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Editor-in-Chief

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Managing & Consulting Editorial Board of the *Collegiate Aviation Review International*

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No juried publications can excel without the tireless efforts of experts from all aerospace disciplines who volunteer their time to serve as anonymous reviewers. Indeed, the ultimate guarantors of quality and appropriateness of scholarly materials for a professional journal are the knowledge, integrity, and thoroughness of those who serve in this capacity. The thoughtful, careful, and timely work of the Editorial Board and the issue reviewers add substantively to the quality of the journal. On behalf of our Editorial Board, we extend our thanks.

STATEMENT OF OBJECTIVES

The University Aviation Association publishes the Collegiate Aviation Review International throughout each calendar year. Papers published in each volume and issue are selected from submissions that were subjected to a double blind peer review process.

The University Aviation Association is the only professional organization representing all levels of the non-engineering/technology element in collegiate aviation education and research. Working through its officers, trustees, committees, and professional staff, the University Aviation Association plays a vital role in collegiate aviation and in the aerospace industry.

The University Aviation Association accomplishes its goals through a number of objectives:

To encourage and promote the attainment of the highest standards in aviation education at the college level

To provide a means of developing a cadre of aviation experts who make themselves available for such activities as consultation, aviation program evaluation, speaking assignment, and other professional contributions that stimulate and develop aviation education

To furnish an international vehicle for the dissemination of knowledge relative to aviation among institutions of higher learning and governmental and industrial organizations in the aviation/aerospace field

To foster the interchange of information among institutions that offer non-engineering oriented aviation programs including business technology, transportation, and education

To actively support aviation/aerospace oriented teacher education with particular emphasis on the presentation of educational workshops and the development of educational materials covering all disciplines within the aviation and aerospace field

University Aviation Association

Editor's Commentary

The reader is in for a treat with this issue. Our first article by Mehta, Rice, Winter and Buza provides the feedback of 449 participants on the question, how do you think passengers would feel about withstanding an intentional rapid decompression to thwart a would-be terrorist? Is the locked flight deck door enough, or can such extreme measures be added to ways of defeating an attacker. You will find the results of this study interesting. In the second article, by Wallace, Loffi, Ison and Courtney, the authors examine the methods of FAA regulatory compliance over the educational use of Unmanned Aircraft Systems, and leave us with a comparative tool and decision matrix whereby educational institutions can select the compliance method that works best for them. Finally, in the article by Casebolt, Bliss, and Depperschmidt, the authors provide the reader with perceptions of U.S. collegiate flight students, on the impact of Public Law 111-216.

This issue will be the first to migrate from a subscription-based dissemination to an open source dissemination. Scholarly Commons will make available articles published in the *CaRi* to a worldwide audience. Anyone performing keyword searches for articles will find your published article quickly and efficiently. It is my hope that all past issues will be uploaded to this open source system. I want to thank the UAA Board for making this a priority and for supporting this effort.

Todd P. Hubbard, Ed.D

Contents

Featured Research Articles

Cabin Depressurization as a Hijacking Mitigation Tactic: A Consumer Perceptions Study

Rian Mehta
Florida Institute of Technology

Stephen Rice
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Scott R. Winter and Paul Buza
Florida Institute of Technology

Abstract

The security of a commercial airline flight is the primary concern of all parties involved in the aviation industry. The policies and strategies of dealing with terrorist threats have evolved since the attacks of September 11, 2001. The current policy requires that the cockpit door be locked so that the hijackers have no access to the flight controls. A new method has been discussed whereby the pilots depressurize the cabin so as to eliminate the hijacking threat since all the cabin crew and passengers will be rendered unconscious. While there is a risk of possible negative impact on brain cells due to reduced oxygen, medical experts state that the short duration of cabin depressurization in order to mitigate a threat would cause almost no medical harm. 449 participants from the United States completed the study, wherein they were presented with one of two scenarios: a) the traditional scenario of preventing hijackers from accessing the flight controls, and b) an alternative scenario whereby the pilot depressurizes the cabin. The data analysis suggested that participants felt more negatively, and were less willing to fly aboard the cabin depressurization scenario, as compared to the current policy scenario. In addition, it was found the female participants were less willing to fly and felt more negatively about the cabin depressurization scenario as compared to their male counterparts. Lastly, the mediation analyses showed that affect completely mediated the relationship between the pilots' actions and willingness to fly, suggesting that participants were basing their decisions on emotions.

While threats to safety and security have existed in aviation since its inception, they have taken on a new form in the last two decades. The first ever aircraft hijacking took place in 1931. Commercial aviation saw a large spike in hijackings during the 1960s between the United States and Cuba, due to the political war going on between the countries (Holden, 1986). While these incidents were classified as air piracy, they were often for the purposes of either monetary gain or gaining asylum and rarely resulted in any loss of life (Landes, 1978). For this reason, there were no major policy amendments or physical changes to the aviation industry. While these situations were an inconvenience and preferably avoided, they did not generate a mass sense of panic in the aviation authorities or the travelling public. This sentiment has since changed within the aviation industry due to the attacks on September 11, 2001.

While aircraft hijackings had caused fatalities in the past, the landscape of the aviation industry's outlook towards hijackings was changed in 2001. The attacks of September 11, 2001, were a turning point for

aviation. It was the first time a hijacking of an aircraft resulted in said aircraft being used as a weapon of mass destruction (9/11 Commission, 2004). Thousands of people lost their lives in these attacks, which left the industry and the travelling public seemingly afraid to fly suggested by the decrease in air travel. The September–December 2001 period saw a drop in air travel of 20% in the United States, as compared to the corresponding time frame of 2000 (Blunk, Clark, & McGibany, 2006).

Among the wide-sweeping changes that were to follow in aviation the world over were structural upgrades and strategic policies on how to deal with these situations should they arise again. A universal standard that seems to have been adopted by most of the airlines worldwide instructs the pilots to ensure the bulletproof cabin door is locked at all times and disallow entrance to any aggressors. This prevents the hijackers from gaining access to the flight controls (Castella, 2015; Jansen, 2015). This, however, does little by way of protection for the passengers in the cabin. While this method seemed to be the best solution to the problem at the time, some alternative procedures may exist. One alternative course of action could require that the pilot, after donning their oxygen masks, depressurize the cabin, thereby reducing the oxygen content and rendering all people on board—including the hijackers—unconscious.

While this does propose a seemingly more effective means of dealing with a hijacking, this new tactic does include potential side effects caused by oxygen deprivation, which can have potentially dangerous physiological ramifications. Since pilots would only need minutes to divert the aircraft and land, it would minimize the amount of time the passengers are exposed to the lack of oxygen, and would potentially have minimal physiological impact on the passengers' health. Conclusive proof that the effects would be minimal does not exist, as it would be unfeasible to carry out an experiment to test for the same. When landing quickly is not an option, an alternative plan would be to depressurize the cabin, render the hijacker(s) unconscious, and then have one pilot don a portable oxygen mask and restrain the hijacker(s) before they regain consciousness. While these procedures would require new types of training, etc., the purpose of this paper is not to discuss how to implement these procedures, but instead to focus on consumer perceptions of these potential procedures.

