Requested – Percentage

Qualitative Questions

Part of this study used qualitative data to answer the research questions. The interview contained two open-ended questions; "In your own words define flight following" and "What factors influence your use of flight following?". From the participant responses to these questions, categories and themes emerged. Most of the time participants' responses fit into more than one category.

Definitions of Flight Following

The first qualitative question asked participants to define flight following in their own words. This question was used to get a rough idea of what pilots actually perceive flight following to be. After analyzing each participant's response, seven categories or themes emerged. These seven themes included similar to instrument flight rules, a service that provides information for situational awareness, a service for specific types of flights, navigational help, traffic advisories, an optional/workload permitting service, for safety and any answers that did not fall into these categories were put in a category labeled "other".

The category "similar to instrument flight rules" included responses that contained phrases such as "next best thing to IFR flight plan", "filing a flight plan", or "cross between IFR and VFR". The category "service that provides information for situational awareness" encompasses phrases such as "help in case I get lost", "weather information" "keeps me out of TFR's and airspace" and "supplementary information for your awareness". The category "service for specific types of flights" contains responses such as "service for recreational general aviation pilots", "for cross country flights" and "under radar contact". The category "navigational help" covers phrases such as "they tell

you where to go", "help with navigation" and "they check on your location and progress". The category "traffic advisories" encompasses terminology such as "traffic advisories", "another set of eyes" and "separation from other traffic". The category "optional/workload permitting service" includes phrases such as "workload permitting", "time permitting" and "optional service". The last major theme or category was "for safety" which contains phrases such as "a safety thing", "they help you" and "watching over you". The responses that did not fit any of these categories fell into the "other" category, which included phrases such as "stupid/waste of time", "getting controlled", "preventing you from getting lonely" and "I don't know a whole lot about it".

Twelve of the participants (N=12) responses fell into the category of "similar to instrument flight rules". Thirty-two participants (N=32) defined flight following as a "service that provides information for situational awareness". Nineteen participants (N=19) reported that flight following was a "service for specific types of flights". Thirteen participants (N=13) stated that flight following was "navigational help". More than three quarters of participants, seventy-nine (N=79), reported flight following as "traffic advisories". Fifteen participants (N=25) defined flight following as an "optional/workload permitting service". Approximately half, forty eight participants (N=48), referred to flight following as being used "for safety". Six participant responses fell into the "other" category. The results are show in the chart below.

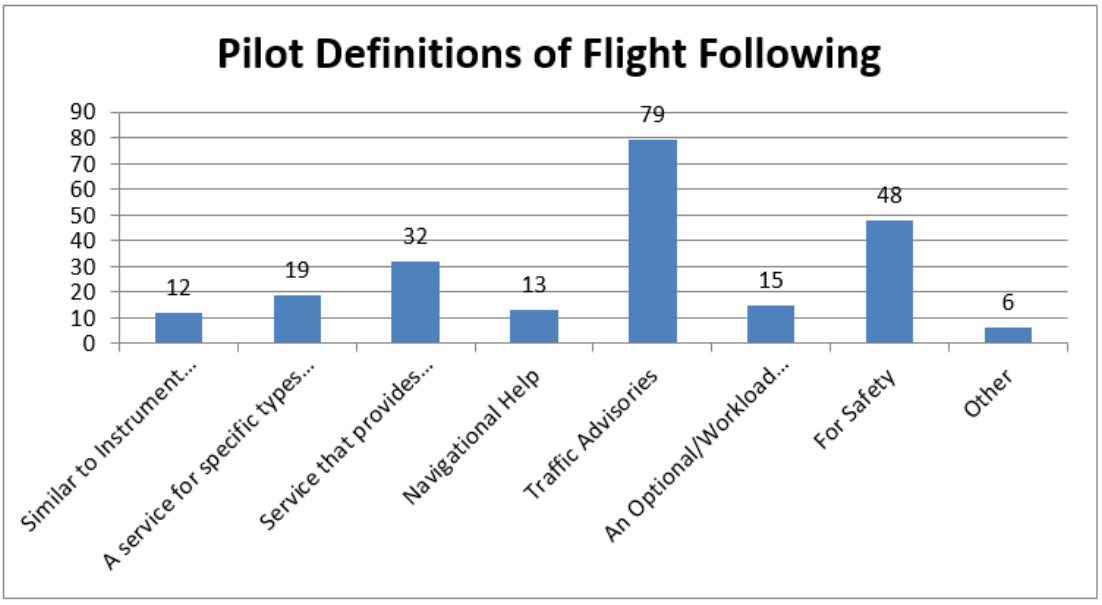


Figure 23. Pilot Definitions of Flight Following

Influences of Flight Following

The second qualitative question asked participants what factors influence their use of flight following; why they use it and why they don't use it. This question was used to get much better idea of why pilots decided to use or not to use flight following. After analyzing each participants' response six categories or themes emerged. These six themes included characteristics of the flight, safety of flight, personal choice/opinion, situational awareness, required/recommended to use it, ability of other technologies and any answers that did not fall into these categories were put in a category labeled "other".

The first category, characteristics of the flight, included a wide range of responses that commented on many different aspects of the flight. Participant responses included characteristics such as type of flight, destination, route, or distance of flight, aircraft characteristics, weather, terrain, airspace complexity and airspace congestion. The second category, safety of flight, included responses referring to traffic advisories, help

for air traffic control or air traffic control watching over their flight, in case of emergency and for search and rescue.

Another category that emerged was personal choice/opinion, which also encompassed a wide range of responses that included statements such as “air traffic control wants to know where I am”, “I usually fly IFR”, “I don’t need it”, “it’s confusing and complicates the flight”, “I’m lazy” and “it adds an extra layer of confidence”. The next category, situational awareness, was comprised of participant responses that mentioned navigational help, as well as additional information including temporary flight restrictions, weather and altimeter settings, sky diving and military airspace. The next category, required/recommended to use it, included responses such as “my company requires that I use it”, “I was taught to use it” and “my school required me to use it”.

The last category, ability of other technologies was comprised of pilots who reported having different technologies on board the aircraft that they feel provide them with the same information that flight following would provide them. The technologies included GPS, T-CAS, electronics with traffic information, other tools, satellite personal tracker, Fore Flight, and on board weather information. Any other responses that did not fit into one of these categories were put into the category “other”. This category included responses such as “prevents loneliness”, “to teach my students how to use it” and “I’m already talking to air traffic control (tower)”.

Eighty participant (N=80) responses fell into the category of characteristics of the flight. Sixty-four participant (N=64) responses reflected that a determining factor for their use of flight following was related to safety of flight. Sixty-two participant (N=62)

responses were grouped into the category of personal choice/opinion. Nineteen participants (N=19) said that a determining factor of their use of flight following is related to situational awareness. Seven participant (N=7) responses fell into the category of required/recommended to use it. Lastly, six participants (N=6) reported that a determining factor of their usage of flight following was the ability of other technologies. There were five participant (N=5) responses that did not fit into any of the categories and are labeled "other".