Trust

Trust is integral in the commercial setting involving a social aspect, including the trust of a passenger in the safe operation of the flight (Davis, Lee, & Ruhe, 2008). In the setting of the current research study, trust and willingness to fly are being judged on the passengers" perception of the system of cabin depressurization. Trust, however, can be defined in several different forms. Trust is a psychological construct. One such definition of trust that is most apt for the context of this research states that trust is defined in terms of vulnerability, it can be noted that trust lies in the faith of a positive result. Additionally, the trustor believes that the relinquishment of control to another person or object to perform what is expected is in their best interest (Mayer, et. al., 1995).

The relationship of trust and willingness to the actual cabin depressurization system is an important facet to recognize. However, another element of the trust relationship that must be considered is the passengers' trust in the pilot/operator to safely execute the depressurization and conduct the emergency maneuvers to get the plane on the ground as soon as possible to eliminate the threat. Another form of the trust definition states that trust can be explained as the predictability of another person (Deutsch, 1958; Eckel & Wilson, 2004; Ergeneli, Saglam, & Metin, 2007). It is important to note however that trust is an extremely volatile function or construct and one that is deeply rooted in emotion and psychology. Slovic (1993) went as far to suggest that once trust was broken or lost, it was almost impossible to regain.

Gender Differences

The study aims at researching differences between the participants' decisions based on gender. The two different scenarios do not necessarily differ drastically in their level of risk from an aviation expert or medical opinion point of view. However, there may be a perceived increased level of risk for the consumer when dealing with the cabin depressurization scenario. Several research studies have analyzed gender differences, including the differences in their decision-making and their risk assessment (Byrnes, Miller, & Schafer, 1999; Powell & Ansic, 1997; Schubert, Brown, Gysler, & Brachinger, 1999).

A study by Powell and Ansic (1997) showed that females were less risk-seeking than males. These findings were stated to be irrespective of familiarity, costs, framing or ambiguity. The study went on to state that females adopted different strategies to make financial decisions and differed significantly to male counterparts in their risk assessment. A meta-analysis study was conducted on 150 studies analyzing risk-taking tendencies of males and females. The results showed that females indicated as having less risk taking tendencies in 14 out of 16 types of tasks (Byrnes, Miller, & Schafer, 1999). However, an anecdote stated by the study claims that the size of the risk taking differences between the genders reduced with an increase in age of the participants. Schubert, Brown, Gysler, and Brachinger (1999) state that there is evidence to suggest that females are more risk-averse than males in financial decision-making. Additionally, that study suggests that when dealing with people of the same economic status, single women are less risky than single men. With an understanding towards the mindset of female passengers, the research could have several practical implications on the aviation industry. This is important since the aviation industry is fairly male dominated field. While aviation experts are responsible for making decisions and policies, it is important for them to have the perspective of all passengers.

Affect

Hogg, Abrams, and Martin (2010) stated that affect refers primarily to feeling or emotion. Alpert and Rosen (1990) suggested that affect can have several different meanings and interpretations of emotions based on the situation. Similarly, it is important to note that Russell (2003) went on to state that at the heart of emotions are "core affect" states of feeling simply good or bad, and these states can influence reflexes, perception, cognition, and behavior. Emotions are tied into the nature in which human beings make decisions (Schwarz, 2000). Humans oftentimes allow emotions to influence their decisions, and sometime cannot eliminate the emotional factor from the decision-making process (Sayegh, Anthony, & Perrewe, 2004). While emotional decision-making is not bad, emotions do introduce a certain level of variability (Bechara, 2004). In this study, affect was measured by the Likert-type ratings of the participants.

Lewis and Wiegert (1985) stated that interpersonal trust has cognitive and affective foundations. While trust is an important construct in understanding the research, it is possible to consider trust in the form of affect-based trust. Affect-based trust can be considered as one where sincere concern and support leads to emotional ties between individuals (McAllister, 1995). Interpersonal trust involving human-to-human trust can be interpolated to the trust between humans and machines. Similarly, affect-based trust between individuals can be translated to understand the relationship of emotional trust between humans and automation (Hughes, Rice, Trafimow, & Clayton, 2009).

Prior research studies have used affect as the mediator of interest. Mediation analyses have been conducted to determine whether affect is a mediator to consumer perceptions (Babin, & Attaway, 2000; Baker & Cameron, 1996; Campbell, 2007; Rice, Winter, Kraemer, Mehta, & Oyman, in press; Winter, Rice, & Mehta, 2014). In several prior studies, affect has been found to mediate the relationship between the condition and the effect thereby suggesting that emotions were partially responsible for the participants" decisions. This study seeks to utilize this area of research and applies it to a scenario involving the safety of the passengers themselves. The aim of this study is geared toward determining whether affect, or emotion, plays a role in the passengers' decision to accept a cabin depressurization policy of terrorist mitigation.

Current Study

A consumer perception study has not yet been conducted to research how passengers would feel about pilots depressurizing the cabin during a hijacking scenario. This study seeks to fill that gap in the scientific research. Participants were asked to respond to certain questions based on two different methods of dealing with hijackings. Participants provided demographic information and ratings of affect and willingness. Gender differences were also examined. A mediation analysis was employed to examine further the relationship between the pilots' actions and willingness to fly, and how that relationship might be mediated by affect. The hypotheses were as follows:

1. That participants would feel more negatively about the cabin depressurization scenario, and would be less willing to fly in these situations.
2. That there would be differences in affect and willingness ratings based on the participants' gender.
3. That affect would mediate the relationship between the type of procedure and willingness ratings of the participants.

Methods

Participants. Four hundred and forty-nine (176 females) participants from the United States participated in the study. The mean age was 35.96 (*SD* = 10.40). Participants were recruited via Amazon's ® Mechanical Turk ® (MTurk).

Procedure, Materials and Stimuli. The study was conducted using an online instrument developed with FluidSurveys ®. MTurk participants were first asked to fill out a consent form and then given instructions. Following this, participants were presented with information of procedures to deal with terrorist threats on a commercial airline flight. The two different scenarios were: a) the traditional scenario of preventing hijackers from accessing the flight controls, and b) an alternative scenario whereby the pilot depressurizes the cabin. Each group of participants was then asked how the scenario made them feel. Participants responded along three different Likert-type scales from extremely negative, unfavorable, bad (-3) to extremely positive, favorable, good (+3). There was a zero neutral option for each scale.

Following this, participants were asked a series of questions to gauge their willingness to fly in the situations. The study utilized a valid and reliable scale that was created by Rice et al. (2015). The questions for which are attached in Appendix A. Participants responded along a Likert-type scale from strongly disagree (-2) to strongly agree (+2). The mediating variables were presented temporally prior to the outcome variables, in order to avoid reverse causal effects (Kenny, 2011). Lastly, participants were asked for demographics information, debriefed and dismissed.

Design. A two-way between-participants factorial design was employed, where the independent variables were: 1) the type of policy used to deal with the hijacking (current or alternative procedure), and 2) gender of the participant.

Results

A Cronbach's Alpha test was conducted on the affect data to determine the level of internal consistency. The values ranged from .94 to .96. Due to high internal consistency between the scores, the affect data was combined for further analyses. The same was performed for the Willingness data, as the scores ranged from .96 to .98.

A two-way ANOVA was conducted on the affect data, with Type of Procedure, and Gender of the participants as the factors. There was a main effect of Type of Procedure, $F(1,445) = 171.84$, $p < .001$, *partial-eta squared* = .28, and Gender, $F(1,445) = 10.52$, $p < .001$, *partial-eta squared* = .02. There was no significant interaction between Gender and Type of Procedure, $F(1, 455) = 0.481$, $p = .488$, *partial-eta squared* = .001. As Figure 1 suggests, the consumers, in general, felt more negatively about the cabin depressurization situations, while females felt much more negative about these situations as compared to the male participants.

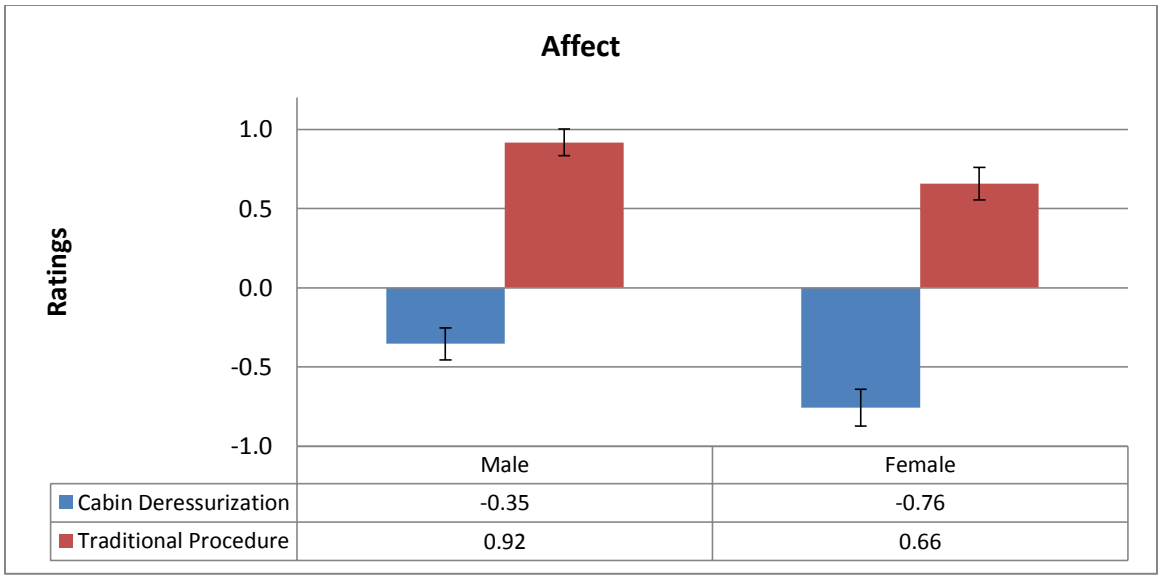

Figure 1. Affect data from the experiment. SE bars are included.

A two-way ANOVA was conducted on the Willingness data, with Type of Procedure and Gender of the participants as the factors. There was a main effect of Type of Procedure $F(1,445) = 92.07$, $p < .001$, *partial-eta squared* = .17, and Gender, $F(1,445) = 14.04$, $p < .001$, *partial-eta squared* = .03. There was no significant interaction between Gender and Type of Procedure, $F(1, 455) = 1.507$, $p = .220$, *partial-eta squared* = .003. As Figure 2 suggests, the consumers, in general, were less willing to fly in the cabin depressurization situations, while females were, in general, less willing to fly in these situations as compared to the male participants.

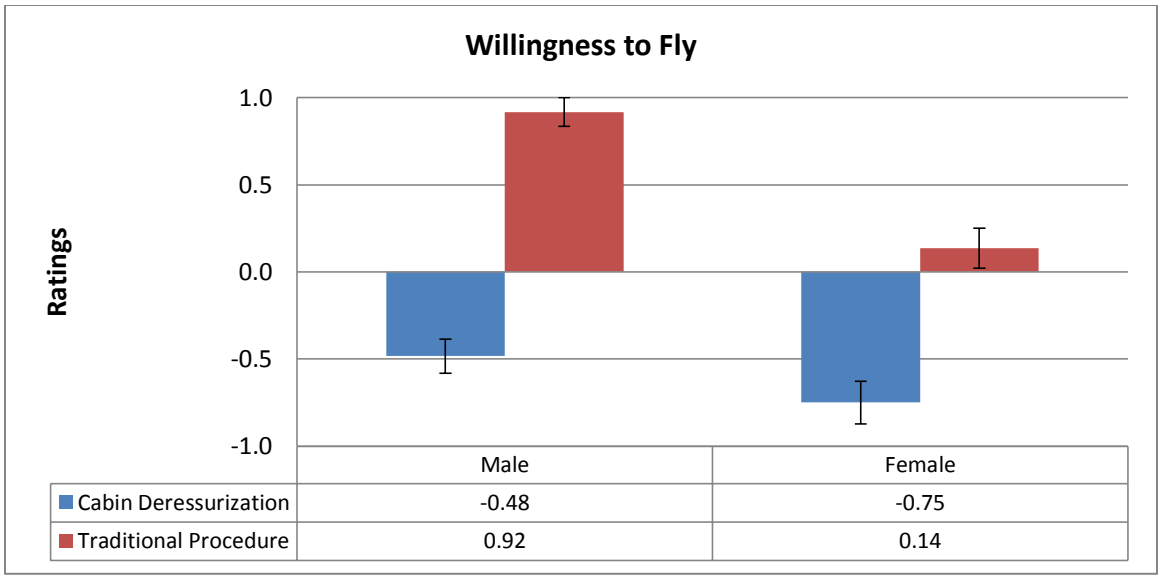

Figure 2. Willingness data from the experiment. SE bars are included.

Mediation Analyses

The mediation analysis was conducted to determine whether affect mediated the relationship between the type of procedure and willingness. The paths for these mediation analyses can be found in A and B in Figure 3.

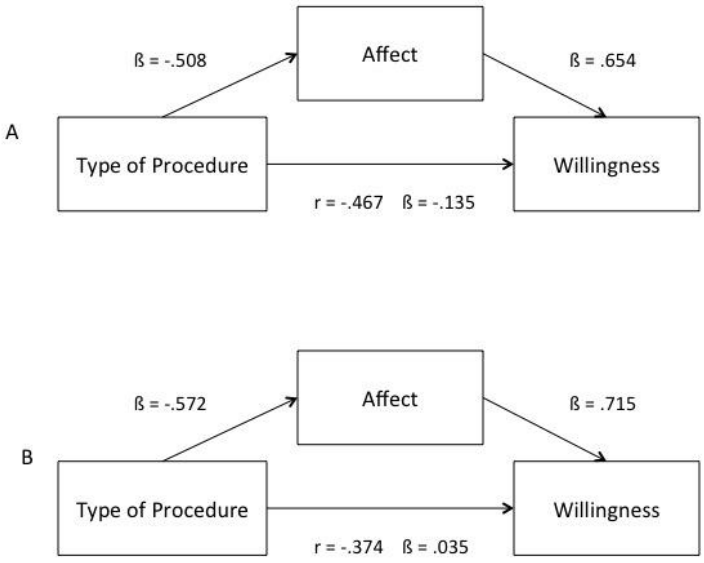

Figure 3. Paths for the mediation analysis

The first mediation analysis was conducted on the male participants. In order to conduct the mediation analysis, the correlation between Type of Procedure and willingness was first found to be significant, $r = -.467$, $p < .001$, showing that the initial variable correlated with the outcome variable. The standardized path coefficients were: Type of Procedure to affect (*Beta* = -.508, $p < .001$); affect to willingness (*Beta* = .654, $p < .001$); Type of Procedure to willingness controlling for affect (*Beta* = -.135; $p = .005$). The second mediation analysis was conducted on the female participants. In order to conduct the mediation analysis, the correlation

between Type of Procedure and willingness was first found to be significant, $r = -.374$, $p < .001$, showing that the initial variable correlated with the outcome variable. The standardized path coefficients were: Type of Procedure to affect (*Beta* = -.572, $p < .001$); affect to willingness (*Beta* = .715, $p < .001$); Type of Procedure to willingness controlling for affect (*Beta* = .035; $p = .6$). These data show that affect had a total mediating effect on the relationship between Type of Procedure and Willingness.