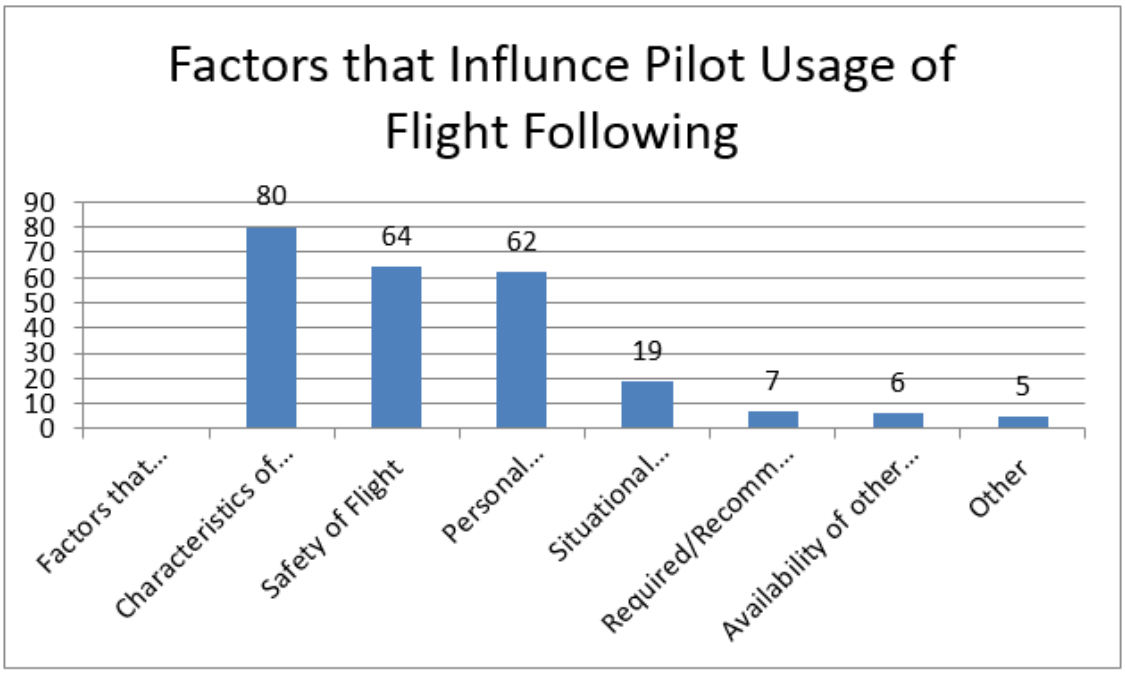


Figure 24. Factors that Influence Pilot Usage of Flight Following

Statistics

Type Airport vs Use of Flight Following

1. Is there a significance between type of airport a pilot is based at or mainly flies out of and use of flight following?

To answer this research question, a one-way ANOVA was used to analyze whether or not there was a significance between the type of airport a pilot is based at or mainly flies out of and use of flight following. Levene's test indicated that the assumption of homogeneity of variance had been violated ($F(2,102) = 3.422$, $p < .05$). The results showed that there was a significance between the type of airport a pilot is based at or mainly flies out of and use of flight following ($F(2, 102) = 23.146$, $P < .001$, $\omega^2 = .17$). The effect size was small. Games-Howell post hoc tests revealed significance between all groups ($p < .001$ for all tests), except between Uncontrolled Paved and Uncontrolled Other Airports.

Table 6. Type Airport vs. Use of Flight Following – Descriptives

How often do you request flight following?

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Towered	55	3.93	1.034	.139	3.65	4.21	1	5
Uncontrolled Paved	33	2.79	1.244	.217	2.35	3.23	1	5
Uncontrolled Other	17	2.12	.857	.208	1.68	2.56	1	4
Total	105	3.28	1.290	.126	3.03	3.53	1	5

Table 7. Type Airport vs. Use of Flight Following - Test of Homogeneity of Variances

How often do you request flight following?

Levene Statistic	df1	df2	Sig.
3.422	2	102	.036

Table 8. Type Airport vs. Use of Flight Following - ANOVA

How often do you request flight following?

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	54.002	2	27.001	23.146	.000
Within Groups	118.989	102	1.167		
Total	172.990	104			

Table 9. Type Airport vs. Use of Flight Following - Multiple Comparisons

Dependent Variable: How often do you request flight following?

	(I) What type of airport are you based at or mainly fly out of?	(J) What type of airport are you based at or mainly fly out of?	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Hochberg	Towered	Uncontrolled Paved	1.139*	.238	.000	.56	1.72
		Uncontrolled Other	1.810*	.300	.000	1.08	2.54
	Uncontrolled Paved	Towered	-1.139*	.238	.000	-1.72	-.56
		Uncontrolled Other	.670	.322	.115	-.11	1.45
	Uncontrolled Other	Towered	-1.810*	.300	.000	-2.54	-1.08
		Uncontrolled Paved	-.670	.322	.115	-1.45	.11
Games-Howell	Towered	Uncontrolled Paved	1.139*	.258	.000	.52	1.76
		Uncontrolled Other	1.810*	.250	.000	1.19	2.43
	Uncontrolled Paved	Towered	-1.139*	.258	.000	-1.76	-.52
		Uncontrolled Other	.670	.300	.077	-.06	1.40
	Uncontrolled Other	Towered	-1.810*	.250	.000	-2.43	-1.19
		Uncontrolled Paved	-.670	.300	.077	-1.40	.06

*. The mean difference is significant at the 0.05 level.

Understanding Air Traffic Control System vs Use of Flight Following

2. Is there a significance between a pilot's perception of their understanding of the Air Traffic Control System and use of flight following?

To answer this research question, a one-way ANOVA was used to analyze whether or not there was a significance between a pilot's perception of their understanding of the air traffic control system and their use of flight following. Levene's test indicated that the assumption of homogeneity of variance had not been violated ($F(2,102) = .289$, $p > .05$). The results showed that there was a significance between a pilot's perception of their understanding of the air traffic control system and use of flight following ($F(2, 102) = 5.509$, $P < .05$, $\omega^2 = .04$). The effect size was small. Games-Howell post hoc tests only revealed significance between good and excellent ($p < .05$).

Table 10. Understanding of the Air Traffic Control System vs. Use of Flight Following – Descriptives

How often do you request flight following?

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Poor	10	2.40	1.506	.476	1.32	3.48	1	5
Good	26	2.88	1.143	.224	2.42	3.35	1	5
Excelent	69	3.55	1.231	.148	3.25	3.85	1	5
Total	105	3.28	1.290	.126	3.03	3.53	1	5

Table 11. Understanding of the Air Traffic Control System vs. Use of Flight Following - Test of Homogeneity of Variances

How often do you request flight following?

Levene Statistic	df1	df2	Sig.
.289	2	102	.750

Table 12. Understanding of the Air Traffic Control System vs. Use of Flight Following - ANOVA

How often do you request flight following?

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	16.864	2	8.432	5.509	.005
Within Groups	156.126	102	1.531		
Total	172.990	104			

Table 13. Understanding of the Air Traffic Control System vs. Use of Flight Following - Multiple Comparisons

Dependent Variable: How often do you request flight following?

	(I) In your opinion, how well is your understanding of the Air Traffic Control System?	(J) In your opinion, how well is your understanding of the Air Traffic Control System?	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Hochberg	Poor	Good	-.485	.460	.647	-1.60	.63
		Excelent	-1.151*	.419	.021	-2.17	-.14
	Good	Poor	.485	.460	.647	-.63	1.60
		Excelent	-.666	.285	.062	-1.36	.02
	Excelent	Poor	1.151*	.419	.021	.14	2.17
		Good	.666	.285	.062	-.02	1.36
Games-Howell	Poor	Good	-.485	.526	.637	-1.87	.90
		Excelent	-1.151	.499	.097	-2.50	.20
	Good	Poor	.485	.526	.637	-.90	1.87
		Excelent	-.666*	.269	.043	-1.32	-.02
	Excelent	Poor	1.151	.499	.097	-.20	2.50
		Good	.666*	.269	.043	.02	1.32

*. The mean difference is significant at the 0.05 level.