Discussion

One of the goals of the commercial aviation industry is to provide safe air travel. As discussed earlier, the threat of an airliner being hijacked is one of the more serious situations that the industry needs to deal with. The purpose of this study was to compare consumers' willingness to fly on board a flight based on the method of dealing with airline hijackings. The study attempted to understand if consumers would have differing perceptions of the alternative proposed procedure of depressurizing the cabin as compared to the current policies. Additionally, the research conducted a mediation analysis to see if the relationship between the consumer's willingness and the type of policy enacted was mediated by affect.

The first hypothesis stated that the participants would be less willing and feel more negatively about the cabin depressurization scenario. The results of the study supported this prediction. The research suggests that passengers were in fact less willing to fly on board a scenario where the pilot had the authority to depressurize the cabin in the event of a hijacking scenario. Additionally, the data revealed that passengers felt much more negatively about this scenario as compared to the current policy where the pilot is required to lock the cockpit door and deny access to the flight controls. While the alternative policy addresses the issue of the safety of the passengers on board the flight during a hijacking, it does add the possibilities of physiological harm due to decreased oxygen content during a cabin depressurization. There could several possible reasons and explanations for these results. A plausible explanation for the same could suggest that passengers are unwilling due to the fear of potential physiological harm to themselves. Terrorist activity on board an airliner has been a prominent topic and fear since the attacks of 9/11. Passenger trust significantly decreased in commercial air travel as witnessed by the significant decline in air travel after the attacks (Blunk, Clark, & McGibany, 2006). While the belief that the effects of short-term oxygen deprivation are minimal, nothing can be stated for certain. There will always remain a certain level of inherent risk. These findings are interesting as they suggest that passengers may be unwilling to test a new policy/procedure even if it may potentially make commercial airline travel significantly safer. Slimak and Dietz (2006) stated that a greater fear is associated with an unknown situation or risk that one that has been experienced before, and this may part of the explanation as to why passengers are less willing to fly on board in this scenario. The question therefore arises as to whether the risk is worth the benefit. This is one of the more valuable contributions of the research, as it provides the consumers' perspective on the question. The results suggest that the travelling public's opinion on the matter is that the potential benefits are not worth the risks involved.

The second hypothesis predicted that there would be differences in consumer ratings based on the gender of the participant. The results of the study supported the hypothesis. The analysis of gender differences revealed that females were both more negative about the cabin depressurization scenario, and much less willing to fly in that situation. One possible explanation of these differences could be founded in the same context of other studies that suggest that females are less risk-taking in several categories of decision-making (Rice et al., 2014; Winter et al., 2015). As mentioned earlier, while experts may deem there to be no significant increase in risks associated with the cabin depressurization, this may not be the same perception of the consumers.

The last hypothesis stated that affect would mediate the relationship between the types of procedure and willingness ratings of the participants. The mediation analysis supported this prediction, and showed that affect fully mediated the relationship, similar to previous research studies (Babin, & Attaway, 2000; Baker & Cameron, 1996; Campbell, 2007; Rice, Winter, Kraemer, Mehta, & Oyman, in press; Winter, Rice, & Mehta, 2014), between the type of policy/procedure to deal with hijackings and willingness to fly. This finding is

interesting, as it appears that an emotional influence on decision-making is found to be present for the results of the willingness to fly ratings of the participants. In other words, the results suggest that the participants are basing their willingness to fly on their emotions. As mentioned earlier, humans tend to have difficulty removing emotions from their decision making process (Sayegh, Anthony, & Perrewe, 2004; Schwarz, 2000). It is important to understand this facet, as it gives the airline industry an understanding of the mindset of the passengers, and their emotional reactions behind the same.

Limitations

No research is without certain limitations, and this study is no exception. One of the primary limitations of the study is that the participant data was collected using Amazon's ® Mechanical Turk ®. While this source of sample data collection is fairly convenient, it is subject to the normal limitations of collecting data from human participants, and this leads to certain risk exposure related to the data. Certain studies have suggested that MTurk data is as reliable as laboratory data (Buhrmester, Kwang, & Gosling, 2011; Germine et al., 2012). A secondary limitation of the methodology of the study is that while participants are collected using an online survey tool, the study does not prevent people from participating even if they have never been on a passenger on a commercial airline flight. Since this is a consumer perception study, it is important to list this limitation when making generalizable claims since some participants may not truly be commercial airline consumers.

Another layer of consideration that must be paid attention to is that the study compensated participants for the completion of the survey, and this may have had an influence on the mindset of the participant. While dealing with economics, it must be mentioned that financial support and funding were limited for the study. For this reason, the minimum number of participants required was utilized. Lastly, while these results are interesting, they only represent participants from the United States of America. Aviation being a global industry, it is unfair to make generalizable claims to the entire industry, and therefore the entire world based on the findings of this study.

Practical Implications

The results of the research study are of value and interest to the aviation industry, and policy makers specifically. Industry experts have the technical knowledge and understanding of aviation, and so are rightfully tasked with developing and implementing policies and procedures that are the safest and most efficient. Conversely, aviation is a consumer-oriented field, and consumer perceptions are of value and interest as well. Understanding the mindset of the travelling public can be very insightful when making decisions. This study suggests that while the alternative procedure may provide a safer environment for the passengers on board the flight (at least from a security perspective), they are less willing to fly on board the flight in such a scenario. This could be a heavily influencing factor in the aviation industry's final decision to implement the proposed alternative of cabin depressurization during hijackings.

Future Research

This study appears to be the first to understand consumer perceptions on cabin depressurization as a potential means of dealing with hijackings. This research lays a foundation for future research to continue to examine this are of aviation and gain a deeper understanding of the reasons and willingness of passengers to fly on board different scenarios. While the foundation has been laid, this study focuses on only on alternative procedure. If newer, less aggressive alternatives are thought up or developed; future research could use this study as a template to understand consumer willingness to fly on flights using those procedures.

While this research does provide some interesting results, this study only collects data from the United States. In order to get an accurate representation of the global aviation industry, future research should seek to collect data from other countries around the world. Additionally, future research may seek to

collect more demographic data from participants to identify certain predictive characteristics that could affect consumer willingness.

Conclusions

The purpose of this study was to understand the consumers' perception of alternative procedures to dealing with hijackings. While depressurizing a cabin does seem excessive and an aggressive approach, it does have potential to be a means of providing a safer and secure environment for all parties involved. However, the results of the study suggest that passengers are much less willing to fly on board flights employing such a policy, and overall feel much more negatively towards these scenarios. Consumer perceptions are an important part of the consumer-oriented field of aviation, and future studies along this line of research could provide more detailed understandings of the overall mindset of a passenger as it relates to different spheres of commercial air travel.