Age

The first measure that was looked at as a potential factor in pilot usage of flight following was age. A bivariate correlation was used to determine whether or not age was a determining factor of pilot usage of flight following. The bivariate correlation compared the pilot's age to their use of flight following. The data used Pearson's Correlation and used a two-tailed test of significance. There was no significance between age and pilot usage of flight following. The correlation coefficient was -.045 with a significance of .651, meaning there was no correlation between age and pilot usage of flight following r=-.045, p (two-tailed)>.05. The results for this correlation are shown in the tables below.

Table 14. Age vs. Use of Flight Following – Correlations

		Age	How often do you request flight following?
Age	Pearson Correlation	1	-.045
	Sig. (2-tailed)		.651
	N	103	103
How often do you request flight following?	Pearson Correlation	-.045	1
	Sig. (2-tailed)	.651	
	N	103	105

Flight Hours

The second measure that was looked at as a potential factor in pilot usage of flight following was flight hours. A bivariate correlation was used to determine whether or not the number of flight hours a pilot had was a determining factor of pilot usage of flight following. The bivariate correlation compared the pilot's number of flight

hours to their use of flight following. The data used Pearson's Correlation and used a two-tailed test of significance. There was no significance between a pilot's flight hours and pilot usage of flight following. The correlation coefficient was .086 with a significance of .382, meaning there was no correlation between flight hours and pilot usage of flight following r=.086, p (two-tailed)>.05. The results for this correlation are shown in the tables below.

Table 15. Flight Hours vs. Use of Flight Following - Correlations

		How often do you request flight following?	Approximately how many flight hours do you have?
How often do you request flight following?	Pearson Correlation	1	.086
	Sig. (2-tailed)		.382
	N	105	105
Approximately how many flight hours do you have?	Pearson Correlation	.086	1
	Sig. (2-tailed)	.382	
	N	105	105

Ratings

The next measure that was examined as a potential factor in pilot usage of flight following was the ratings that a pilot holds. The ratings were grouped into Private Pilot Certificate/LightSport Certificate, Instrument Rating/Commercial Rating, Certified Flight Instructor/Certified Flight Instructor Instrument, Seaplane Rating and Airline Transport Pilot. An independent t-test was used to determine if a particular rating was a factor in pilot usage of flight following.

Since every pilot interviewed was required to have a Private Pilot Certificate and/or Light Sport Certificate, this group was not analyzed for obvious reasons. The first area to be examined was whether or not having an Instrument Rating and/or Commercial Rating is a factor in pilot usage of flight following. When running a t-test on this data Levene's test showed no significance ($p=.160>.05$) so equal variances are assumed. On average, participants were more likely to use flight following if they had an Instrument Rating and/or Commercial Rating ($M=3.66$, $SE=.137$) than if they did not have an Instrument Rating and/or Commercial Rating ($M=2.61$, $SE=.212$). This difference was significant $t(103)=4.346$, $p<.05$ and represented a medium-sized effect $r=.39$. The results for this t-test are shown in the tables below.

Table 16. Instrument and/or Commercial Rating vs. Use of Flight Following - Group Statistics

	Do you have Instrument and/or Commercial rating?	N	Mean	Std. Deviation	Std. Error Mean
How often do you request flight following?	1	67	3.66	1.122	.137
	2	38	2.61	1.306	.212

Table 17. Instrument and/or Commercial Rating vs. Use of Flight Following - Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
How often do you request flight following?	Equal variances assumed	1.999	.160	4.346	103	.000	1.051	.242	.572	1.531
	Equal variances not assumed			4.167	67.819	.000	1.051	.252	.548	1.555

The second area to be examined was whether or not being a Certified Flight Instructor and/or Certified Flight Instructor Instrument is a factor in pilot usage of flight following. When running a t-test on this data, Levene's test showed no significance ($p=.364>.05$), so equal variances are assumed. On average, participants were more likely to use flight following if they were a Certified Flight Instructor and/or Certified Flight Instructor Instrument ($M=3.43$, $SE=.175$) than if they were not a Certified Flight

Instructor and/or Certified Flight Instructor Instrument (M=3.14, SE=.179). This difference was not significant t(103)=1.134, p>.05 and represented a small-sized effect r=.01. The results for this t-test are shown in the tables below.

Table 18. Certified Flight Instructor and/or Certified Flight Instructor Instrument Rating vs. Use of Flight Following - Group Statistics

	Do you have Certified Flight Instructor and/or Certified Flight / Instructor Instrument rating?	N	Mean	Std. Deviation	Std. Error Mean
How often do you request flight following?	1	49	3.43	1.225	.175
	2	56	3.14	1.341	.179

Table 19. Instrument and/or Commercial Rating vs. Use of Flight Following - Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
How often do you request flight following?	Equal variances assumed	.832	.364	1.134	103	.259	.286	.252	-.214	.785
	Equal variances not assumed			1.141	102.797	.257	.286	.250	-.211	.782

The next area to be examined was whether or not having a Seaplane Rating is a factor in pilot usage of flight following. When running a t-test on this data, Levene's test showed no significance (p=.184 >.05), so equal variances are assumed. On average, participants were less likely to use flight following if they had a Seaplane Rating (M=3.17, SE=.215) than if they did not have a Seaplane Rating (M=3.32, SE=.154). This

difference was not significant t(103)=-.548, p>.05 and represented a small-sized effect r=.05. The results for this t-test are shown in the tables below.

Table 20. Seaplane Rating vs. Use of Flight Following - Group Statistics

	Do you have a Seaplane Rating rating?	N	Mean	Std. Deviation	Std. Error Mean
How often do you request flight following?	1	30	3.17	1.177	.215
	2	75	3.32	1.337	.154

Table 21. Seaplane Rating vs. Use of Flight Following - Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
How often do you request flight following?	Equal variances assumed	1.792	.184	-.548	103	.585	-.153	.280	-.708	.401
	Equal variances not assumed			-.580	60.375	.564	-.153	.265	-.683	.376

The next area to be examined was whether or not being an Airline Transport Pilot is a factor in pilot usage of flight following. When running a t-test on this data, Levene's test showed no significance (p=.229 >.05), so equal variances are assumed. On average, participants were more likely to use flight following if they were an Airline Transport Pilot (M=3.74, SE=.274) than if they were not an Airline Transport Pilot (M=3.17, SE=.140). This difference was not significant t(103)=1.737, p>.05 and represented a small-sized effect r=.17. The results for this t-test are shown in the tables below.

Table 22. ATP Rating vs. Use of Flight Following - Group Statistics

	Do you have an ATP rating?	N	Mean	Std. Deviation	Std. Error Mean
How often do you request flight following?	1	19	3.74	1.195	.274
	2	86	3.17	1.294	.140

Table 23. ATP Rating vs. Use of Flight Following - Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
How often do you request flight following?	Equal variances assumed	1.466	.229	1.737	103	.085	.562	.324	-.080	1.205
	Equal variances not assumed			1.829	28.147	.078	.562	.308	-.067	1.192

Type Aircraft

The next measure that was examined as a potential factor in pilot usage of flight following was the type of aircraft a pilot flies. The aircraft were grouped into Helicopter, Weight-Shift Control, Single-Engine Land and/or Sea and Multi-Engine Land and/or Sea. An independent t-test was used to determine if a particular type of aircraft was a factor in pilot usage of flight following.