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Appendix A

Willingness to Fly Scale

(Rice et al., 2015)

"I would be happy to fly in this situation"

Strongly disagree Disagree Neutral Agree Strongly agree

"I would be willing to fly in this situation"

Strongly disagree Disagree Neutral Agree Strongly agree

"I have no fears of flying in this situation"

Strongly disagree Disagree Neutral Agree Strongly agree

"I would be comfortable flying in this situation"

Strongly disagree Disagree Neutral Agree Strongly agree

"I would have no problem flying in this situation"

Strongly disagree Disagree Neutral Agree Strongly agree

"I feel confident flying in this situation"

Strongly disagree Disagree Neutral Agree Strongly agree

"I would feel safe flying in this situation"

Strongly disagree Disagree Neutral Agree Strongly agree

Evaluating Methods of FAA Regulatory Compliance for Educational Use of Unmanned Aircraft Systems (UAS)

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Abstract

Educational institutions on all levels of the educational spectra are interested in integrating unmanned aircraft systems into their curricula; however, complex Federal Aviation Administration (FAA) regulations and potential liability issues may deter some institutions from proceeding. Using document analysis of FAA regulations, legal interpretations, and precedent, the researchers codify and compare the methods by which educational entities can legally comply with the FAA's UAS regulations. This research overviews key issues with each method of compliance, including UAS flown as: a Public Aircraft Operation, under a Public Law 112-95 Section 333 Exemption, for hobby and recreational purposes under Public Law 112-95 Section 336 Model Aircraft Rules, and in compliance with the newly released 14 CFR Part 107 Regulations. The researchers present a recommended decision matrix for educational entities to evaluate their individual operational needs and select the most appropriate method of regulatory compliance for UAS integration. Additionally, the researchers present a proposed framework for an institutional review committee to evaluate and safely implement UAS operations at educational campuses.

As high schools, vocational schools, colleges, universities, and other institutions of higher learning move to integrate unmanned aerial systems into their curriculum, many are quickly discovering that the Federal Aviation Administration (FAA) compliance requirements are quite complex.

Problem

The FAA anticipates that the UAS market will balloon to more than 4.3 million hobbyist platforms and 2.7 million commercial systems by 2020 (Masunaga, 2016). The growth of the UAS industry has not been lost on educational institutions: many are eager to use UAS platforms both for research and in the classroom.

With the FAA's recent release of 14 CFR Part 107 rules, many educational institutions are trying to determine how best to proceed. Attorney Debbie Esterak from Roger Moris & Grover highlights some of the potential pitfalls for educational institutions integrating unmanned aircraft (Marchman, 2016):

> The overarching issue is how school districts can use drones without running afoul of FAA regulations and also without putting themselves at risk for liability concerns…Luckily, the FAA's enforcement strategy is not to fine people right away for infractions, unless the operation is something really egregious. Right now, the FAA is taking an educational role and position. They want to get the word out about safety and security. It is important to be aware; however, that drone use is a federally regulated area and the laws are changing rapidly. Schools and school employees need to be aware that if they venture down the drone path, they do so with their eyes open and knowing the rules of the road. (p. 30, 32)

Purpose

This study sought to examine existing U.S. UAS regulations, case law, precedent, and legal interpretations to codify UAS restrictions as they apply to educational use. The overarching goals of this project are to:

- Consolidate relevant UAS regulatory information from multiple Federal Aviation Administration sources into a singular reference document
- Document available regulatory methods of compliance for educational institutions to conduct UAS operations
- Establish a comparative tool and decision-matrix for educational institutions to select the regulatory method of compliance that best meets their objectives for planned UAS operations

Method

This study utilized a qualitative design, using both document analysis and case study modes of inquiry. The study sought to answer the following research questions:

1. How can educational institutions legally incorporate use of Unmanned Aircraft Systems?
2. What legal or operational conditions or limitations are associated with educational use of Unmanned Aircraft Systems?
3. What legal issues are left unanswered by the FAA's guidance on educational use of UAS?

The study evaluated 50 regulatory references and legal interpretations from the FAA to triangulate relevant information to answer the posed research questions.

Literature Review

Legal use of unmanned aircraft is codified in Sections 331-336 of the FAA Modernization and Reform Act (FMRA) of 2012 (Public Law PL 112-95). These sections outline the establishment of research and development infrastructure, designation of UAS test ranges, execution of UAS integration safety studies, implementation of Arctic UAS operations, and adoption of a planned national UAS integration plan. The six page excerpt further charges the Secretary of Transportation and the Administrator of the Federal Aviation Administration with implementing interim authorization procedures for UAS operations as they apply to public governmental UAS platforms and UAS platforms and operations deemed safe for immediate integration (via Section 333 exemptions). The act also differentiates model aircraft usage from other types of UAS operations and restricts the Federal Aviation Administration from engaging in further regulation of hobby and recreational model aircraft activities.

On June 21, 2016, the FAA released the 14 CFR Part 107, Small UAS Rule. This regulatory addition codifies guidance on the airmen certification, operation, and maintenance of small, low-risk UAS platforms and goes into effect on August 29, 2016.

Methods of Compliance

Currently, there are five methods of compliance by which an individual can legally operate UAS platforms in the United States (FAA, 2015b; FAA, 2016m):

- FMRA Section 334 Public Operation with a Public Aircraft and Certificate of Waiver or Authorization (COA)
- FMRA Section 333 Airworthiness Certification with Certificate of Authorization
- FMRA Section 333 Exemption with Certificate of Authorization
- FMRA Section 336 Model Aircraft Operations (FAA, 2014a)
- 14 CFR Part 107

Public Operations

FMRA Section 334 Public Operation with a Public Aircraft and Certificate of Authorization.

Public Aircraft. According to the Federal Aviation Administration (2014b):

> Although these [public aircraft] operations must continue to comply with certain general operating rules, including those applicable to all aircraft in the National Airspace System (NAS), other civil certification and safety oversight regulations do not apply to these operations. Accordingly, most aspects of PAO [Public Aircraft Operations] are not subject to FAA oversight (p. 1).
>
> The relief from regulatory provisions makes this method of compliance quite convenient for conducting UAS operations, if the entity meets the required eligibility criteria.

The decision matrix for determining Public Aircraft Operations is codified in AC 00-1.1A, p. 12 (FAA, 2014b). A three-pronged test is used to determine if operations qualify as Public Aircraft Operations:

- Aircraft ownership and use
- Crew compliment
- Intended mission

Aircraft Ownership. Federal Public Aircraft Operations must employ aircraft exclusively owned and used by the U.S. government. Similarly, State Public Aircraft Operations must employ aircraft owned [or exclusively leased for 90 consecutive days] and operated by a state entity [including the District of Columbia, U.S. territories, and possessions] (49 CFR 40102a41).

Crew Compliment. Public aircraft flights must not be conducted for commercial purposes and must be manned by either crewmembers or qualified non-crewmembers (49 CFR 40102a41). It is important to note that the term *commercial purpose* is interpreted broadly by the FAA, and forbids reimbursement to government entities for Public Aircraft Operations (FAA, 2014b).

Intended Mission. Only selected government functions are eligible for designation as a public aircraft. Government functions may include [but are not limited to] national defense, intelligence, firefighting, search and rescue, law enforcement, aeronautical research, or geological resource management (14 CFR 1.1-Public Aircraft (1)(ii)).