The first aircraft type to be examined was Helicopters. When running a t-test on this data, Levene's test showed no significance (p=.219>.05), so equal variances are assumed. There was no significant difference between pilots who flew Helicopters and their use of flight following (M=3.25, SE=.479) and pilots who did not fly Helicopters (M=3.28, SE=.130). This difference was not significant t(103)=-.041, p>.05 and represented a small-sized effect r=.00. The results for this t-test are shown in the tables below.

Table 24. Helicopters vs. Use of Flight Following - Group Statistics

	Do you fly Helicopters?	N	Mean	Std. Deviation	Std. Error Mean
How often do you request flight following?	1	4	3.25	.957	.479
	2	101	3.28	1.305	.130

Table 25. Helicopters vs. Use of Flight Following - Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
How often do you request flight following?	Equal variances assumed	1.532	.219	-.041	103	.967	-.027	.661	-1.338	1.283
	Equal variances not assumed			-.055	3.457	.959	-.027	.496	-1.494	1.440

The second aircraft type to be examined was Weight-Shift Control. When running a t-test on this data, Levene's test showed no significance (p=.193>.05), so equal variances are assumed. On average, participants were less likely to use flight following if they flew Weight-Shift Control (M=2.22, SE=.401) than if they did not fly Weight-Shift Control (M=3.38, SE=.128). This difference was significant t(103)=-.2.636, p<.05 and represented a small-sized effect r=.25. The results for this t-test are shown in the tables below.

Table 26. Weight Shift Control vs. Use of Flight Following - Group Statistics

	Do you fly Weight-Shift control ?	N	Mean	Std. Deviation	Std. Error Mean
How often do you request flight following?	1	9	2.22	1.202	.401
	2	96	3.38	1.259	.128

Table 27. Weight Shift Control vs. Use of Flight Following - Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
How often do you request flight following?	Equal variances assumed	1.716	.193	-2.636	103	.010	-1.153	.437	-2.020	-.286
	Equal variances not assumed			-2.740	9.721	.021	-1.153	.421	-2.094	-.212

The next aircraft type that would be examined was Single-Engine Land and/or Single-Engine Sea. Since all participants interviewed reported that they fly Single-Engine Land and/or Single-Engine Sea this group will not be analyzed for obvious reasons.

The next aircraft type to be examined was Multi-Engine Land and/or Multi-Engine Sea. When running a t-test on this data, Levene's test showed no significance ($p=.278>.05$) so equal variances are assumed. On average, participants were more likely to use flight following if they flew Multi-Engine Land and/or Multi-Engine Sea ($M=3.69$, $SE=.161$) than if they did not fly Multi-Engine Land and/or Multi-Engine Sea ($M=2.87$, $SE=.177$). This difference was significant $t(103)=3.441$, $p<.05$ and represented a medium-sized effect $r=.32$. The results for this t-test are shown in the tables below.

Table 28. Multi-Engine Land and/or Multi-Engine Sea vs. Use of Flight Following - Group Statistics

	Do you fly Multi-Engine Land and/or sea?	N	Mean	Std. Deviation	Std. Error Mean
How often do you request flight following?	1	52	3.69	1.164	.161
	2	53	2.87	1.287	.177

Table 29. Multi-Engine Land and/or Multi-Engine Sea vs. Use of Flight Following - Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
How often do you request flight following?	Equal variances assumed	1.191	.278	3.441	103	.001	.824	.240	.349	1.299
	Equal variances not assumed			3.445	102.332	.001	.824	.239	.350	1.299

Equipment

The next measure that was looked at as a potential factor in pilot usage of flight following was the type of equipment a pilot has in the aircraft he or she normally flies. The different equipment that was looked at was Radio, ADS-B and TACS. An independent t-test was used to determine if a particular piece of equipment in an aircraft was a factor in pilot usage of flight following.

The first piece of equipment to be examined was the Radio. Participants were asked whether the aircraft they normally flew had a radio, did not have a radio or did not have a radio but they used a hand-held. No participants answer that they did not have a radio at all; they either answered "yes they have a radio", or "no, but I use a hand-held". Since there were only two different answers, a t-test was used to analyze this data. When running a t-test on this data, Levene's test showed significance ($p=.003 <.05$), so equal variances are not assumed. On average, participants were more likely to use flight following if they had a radio in the aircraft that they normally fly ($M=3.53$, $SE=.126$) than if they did not have a radio but used a hand-held radio in the aircraft that they normally fly ($M=1.73$, $SE=.153$). This difference was significant $t(36.532)=9.083$, $p<.05$ and represented a large-sized effect $r=.83$. The results for this t-test are shown in the tables below.

Table 30. Radio vs. Use of Flight Following - Group Statistics

	Does the aircraft you normally fly have a radio?	N	Mean	Std. Deviation	Std. Error Mean
How often do you request flight following?	Built in	90	3.53	1.192	.126
	Hand-held	15	1.73	.594	.153

Table 31. Radio vs. Use of Flight Following - Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
How often do you request flight following?	Equal variances assumed	9.527	.003	5.716	103	.000	1.800	.315	1.175	2.425
	Equal variances not assumed			9.083	36.532	.000	1.800	.198	1.398	2.202

The next piece of equipment to be examined was ADS-B. When running a t-test on this data, Levene's test showed no significance ($p=.051 > .05$), so equal variances are assumed. On average, participants were more likely to use flight following if the aircraft they normally fly has ADS-B ($M=3.74$, $SE=.229$) than if the aircraft they normally fly did not have ADS-B ($M=3.15$, $SE=.145$). This difference was not significant $t(103)=1.975$, $p>.05$ and represented a small-sized effect $r=.19$. The results for this t-test are shown in the tables below.

Table 32. ADS-B vs. Use of Flight Following - Group Statistics

	Does the aircraft you normally fly have ADS-B?	N	Mean	Std. Deviation	Std. Error Mean
How often do you request flight following?	1	23	3.74	1.096	.229
	2	82	3.15	1.316	.145

Table 33. ADS-B vs. Use of Flight Following - Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
How often do you request flight following?	Equal variances assumed	3.882	.051	1.975	103	.051	.593	.300	-.002	1.188
	Equal variances not assumed			2.189	41.534	.034	.593	.271	.046	1.140

The next piece of equipment that was studied was T-CAS. When running a t-test on this data, Levene's test showed no significance ($p=.187 > .05$), so equal variances are

assumed. On average, participants were more likely to use flight following if the aircraft they normally fly has T-CAS (M=3.74, SE=.207) than if the aircraft they normally fly did not have T-CAS (M=3.08, SE=.151). This difference was not significant t(103)=2.452, p<.05 and represented a small-sized effect r=.23. The results for this t-test are show in the tables below.