Certificates of Authorization. "The COA allows an operator to use a defined block of airspace and includes special safety provisions unique to the proposed operation. COAs usually are issues for a specific period – up to two years in many cases" (FAA, 2016h). Certificates of Authorization are limited to specified state or federal public, governmental flight operations, defined as Public Aircraft according to 14 CFR 1.1.

FAA Legal Interpretations of Public Operations. A June 13, 2014 FAA legal interpretation provided to AFS-80 UAS Integration Office Manager James Williams, overviews how the agency interprets various research endeavors under Certificate of Authorization constraints (Bury & Petronis, 2014c). The

agency concedes that public institutions of higher education do indeed qualify as subordinate elements of state government, thereby allowing aircraft meeting the requirements of 49 USC 40102 to be considered public aircraft (Bury & Petronis, 2014c). Additionally, the agency acknowledges that as long as the proposed activities does not exceed the defined scope of *aeronautical research* [emphasis added], which are generally defined as the development of aircraft, capabilities, aircraft systems, or aircraft uses, the operation meets the government function requirement (Bury & Petronis, 2014c). The agency further emphasizes that the results of the proposed research must remain the property of the state, and the flights may not carry equipment or property of another entity (Bury & Petronis, 2014c). Given compliance with the aforementioned provisions and restrictions, the flight may be considered a public aircraft operation (Bury & Petronis, 2014c; Bury, 2014). Perhaps most importantly, as long as the aforementioned provisions are met, the flights may be grant funded (Bury & Petronis, 2014c; Bury, 2014).

In a July 3, 2014 FAA legal interpretation to the UAS Integration Office the FAA also clarified that *education* was not a valid governmental function under 49 USC 40125(a)(2) for the purposes of operating public aircraft (Bury & Petronis, 2014b). A separate July 3, 2014 legal interpretation clarified that while the list of government functions contained in 49 USC 40125(a)(2) was not exhaustive, the agency would evaluate additional proposed government functions on the basis of similarity to those defined in the statute (Bury & Petronis, 2014a).

According to the FAA records, 32 institutions of higher education have been granted Certificates of Authorization (FAA, 2015d).

Civil Operations (Non-Governmental)

FMRA Section 333. FMRA Section 333 was written to provide civil UAS operators a method to receive FAA approval to conduct low-risk operations in the National Airspace System without adhering to all regulatory provisions normally required by manned aircraft under 14 CFR. This provision was designed as a stop-gap measure until the FAA released final UAS rules (FAA, 2016k). Since the FAA's June release of the 14 CFR 107 Small UAS rules, *FMRA Section 333 Exemptions now only apply to UAS platforms weighing more than 55 pounds* [emphasis added] (FAA, 2016b).

UAS operations that do not meet the criteria for public aircraft operations may request to be granted a special exemption to the requirements specified by Section 332 and 334 of the FAA Modernization and Reform Act (FMRA) of 2012 (U.S. House, 2012). This process authorizes the Secretary of Transportation to individually determine if a UAS can safely operate in the National Airspace System (U.S. House, 2012). The FMRA mandates the Secretary of Transportation to assess UAS characteristics and operational factors such as:

- Size, weight, speed, and operational capability
- Proximity to airports and populated areas
- Operation within visual line of sight

Such factors will be weighed against the likelihood of an unmanned aerial system's likelihood to "create a hazard to users of the National Airspace System or the public or pose a threat to National Security" (FMRA Sec 333(b)(1)). FMRA also requires the Secretary of Transportation to determine if a Certificate of Waiver, Authorization, or Airworthiness is required, based on guidance contained in 49 USC 44704. If a UAS is determined to be able to operate safely in the NAS, the Secretary of Transportation will codify requirements for safe operation.

Option 1: FMRA Section 333 Petition for Exemption of Airworthiness (or other 14 CFR requirements). Dorr and Duquette (2015) cite that generally, section 333 applicants request "relief from

airworthiness certification…general flight rules, pilot certification requirements, manuals, and maintenance and equipment mandates" (FAA, 2015c, p. 3). The FAA has a specific process for requesting selective 14 CFR regulatory exemptions, codified in 14 CFR 11.61-11.103. To request exemption from selective 14 CFR provisions, an operator must demonstrate (FAA, n.d.a):

- That the selected regulatory requirement(s) create an undue burden
- The proposed operation can maintain an equivalent level of safety to the proposed rule exemption
- The request is in the public interest

"UAS operators who have obtained an exemption must also obtain a COA before conducting UAS operations" (FAA, 2015b, p. C-3).

Option 2: FMRA Section 333 Airworthiness Certification. Airworthiness Certification for UAS platforms may be required, if determined appropriate by the Secretary of Transportation while conducting an assessment of the UAS operation proposed by the respective 333 exemption request.

If required, UAS platforms must meet the same provisions as manned aircraft, as codified by 49 USC 44704 and 44711 (FAA, 2014c). UAS operators may apply for one of three types of airworthiness certifications:

> *Type Certificate Certification for Special Class Aircraft.* This risk-based certification method is used for aircraft for which airworthiness standards have not been published. The FAA instead applies existing airworthiness requirements [such as those contained in 14 CFR Parts 23, 25, 27, 29, 31, 33, and 35], on an individual basis, as applicable to the type design and aircraft, so as to ensure an equivalent level of safety (14 CFR 21.17b). These aircraft are issued a standard airworthiness certificate in accordance with 14 CFR 21.183.
>
> *Type Certificate Certification for Restricted Category Aircraft.* This airworthiness certification method applies specifically to surplus armed forces, de-militarized UAS aircraft repurposed for civil use, as described in 14 CFR 21.27. Such UAS platforms must have been accepted, serviced, and returned as military surplus in serviceable condition. The process and provisions for issuance of this certificate are contained in FAA order 8110.56A (2008), *Restricted Category Type Certification.* These aircraft are issued a restricted category special airworthiness certificate in accordance with 14 CFR 21.185b.
>
> *Special Airworthiness Certification in the Experimental Category.* This certification method applies only to UAS craft purposed for conducting research and development, crew training, or market surveys, or other purposes as prescribed by 14 CFR 21.191. The process and provisions for issuance of this certificate are codified in FAA Order 8130.34C (2013), *Airworthiness Certification of Unmanned Aircraft Systems and Optionally Piloted Aircraft*. These aircraft are issued an experimental special airworthiness certificate in accordance with 14 CFR 21.191. Carrying property for compensation or hire with an Experimental Category Airworthiness Certificate is prohibited (FAA, 2015a).

"UAS operators who have obtained an airworthiness certificate for their UAS must also obtain a COA before conducting UAS operations" (FAA, 2015b, p. C-3). A COA is also required for UAS operators that have received a FMRA Section 333 Exemption for Airworthiness.

> **Certificate of Authorization requirements.**
> ***Blanket Certificate of Authorization provisions.*** Under the previous approval process, the FAA issued a joint Certificate of Authorization to small UAS operators conducting flights under FMRA Section 333 that authorizes national UAS operation in accordance with the Blanket COA provisions, as established in FAA Form 7711-1, UAS COA: Blanket COA for Any Operator with a valid Section

333 Grant of Exemption (FAA, 2016g; FAA, 2016c). *Blanket Certificates of Authorization for small UAS platforms have been largely replaced by new 14 CFR 107 rules, making this process now defunct.*

Certificates of Authorization for UAS platforms weighing more than 55 pounds. UAS platforms weighing more than 55 lbs are still required to apply for COA authorization under the existing FMRA Section 333 exemption process and are subject to operating rules and requirements "the same or similar to operators flying under the small UAS rule" (FAA, 2016b, p. 1).