Table 34. T-CAS vs. Use of Flight Following - Group Statistics

	Does the aircraft you normally fly have T-CAS?	N	Mean	Std. Deviation	Std. Error Mean
How often do you request flight following?	1	31	3.74	1.154	.207
	2	74	3.08	1.301	.151

Table 35. T-CAS vs. Use of Flight Following - Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
How often do you request flight following?	Equal variances assumed	1.768	.187	2.452	103	.016	.661	.270	.126	1.195
	Equal variances not assumed			2.576	63.101	.012	.661	.257	.148	1.173

Main Purpose of Flight

The next measure that was examined as a potential factor in pilot usage of flight following was a pilot's main purpose of flight. To answer this research question, a one-way ANOVA was used to analyze whether or not there was a significance between a pilot's purpose of flight and use of flight following. Levene's test indicated that the assumption of homogeneity of variance had been violated ($F(3,101) = 3.216$, $p < .05$). The results showed that there was a significance between a pilot's main purpose of flight

and use of flight following ($F(3,101) = 5.645$, $P < .05$, $\omega^2 = .04$). The effect size was small. Games-Howell post hoc tests revealed no significance between any groups except between enjoyment and work ($p < .05$).

Table 36. Main Purpose of Flight vs. Use of Flight Following - Descriptives

How often do you request flight following?

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Enjoyment	65	2.91	1.296	.161	2.59	3.23	1	5
Work	21	4.05	.921	.201	3.63	4.47	2	5
Flight Instruct	16	3.63	1.204	.301	2.98	4.27	1	5
Other	3	4.00	1.000	.577	1.52	6.48	3	5
Total	105	3.28	1.290	.126	3.03	3.53	1	5

Table 37. Main Purpose of Flight vs. Use of Flight Following - Test of Homogeneity of Variances

How often do you request flight following?

Levene Statistic	df1	df2	Sig.
3.216	3	101	.026

Table 38. Main Purpose of Flight vs. Use of Flight Following - ANOVA

How often do you request flight following?

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	24.842	3	8.281	5.645	.001
Within Groups	148.149	101	1.467		
Total	172.990	104			

Table 39. Main Purpose of Flight vs. Use of Flight Following - Multiple Comparisons

Dependent Variable: How often do you request flight following?

	(I) For what purpose do you mainly fly?	(J) For what purpose do you mainly fly?	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Hochberg	Enjoyment	Work	-1.140*	.304	.002	-1.95	-.32
		Flight Instruct	-.717	.338	.197	-1.62	.19
		Other	-1.092	.715	.560	-3.01	.83
	Work	Enjoyment	1.140*	.304	.002	.32	1.95
		Flight Instruct	.423	.402	.874	-.65	1.50
		Other	.048	.748	1.000	-1.96	2.05
	Flight Instruct	Enjoyment	.717	.338	.197	-.19	1.62
		Work	-.423	.402	.874	-1.50	.65
		Other	-.375	.762	.997	-2.42	1.67
	Other	Enjoyment	1.092	.715	.560	-.83	3.01
		Work	-.048	.748	1.000	-2.05	1.96
		Flight Instruct	.375	.762	.997	-1.67	2.42
Games-Howell	Enjoyment	Work	-1.140*	.257	.000	-1.82	-.46
		Flight Instruct	-.717	.341	.181	-1.66	.22
		Other	-1.092	.599	.438	-4.65	2.47
	Work	Enjoyment	1.140*	.257	.000	.46	1.82
		Flight Instruct	.423	.362	.652	-.57	1.41
		Other	.048	.611	1.000	-3.34	3.43
	Flight Instruct	Enjoyment	.717	.341	.181	-.22	1.66
		Work	-.423	.362	.652	-1.41	.57
		Other	-.375	.651	.933	-3.38	2.63
	Other	Enjoyment	1.092	.599	.438	-2.47	4.65
		Work	-.048	.611	1.000	-3.43	3.34
		Flight Instruct	.375	.651	.933	-2.63	3.38

*. The mean difference is significant at the 0.05 level.

CHAPTER IV

DISSCUSION

This study explores pilot usage of flight following and the different factors that may play a role in a pilot's usage of flight following. This chapter presents a discussion of the results that were presented in the previous chapter and concludes with recommendations for future research.

Discussion of Results

Research Question 1

Research question 1: Is there a significance between type of airport a pilot is based at or mainly flies out of and use of flight following?

A one-way ANOVA was used to determine that there was significance between the type of airport a pilot is based at or mainly flies out of and use of flight following at .000 which is < .001 with a small effect size of $\omega^2 = .17$. There was significance between towered airports and both types of uncontrolled airports, but not between uncontrolled paved and uncontrolled other and was confirmed by the Games-Howell post hoc tests. It is important to note that the assumption of homogeneity of variance was violated.

This is interpreted to mean that the type of airport a pilot is based at or mainly flies out of is a factor that influences pilot usage of flight following. Pilots who are based at or mainly fly out of towered airports use flight following, while pilots who are based at or mainly fly out of uncontrolled airports do not.

Research Question 2

Research Question 2: Is there significance between a pilot's perception of their understanding of the Air Traffic Control System and use of flight following?

A one-way ANOVA was used to determine that there was a significance between a pilot's perception of their understanding of the air traffic control system and use of flight following at .005 which is <.01 with a small effect size of $\omega^2 = .04$. There was only significance between poor and excellent. In contrast, the Games-Howell post hoc tests revealed significance only between good and excellent. The results show that pilots who have a better understanding of the air traffic control system feel more comfortable using the system than those who feel their understanding is subpar.

This appears to indicate that as a pilots' perceptions of their understanding of the air traffic control system increase, so does their use of flight following. A pilot's perception of his or her understanding of the air traffic control system is a factor in pilot usage of flight following. Pilots who feel as though their understanding of the air traffic control system is on the poor to good side of a scale of poor, fair, good, very good or excellent, do not use flight following, while those whose understanding is very good or excellent use flight following.

Research Question 3

Research Question 3: What factors influence pilot usage of flight following?

This research question used multiple statistical analyses to look for significance in different factors such as age, flight hours, rating, type aircraft, electronics, purpose of flight, understanding of the air traffic control system and pilot reported reasons.

The first two factors of pilots' usage of flight following that were analyzed were age and flight hours. A correlation was used to test for significance and both resulted in non-significant findings. This appears to indicate that no matter a pilot's age or how many flight hours one has, it does not affect his or her usage of flight following.

The next factor of pilot usage of flight following analyzed was the certificates/ratings a pilot had obtained. A t-test analysis showed that participants were more likely to use flight following if they had an Instrument Rating and/or Commercial Rating than if they did not have an Instrument Rating and/or Commercial Rating. This was significant at .000 which is <.01. This indicates that having an Instrument Rating and/or Commercial Rating is a factor that influences pilot usage of flight following. Pilots with a Commercial Certificate and/or Instrument Rating, request flight following while pilots without a Commercial Certificate and/or Instrument Rating do not request flight following.

The next analysis done was a t-test to look for significance between being a Certified Flight Instructor and/or Certified Flight Instructor Instrument. The analysis showed no significance. While the results were not significant, it did indicate that there was a small trend that pilots are more likely to use flight following if they are a Certified Flight Instructor and/or Certified Flight Instructor Instrument than if they were not a Certified Flight Instructor and/or Certified Flight Instructor Instrument.

The next analysis also used a t-test to test for significance between a pilot having a Seaplane Rating and usage of flight following. This analysis indicated no significance. Although the result was not significant, it does suggest a small trend that pilots are less likely to use flight following if they have a Seaplane Rating than if they did not have a

Seaplane Rating. This indicates that having, or not having a Seaplane Rating is a factor that influences pilot usage of flight following. Pilots with a Seaplane Rating are less likely to use flight following.

The last rating to be analyzed against flight following was an Airline Transport Pilot Certificate. A t-test was used and determined non-significant results. While the results showed no significance, they did indicate a small trend in that pilots were more likely to use flight following if they were an Airline Transport Pilot than if they were not an Airline Transport Pilot. It appears, therefore, that having an Airline Transport Pilot Certificate is a factor that influences pilot usage of flight following. Pilots with an Airline Transport Pilot Certificate use flight following while pilots without an Airline Transport Pilot Certificate do not.

The next possible factor of pilot usage of flight following was the type of aircraft being flown. The different types that were analyzed against pilot usage of flight following were Helicopter, Weight-Shift Control and Multi-Engine.

The first analysis on aircraft type was a t-test to determine whether or not flying a helicopter influenced pilot usage of flight following. The t-test showed no significant difference between pilots who flew helicopters and pilots who did not fly helicopters and their use of flight following. This is interpreted to mean that flying a helicopter is not a factor that influences pilot usage of flight following.

The next analysis was another t-test to determine whether or not flying Weight-Shift Control influenced pilot usage of flight following. The analysis indicates significant results at .010 which is < .05. This appears to indicate that flying Weight

Shift Control is a factor that influences pilot usage of flight following. Pilots who fly Weight-Shift Control aircraft do not use flight following.

The next type of aircraft was Single-Engine Land and/or Single-Engine Sea. Since every participant flew either Single-Engine Land and/or Single-Engine Sea aircraft, there was no way to analyze this data against pilots who did not fly either Single-Engine Land and/or Single-Engine Sea aircraft.

The last analysis was a t-test to determine whether or not flying Multi-Engine aircraft influenced pilot usage of flight following. The t-test was significant at .001 which is < .01. This indicates that flying Multi-Engine Land and/or Multi-Engine Sea aircraft is a factor that influences pilot usage of flight following. Pilots who fly Multi-Engine Land and/or Multi-Engine Sea aircraft use flight following, while pilots who do not fly Multi-Engine Land and/or Multi-Engine Sea aircraft do not use flight following.

The next potential factor of pilot usage of flight following was aircraft equipment including radio, ADS-B and T-CAS. The first analysis of aircraft equipment was a t-test to determine if there was significance between having a radio built into the aircraft or using a hand-held radio and pilot usage of flight following. The results were significant at .000 which is < .001. This indicates that having a built in radio is a factor that influences pilot usage of flight following. Pilots who normally fly aircraft that do not have a radio built in but instead have a hand-held radio do not use flight following.

The second analysis on aircraft equipment was a t-test to determine if there was significance between pilots who normally fly aircraft with ADS-B and pilots who normally fly aircraft without ADS-B. The results were not significant; however, they do indicate a small trend. This indicates that having ADS-B is a factor that influences pilot

usage of flight following. Pilots use flight following if the aircraft they normally fly has ADS-B while pilots who normally fly aircraft without ADS-B do not use flight following.

The last analysis on aircraft equipment was a t-test to determine if there was significance between pilots who normally fly aircraft with T-CAS and pilots who normally fly aircraft without T-CAS. The results were not significant; however, they do indicate a small trend. This implies that having T-CAS is a factor that influences pilot usage of flight following. Pilots use flight following if the aircraft they normally fly has T-CAS and do not use flight following if the aircraft they normally fly does not have T-CAS.

The final possible factor of flight following examined was a pilot's main purpose of flight. A one-way ANOVA was used to determine that there was a significance between a pilot's main purpose of flight and use of flight following at .001 which is <.01 with a small effect size of $\omega^2 = .04$. There was only significance between Enjoyment and Work. The Games-Howell post hoc tests revealed the same results. This significance suggests that the purpose of flight is a factor that influences pilot usage of flight following. Pilots who mainly fly for enjoyment do not use flight following while those who mainly fly for work use flight following.

The last section of this research project was qualitative with the desire to develop a better understanding of the factors that influence flight following. Six themes surfaced from the pilot responses, including characteristics of the flight, safety of flight, personal choice/opinion, situational awareness, required/recommended to use it and ability of other technologies.

Eighty participant (N=80) responses fell into the category of "characteristics of the flight". This category contained a wide range of different flight characteristics that contributed to a pilot's decision as to whether or not to use flight following. Some of the characteristics were positively correlated to pilot usage of flight following, while others were negatively correlated to a pilot's use of flight following. Now that a major factor in pilot usage of flight following has been discovered, further research could be done in this specific area to determine a more specific factor. That knowledge could then be used to educate pilots on how flight following could be helpful for specific flight characteristics.

Sixty four participant (N=64) responses reflected that a determining factor for their use of flight following was related to "safety of flight". This category was unanimously a factor that positively impacted a pilot's use of flight following. This is important because knowing that a majority of pilots feel as though using flight following increases the safety of flight can be used to encourage pilots to use flight following.

Sixty two participant (N=62) responses were grouped into the category of "personal choice/opinion". This category consisted of both positive and negative opinions about why pilots choose to use, or choose not to use, flight following. This is also a category that needs to be further researched to pin-point more specific opinions about flight following. This theme is important because with education, facts and the right approach, a pilot with a negative opinion could be encouraged to use flight following.

Nineteen participants (N=19) said that a determining factor of their use of flight following is related to situational awareness. The majority of these responses were positively related to pilot's usage of flight following. This is another factor that can be

used to encourage pilots to use flight following. Some pilots may not be aware of the services that can enhance situational awareness provided by flight following. If one can educate these pilots on how flight following can be helpful with situational awareness, we might then be able to encourage a pilot's use of flight following.

Seven participant (N=7) responses fell into the category of required/recommended to use it. This category was another category with unanimous positive responses to pilot usage of flight following. These recommendations or requirements seemed to come mainly from flight schools/instructors and companies. This is important because when targeting pilots to encourage use of flight following, a specific target could be flight schools/instructors and companies. One could encourage this group to have polices in place to encourage use of flight following.

Lastly, six participants (N=6) reported that a determining factor of their usage of flight following was the ability of other technologies. These responses were negative toward the use of flight following. This is important when trying to target pilots to encourage use of flight following, because if these pilots are able to be educated on the layers of protection and limitations of technologies, it might be possible to persuade them to use flight following along with other technologies.

Research Question 4

Research Question 4: How do pilots define flight following?

This question used qualitative data in order to get a rough idea of what pilots actually perceive flight following to be. After analyzing each participants' response seven categories or themes surfaced. These seven themes included the similarity of flight following to instrument flight, a service that provides information for situational

awareness, a service for specific types of flights, navigational help, traffic advisories, an optional/workload permitting service and the safety of flight.

This research question was designed to better understand how pilots actually define flight following. Now that it has been determined what pilots actually understand flight following to be, one can use the information to better educate pilots on the services provided in hopes to encourage the use of flight following. One could look at each theme and educate pilots on the truths and myths that emerged from each category. A lot of the responses seem to be opinions or perceptions that could, with education and facts, be changed in order to increase use of flight flowing.

Previous and Future Research

Looking at the previous studies done on help-seeking in relationship to this study on flight following, many of the findings were similar. The results of Ryan, Gheen, and Midgley's (1998) study on why some students avoid seeking help in the classroom concur with the results of this study. Just as goal structure and self-efficacy were found to be factors in help-seeking in the classroom, they were also determined to be factors in pilot usage of flight following. When the specific goal or reason for a flight is enjoyment, the pilot chooses not to seek help from air traffic control by not using flight following. Also, pilots who feel as though their understanding of the Air Traffic Control system is poor, fair, or good, as opposed to very good or excellent, do not request flight following. In this case the current study concurs with Ryan, Gheen, and Midgley's study.