Previously issued certificates of authorization. Small UAS flights conducted under a previously-issued COA may still be conducted, provided the COA has not expired (FAA, 2016n). Small UAS operators with a valid Section 333 Exemption were given the following key permissions and restrictions under the Blanket COA (FAA, 2016c):

Permissions

- Applicable only to small Unmanned Aircraft Systems (sUAS) [less than 55 lbs]
- Conduct operations in daytime, VFR conditions
- Altitude must remain at or below 400 feet AGL
- Operations conducted in excess of prescribed distances of the airport reference point of public-use airports, gliderports, or seaports, as published in the Airport Facility Directory and applicable supplements
    - 5 NM from airports with an operational control tower
    - 3 NM from an airport with a published instrument flight procedure (but without a control tower)
    - 2 NM from an airport not having a published instrument flight procedure or operational control tower
    - 2 NM from a heliport

Restrictions

- Requirement for UAS registration
- Requirement for use of visual observers who can monitor the unmanned aircraft and airspace and maintain instantaneous communication with UAS pilot in command
- Restriction from operating Prohibited Areas, Special Flight Rule Areas, the Washington National Capital Region Flight Restricted Zone (FAA, 2016d)
- Remain in compliance with Temporary Flight Restrictions and operational restrictions imposed by Notices to Airmen (NOTAMS)
- Compliance with monthly operations reporting requirements
- Submit reports for UAS incident, accidents, or mishaps that meet specified damage, malfunction, injury, or deviation criteria
- Issuance of a distant NOTAM when conducting UAS operations
- Compliance with operator and equipment requirements, based on airspace class used for UAS operations
- Coordinate and de-conflict operations from Military Training Routes
- Provide advanced notification to affected Air Traffic Control facility (accomplished via NOTAM issuance)
- Conduct communications around airports without an operating control tower in accordance with traffic advisory practices, as prescribed in the FAA Aeronautical Information Manual, 4-1-9

Full Certificate of Authorization application. Operators may submit a subsequent application for a "full" COA, if they want to fly outside the parameters specific by the Blanket COA (FAA, 2016g).

A full COA application is also required if the UAS platform exceeds 55 pounds (FAA, 2016b). COA applications are filed electronically using the FAA's UAS Civil COA Portal (FAA, 2016g). This process "makes applicable Air Traffic Control facilities aware of proposed UAS operations, and provides the FAA the ability to consider airspace issues unique to airspace operations" (FAA, n.d.c, p. 1). The FAA generally processes civil COA applications within 60 business days, but the approval timeline may be affected by the provisions of the request. Applicants are required to agree to several Civil COA UAS Freedom of Information Act (FOIA) declaration and COA declaration statements to process COA requests (FAA, 2015g). Certificates of Authorization are generally valid for up to two years, but may be renewed or extended (FAA, 2015h). *Currently, a full COA is required prior to operating any UAS platform under FMRA Section 333 rules that weighs more than 55 pounds.*

Applicability of other 14 CFR requirements. UAS platforms operating under FMRA 333 exemptions are not exempt from other Title 14 CFR regulatory requirements. Operators must remain in compliance with all applicable 14 CFR requirements, including the following notable provisions (FAA, 2014c):

- UAS Registration: As required by 14 CFR 47
- Identification Markings: In accordance with 14 CFR 45(C)
- Noise Certification: As required by 14 CFR 36 [only if airworthiness certification is required]
- Operator Airmen Certification: As prescribed by 14 CFR 61
- Operator Medical Certificate: As prescribed by 14 CFR 67
- Operator TSA Security Eligibility: as required by 14 CFR 61.18

Model Aircraft Operations

Section 336 Special Rule for Model Aircraft of FAA Modernization and Reform Act of 2012. The final method of compliance is to operate UAS platforms in compliance with the FAA's Special Rule for Model Aircraft Operations, as codified by Section 336 of the FAA Modernization and Reform Act of 2012. In some circumstances, some educational activities can fall under this rule. FMRA provides specific regulatory exemptions for model aircraft operations. Unlike Public Operations and Civil Operations, individuals who operate UAS platforms strictly for hobby and recreational purposes under model aircraft rules and adhere to the FAA's established guidelines do not require agency authorization to fly their platform in the National Airspace System. To qualify as a model aircraft under FMRA, the following criteria must be met (FAA, 2014a):

Definition of Model Aircraft

- Unmanned aircraft is capable of sustained flight through the atmosphere
- Flown within [natural, un-augmented] visual line of sight of the person operating the aircraft
- Flown for hobby and recreational purposes [which specifically exclude commercial operations for compensation or hire, as defined by 14 CFR 1.1]

Operational Limitations of Model Aircraft

- Flown strictly for hobby or recreational use
- Operated in accordance with safety guidelines and within the programming of a nationwide community-based organization [such as the Academy of Model Aeronautics]
- Aircraft is limited to not more than 55 lbs, unless certified through a design, construction, inspection, flight test, and operational safety program administered by a community-based organization
- Operated in a manner that does not interfere with and gives way to any manned aircraft

- When flown within 5 miles [SM] of an airport, the model operator provides the airport operator and air traffic control tower (if applicable) with prior notice of the operation (or adhere to a mutually agreed-upon operating procedure for permanent model aircraft locations)

FAA Legal Interpretations of the Special Rule for Model Aircraft. In a legal interpretation issued by the agency, the FAA clarified that AC 91-57 and the provisions applicable to model aircraft "apply only to modelers, and thus specifically excludes its use by persons or companies for business purposes (72 FR 6690, 2007). The FAA further cites that flights conducted "in furtherance of a business, *or incidental to the business* [emphasis added] would not be a hobby or recreational flight" (FAA, 2014a, p. 10).

In a subsequent policy statement issued on June 18, 2014, the FAA reiterated model aircraft operating guidelines, as presented in Advisory Circular 91-57 (FAA, 1981). Originally issued in 1981, the document specifies model aircraft operators should adhere to the following general guidelines (FAA, 1981; FAA, 2015e):

- Operated at a site away from populated areas and noise-sensitive locations [presumably no longer applicable following release of updated AC 91-57A, September 2, 2015]
- Not operate model aircraft for spectators until the aircraft is tested and deemed airworthy [presumably no longer applicable following release of updated AC 91-57A, September 2, 2015]
- Operated at an altitude not to exceed 400 feet AGL unless operating under a community-based organization's safety guidelines (AMA, 2016b).
- Operations should be coordinated with the airport operator, control tower or Flight Service Station (FSS), when operated within 3 miles of an airport [proximity modified to operations within 5 miles of an airport; removed notification requirement to FSS in release of updated AC 91-57A, September 2, 2015].
- Always give right of way to manned aircraft
- Recommends the use of observers

Applicability of other 14 CFR requirements. Similar to civil UAS operations authorized under a FMRA Section 333 exemption, model aircraft operations are also subject to certain sections of FAA 14 CFR provisions. The FAA breaks these provisions down into three basic categories of limitations:

- Aircraft operations
    - Not operated in a reckless fashion, adhering to 14 CFR 91.13-91.19.
- Airspace restriction adherence
    - Adherence to restrictions of applicable airspace class, Special Use Airspace, Restricted Areas, Prohibited Areas & Special Flight Rules Area (14 CFR 91.126-91.135; FAA, 2016d).
- Special restrictions
    - Adherence to Temporary Flight Restrictions and NOTAMS, as applicable (14 CFR 91.137-91.145; 14 CFR 99.7).