The results of Steinfeldt's (2011) study on the relationship between traditional masculine norms and help-seeking attitudes within the context of football were not able

to be compared to the current study on flight following. This is due to the small number of female participants leaving too small of a sample to make a strong argument. If this study was replicated with a larger number of female participants, one may be able to acquire a similar finding.

When comparing previous studies done on Cockpit-Cabin Communication to the current study on flight following, there are some similarities in the results. In Chute and Wiener's (1995) study on flight attendant and pilot communications, the results concluded that the basic problem lies within different cultures. Having different cultures causes individuals to make different choices or form different opinions about certain things. The current study on flight following determined that one factor in pilot usage of flight following is personal choice or opinion. The personal choices or opinions made by pilots may be due to the different cultures the pilots learned to fly in or currently fly within. This demonstrates that there is a similarity between the two studies and that they concur on the fact that different cultures play a large role in communication.

Chute conducted a study in 2006 to examine certain communications between cabin crew and pilots. The results of this study determined that some barriers to communication between cabin crews and pilots included different cultures, a lack of understanding of the sterile cockpit rule and a lack of training in cockpit-cabin communication. The finding that different cultures play a role in communication is related to the current study's finding that a pilot's choice or opinion is a factor in using flight following. This is related in the same way as Chute and Wiener's (1995) study since they had similar findings. A lack in understanding and training is also related to the results of the current study. A pilot's perception of their understanding of the ATC

system plays a role in pilot usage of flight following, just as understanding and training play a role in pilot and cabin crew communication.

The results of Brown and Rantz's study in 2010 are related to the current study on flight follow in the same way as Chute's and Chute and Wiener's studies. The connection is between the results of different cultures in Brown and Rantz's study and different choices and opinions in the current study. Brown and Rantz also found that a person's understanding of a certain system plays a large role in communications, or lack of communications, just as the current study showed that a pilot's understanding of the ATC system plays a role in whether or not they request flight following.

When examining the results of previous studies on pilot-controller communications and the results of the current study on flight following, there are no connections in the findings. Morrow, Lee and Rodvold (1993), Howard (2008) and Prinzo and Morrow (2002) all had great contributions to this particular field of research and the current study expanded on these studies by looking at different aspects of pilot-controller communications.

It is anticipated that this study will be able to provide a framework for future research in this particular discipline. Since it appears as though there has been no previous research on the specific topic of pilot usage of flight following, this study is a starting point in the collection of data on factors that influence pilot usage of flight following. More research in this area as a whole is recommended. This study is able to guide future research in this particular area of the aviation discipline. Research should be conducted with more participants in a larger geographical location that seeks more in-

depth answers to questions as to the reasons why pilots choose not to use flight following. The study was limited to a select population based upon a geographic location that was within reasonable distance of the researcher. A future study encompassing a larger geographical area is recommended. One final recommendation for future research would be to form a quantitative study from the qualitative responses to get a better understanding why pilots do not use flight following. This would help in determining which pilot group to target in order to encourage use of flight following.

Conclusions

This study has led to many interesting findings about the factors that influence pilot usage of flight following. This study was able to identify certain factors that influence pilot usage of flight following. These factors include type of airport a pilot is based at or mainly flies out of, understanding of the air traffic control system, having a Seaplane Rating, Instrument and/or Commercial Rating, or Airline Transport Pilot Certificate, flying Weight-Shift Control or Multi-Engine aircraft, having ADS-B, TCAS, or a built in radio and purpose of flight. Now that these factors have been discovered, it is much easier to determine which pilots to target when encouraging the use of flight following.

The pilots to be targeted include, 1). pilots who fly out of uncontrolled airports, 2). pilots whose understanding of the air traffic control system is poor to good, 3). pilots who have a Seaplane Rating, 4). pilots who do not have an Instrument and/or Commercial Rating, 5). pilots who do not have an Airline Transport Pilot Certificate, 6). pilots who fly Weight Shift Control, 7). pilots who do not fly Multi-Engine Aircraft, 8). pilots who normally fly aircraft without ADS-B, 9). pilots who normally fly aircraft

without TCAS, 10). pilots who normally fly aircraft without a built in radio, and 11). pilots who mainly fly for enjoyment. Now that we have determined a specific target group, one can now encourage this group of pilots to use flight following. If these pilots used flight following, the NAS would in turn be much safer for all.

This study also discovered categories or themes that emerged from pilot definitions of flight following, as well as factors that influence pilot usage of flight following. The themes that emerged from pilot definitions of flight following included; the similarity of flight following to instrument flight, a service that provides information for situational awareness, a service for specific types of flights, navigational help, traffic advisories, an optional/workload permitting service, and the safety of flight. These categories can be used as a starting point in developing an educational program to encourage pilots to use flight following. Now that we know how pilots define flight following, one can expand upon the truths and correct the myths.

The themes that emerged from factors that influence pilot usage of flight following included; characteristics of the flight, safety of flight, personal choice/opinion, situational awareness, required/recommended to use it, and ability of other technologies. Although these categories do not tell us whether each category or theme has a positive or negative impact on pilot usage of flight following, it does provide a starting point of topics to discuss when trying to educate pilots and encourage the use of flight following.

It appears as though there is a common link between the pilots who do use flight following as opposed to those who do not. This researcher believes that this link revolves around a pilot's familiarity with talking to ATC. Pilots who fly out of uncontrolled

airports are never forced to talk to ATC and are less likely to be familiar with talking on a radio. Pilots whose understanding of the air traffic control system were reported as poor to good are clearly not using the ATC system enough to understand how it works and must not be familiar with the skills necessary to talk to ATC.

Pilots who fly Seaplanes tend to fly low and slow over lakes and usually are not within radio or radar coverage of ATC which leads to an unfamiliarity of talking with ATC. Pilots who do not have an Instrument and/or Commercial Rating are clearly less experienced with talking to ATC than those pilots with an Instrument and/or Commercial Rating due to the fact that when flying IFR one is required to talk to ATC and when flying commercially most companies require their pilots to talk to ATC. Pilots who do not have an Airline Transport Pilot Certificate are also clearly less experienced on the radio and therefore not as familiar with talking to ATC. When flying Weight Shift Control aircraft it is much harder to communicate with ATC because of radio limitations in the aircraft. Radio and radar coverage limitations exist due to the nature of the flights normally being flown at very low altitudes. This leads to Weight Shift Control pilots being less familiar with the skills necessary to talk to ATC. Pilots who fly Multi-Engine Aircraft are more likely to be familiar with the skills necessary to talk to ATC because they usually fly at higher altitudes where flight following is available and have the appropriate equipment to be in contact with ATC. When flying a bigger and faster aircraft one has more of a reason to communicate with ATC and therefore is more likely to be familiar with talking to ATC than a pilot who does not fly a Multi-Engine Aircraft.

Pilots who normally fly aircraft with ADS-B and/or TCAS are probably flying certain aircraft or flying in certain airspace where traffic avoidance is a concern. These

aircraft are usually commercial aircraft that are required to talk to ATC and fly in congested airspace that is normally controlled by ATC. This means that the pilots are probably more likely to be familiar with talking to ATC since they are flying in these types of aircraft or airspace.

Pilots who normally fly aircraft without a built in radio are certainly less familiar with talking to ATC because of the technical difficulties of using a hand help radio and the limitation of battery life that restrict communications. Lastly pilots who mainly fly for enjoyment are normally just out to fly for fun and have a good time. These pilots are more likely to be talking to their passengers and enjoying the flight and therefore have less experience talking with ATC. This causes them to be less familiar with talking with ATC.

Knowing that the common link between all of the factors that influence pilot usage of flight following, means that one can now develop a plan to educate these pilots and get them to be more familiar with talking to ATC. In the opinion of this researcher, once these pilots are reached and encouraged and/or educated to use flight following the NAS will be a safer place. With more pilots talking to ATC, there are no more missing links in the communications between pilots and ATC. More aircraft are then aware of each other which in turn will lead to fewer mid-air collisions.

APPENDIX

Interview Questions

UNIVERSITY OF NORTH DAKOTA

Gender.

- ◯ Male
- ◯ Female

Age.

- ◯ My age is

  [ ]
- ◯ I would prefer not to answer.

Approximately how many flight hours do you have?

[ ]

Do you have Light Sport and/or Private rating?

- ◯ Yes
- ◯ No

Do you have Instrument and/or Commercial rating?

- ◯ Yes
- ◯ No

Do you have Certified Flight Instructor and/or Certified Flight Instructor Instrument rating?

- ◯ Yes
- ◯ No

Do you have a Sea Plane Rating rating?

- ◯ Yes
- ◯ No

Do you have an ATP rating?

- ◯ Yes
- ◯ No

What type of airport are you based at or mainly fly out of? (If the airport is uncontrolled and has a paved runway AND a grass strip or water landing, please select Uncontrolled other.)

- ◯ Towered
- ◯ Uncontrolled Paved
- ◯ Uncontrolled Other (grass strip, seaplane base etc.)

Do you flight Helicopters?

- ◯ Yes
- ◯ No

Do you fly weight shift control?

- ◯ Yes
- ◯ No

Do you fly single engine land and/or sea?

- ◯ Yes
- ◯ No

Do you fly multi engine land and/or sea?

- ◯ Yes
- ◯ No

Does the aircraft you normally fly have a radio?

- ◯ Yes
- ◯ No
- ◯ No, but I use a hand held radio.

Does the aircraft you normally fly have ADS-B?

- ◯ Yes
- ◯ No

Does the aircraft you normally fly have TCAS?

- ◯ Yes
- ◯ No

For what purpose do you mainly fly?

- ◯ Enjoyment
- ◯ Work
- ◯ Flight instruct
- ◯ Other (Please specify)

In your opinion, how well is your understanding of the Air Traffic Control System?

- ◯ Poor
- ◯ Fair
- ◯ Good
- ◯ Very Good
- ◯ Excellent

In your own words define Flight Following.

Have you ever used flight following?

- ◯ Yes
- ◯ No

How often do you request flight following?

- ◯ Never
- ◯ Rarely
- ◯ Sometimes
- ◯ Often

REFERENCES

AOPA. What is general aviation? Retrieved June 7, 2015 from http://www.aopa.org/letsgoflying/ready/steps/whatis.html

AOPA Air Safety Foundation. (2009). Collision Avoidance Strategy and Tactics. *Safety Advisory Operations and Proficiency, No. 4*, 7.

AOPA Air Safety Foundation. (2006). *2006 NALL REPORT accident trends and factors for 2005*. (pg 22)Bruce Landsberge.

AOPA Air Safety Foundation. (2007). *2007 NALL REPORT accident trends and factors for 2006*. (pg 27) Bruce Landsberge.

AOPA Air Safety Foundation. (2008). *2008 NALL REPORT accident trends and factors for 2007*. (pg 28) Bruce Landsberge.

AOPA Air Safety Foundation. (2009). *2009 NALL REPORT accident trends and factors for 2008*. (pg 30) Bruce Landsberge.

AOPA Air Safety Foundation. (2010). *2010 NALL REPORT accident trends and factors for 2009*. (pg 34)Bruce Landsberge.

AOPA Air Safety Foundation. (2011). *2011 NALL REPORT accident trends and factors for 2010*. (pg 42) Bruce Landsberge.

Brown, L. J., & Rantz, W. G. (2010). The efficacy of flight Attendant/Pilot communication in a post-9/11 environment: Viewed from both sides of the fortress door. *International Journal of Applied Aviation Studies, 10*, 228.

Chute, R. D., & Weiner, E. L. (1995). Cockpit-cabin communication: I. A tale of two cultures. *International Journal of Aviation Psychology, 5*(3), 257. Retrieved June 7, 2015from http://ezproxy.library.und.edu/login?url=http://search.ebscohost.com.ezproxy.library.und.edu/login.aspx?direct=true&db=aph&AN=7366491&site=ehost-live&scope=site

Chute, R. D., & Winter, E. L. (1996). Cockpit-cabin communication: II. shall we tell the pilots? *International Journal of Aviation Psychology, 6*(3), 211. Retrieved June 7, 2015 from http://ezproxy.library.und.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=7370202&site=ehost-live&scope=site

Crossman, Ashley. In-Depth Interviews. Retrieved June 7, 2015 from http://sociology.about.com/od/Research-Methods/a/Interviews.htm

Federal Aviation Administration. (2014). Aeronautical Information Manual. AIM.

Federal Aviation Administration. (2014). Federal Aviation Regulations. FAR.

Federal Aviation Administration. (2014). Pilot Controller Glossary. PCG.

Federal Aviation Administration. (April 23, 2010). Mission. Retrieved June 7, 2015 from https://www.faa.gov/about/mission/

Howard, J. W. (2008). "Tower, am I cleared to land?": Problematic communication in aviation discourse. *Human Communication Research, 34*(3), 370-391. doi: 10.1111/j.1468-2958.2008.00325.x

Morrow, D., Lee, A., & Rodvold, M. (1993).Analysis of problems in routine controller-pilot communication. *International Journal of Aviation Psychology, 3*(4), 285. Retrieved June 7, 2015 from http://ezproxy.library.und.edu/login?url=http://search.ebscohost.com.ezproxy.library.und.edu/login.aspx?direct=true&db=aph&AN=7369911&site=ehost-live&scope=site

National Air Traffic Controller Association. *NATCA A history of air traffic control.* Unpublished manuscript. Retrieved June 7, 2015 from http://www.natca.org/ULWSiteResources/natcaweb/Resources/file/Media%20Center/ATCHistory.pdf

Prinzo, O. V., & Morrow, D. G. (2002).Improving Pilot/Air traffic control voice communication in general aviation. *International Journal of Aviation Psychology, 12*(4), 341-357. Retrieved June 7, 2015 from http://ezproxy.library.und.edu/login?url=http://search.ebscohost.com.ezproxy.library.und.edu/login.aspx?direct=true&db=aph&AN=8597182&site=ehost-live&scope=site

Ryan, A. M., Gheen, M. H., & Midgley, C. (1998). Why do some students avoid asking for help? An examination of the interplay among students' academic efficacy, teachers' social–emotional role, and the classroom goal structure. *Journal of Educational Psychology, 90*(3), 528-535. doi: 10.1037/0022-0663.90.3.528

Snow, R. I.VFR Traffic Advisories. Retrieved June 7, 2015 from http://flighttraining.aopa.org/students/crosscountry/articles/2931.html

Steinfeldt, J. A., & Steinfeldt, M. C. (2012).Profile of masculine norms and help-seeking stigma in college football. *Sport, Exercise, and Performance Psychology, 1*(1), 58-71. doi: 10.1037/a0024919