Succinctly, the FAA expects that model aircraft operators will conduct operations that are comparable in risk to manned operations and do not pose an undue hazard to manned aircraft or people or property on the ground. In its interpretation, the FAA indicates that additional situationally-dependent regulatory provisions may apply to model aircraft, depending on the operation.

FAA Legal Interpretations for Educational Use of UAS for Hobby & Recreational Purposes. On May 4, 2016, the FAA issued a legal interpretation regarding the use of UAS platforms for educational use, clarifying the following provisions (Govan & Griffith, 2016):

- Students may conduct model aircraft UAS operations in accordance with FMRA Section 336 in pursuit of aviation education at an accredited educational institution.
- UAS platforms may be operated under FMRA Section 336 model aircraft rules at educational institutions and community-sponsored events, provided the operator is not compensated directly or incidentally related to the operation of the aircraft. The FAA interprets *compensation* broadly to include both tangible and potentially intangible rewards. The FAA does not consider student receipt of financial aid, work-study, or research assistantship payments as compensation for purposes of complying with FMRA Section 336 criteria (p. 4 Note 9).
- Faculty teaching aviation courses, including those directly applicable to UAS operation, at accredited educational institutions may aid students operating model aircraft conducted under FMRA Section 336 rules. The instructor's operation of the model aircraft must be incidental and secondary to the student's operational control of the platform. The FAA states that "de minimus limited instructor participation in student operation of UAS as a part of coursework does not rise to the level of faculty conducting operation outside of the hobby or recreation construct" (p. 5). According to the West Encyclopedia of Law, 2nd Ed, "De Minimis" is a Latin abbreviation meaning "the law cares not for small things" (2008, p. 1). Conversely, the FAA stops short of issuing carpe blanche approval for faculty UAS instruction, citing that the interpretation only applies in situations where UAS operation is secondary to other course objectives. The agency specifically excludes faculty members from applying the FMRA Section 336 model aircraft rules to courses whose primary function is UAS flight instruction.
- Faculty conducting or supervising UAS research flight operations are not considered hobby and recreational use, as defined by FMRA Section 336.

14 CFR 107 Small UAS Rule

Summary of Key Small UAS Regulatory Provisions. The provisions of this regulation codifies existing regulation applicability to 14 CFR (FAA, n.d.b; FAA, 2016f):

- Part 21: Certification for Products & Articles
- Part 43: Maintenance, Preventative Maintenance, Rebuilding & Alteration
- Part 61: Certification: Pilots, Flight Instructors, & Ground Instructors
- Part 91: General Operating & Flight Rules
- Part 101: Moored Balloons, Kites, Amateur Rockets & Unmanned Free Balloons
- Part 107: Small UAS Rule
- Part 119: Certification of Air Carriers & Commercial Operators
- Part 133: Rotorcraft External-Load Operations
- Part 183: Representatives of the Administrator

Implementation of 14 CFR Part 107 provisions takes place in August 2016 (FAA, 2016m). Once implemented, the 14 CFR Part 107 regulations would preempt the need for civil sUAS operators to apply for an FMRA Section 333 exemption and subsequent COA(s), so long as the planned operation conforms to regulatory specifications contained in Part 107. In addition to the regulatory provisions, UAS operators conducting flights under 14 CFR 107 rules can obtain additional information and guidance from FAA Advisory Circular: AC 107-2, Small Unmanned Aircraft Systems (FAA, 2016i).

Table 1.

Overview of Small Unmanned Aircraft rule codified in 14 CFR Part 107 (FAA, 2016j). Public domain document.

Summary of Small Unmanned Aircraft Rule (Part 107)

The following provisions are included in 14 CFR Part 107, Released June 21, 2016:

Operational Limitations	• Unmanned aircraft must weigh less than 55 lbs. (25 kg). • Visual line-of-sight (VLOS) only; the unmanned aircraft must remain within VLOS of the remote pilot in command and the person manipulating the flight controls of the small UAS. Alternatively, the unmanned aircraft must remain within VLOS of the visual observer. • At all times the small unmanned aircraft must remain close enough to the remote pilot in command and the person manipulating the flight controls of the small UAS for those people to be capable of seeing the aircraft with vision unaided by any device other than corrective lenses. • Small unmanned aircraft may not operate over any persons not directly participating in the operation, not under a covered structure, and not inside a covered stationary vehicle. • Daylight-only operations, or civil twilight (30 minutes before official sunrise to 30 minutes after official sunset, local time) with appropriate anti-collision lighting. • Must yield right of way to other aircraft. • May use visual observer (VO) but not required. • First-person view camera cannot satisfy "see-and-avoid" requirement but can be used as long as requirement is satisfied in other ways. • Maximum groundspeed of 100 mph (87 knots). • Maximum altitude of 400 feet above ground level (AGL) or, if higher than 400 feet AGL, remain within 400 feet of a structure. • Minimum weather visibility of 3 miles from control station. • Operations in Class B, C, D and E airspace are allowed with the required ATC permission. • Operations in Class G airspace are allowed without ATC permission. • No person may act as a remote pilot in command or VO for more than one unmanned aircraft operation at one time. • No operations from a moving aircraft. • No operations from a moving vehicle unless the operation is over a sparsely populated area. • No careless or reckless operations. • No carriage of hazardous materials. •

Table 1. continued

Overview of Small Unmanned Aircraft rule codified in 14 CFR Part 107 (FAA, 2016j). Public domain document.

Operational Limitations	• Requires preflight inspection by the remote pilot in command. • A person may not operate a small unmanned aircraft if he or she knows or has reason to know of any physical or mental condition that would interfere with the safe operation of a small UAS. • Foreign-registered small unmanned aircraft are allowed to operate under part 107 if they satisfy the requirements of part 375. • External load operations are allowed if the object being carried by the unmanned aircraft is securely attached and does not adversely affect the flight characteristics or controllability of the aircraft.
	• Transportation of property for compensation or hire allowed provided that- o The aircraft, including its attached systems, payload and cargo weigh less than 55 pounds total; • The flight is conducted within visual line of sight and not from a moving vehicle or aircraft; and • The flight occurs wholly within the bounds of a State and does not involve transport between (1) Hawaii and another place in Hawaii through airspace outside Hawaii; (2) the District of Columbia and another place in the District of Columbia; or (3) a territory or possession of the United States and another place in the same territory or possession. • Most of the restrictions discussed above are waivable if the applicant demonstrates that his or her operation can safely be conducted under the terms of a certificate of waiver.
Remote Pilot in Command Certification and Responsibilities	• Establishes a remote pilot in command position. • A person operating a small UAS must either hold a remote pilot airman certificate with a small UAS rating or be under the direct supervision of a person who does hold a remote pilot certificate (remote pilot in command). • To qualify for a remote pilot certificate, a person must: • Demonstrate aeronautical knowledge by either: o Passing an initial aeronautical knowledge test at an FAA-approved knowledge testing center; or o Hold a part 61 pilot certificate other than student pilot, complete a flight review within the previous 24 months, and complete a small UAS online training course provided by the FAA. o Be vetted by the Transportation Security Administration. o Be at least 16 years old. • Part 61 pilot certificate holders may obtain a temporary remote pilot certificate immediately upon submission of their application for a permanent certificate. Other applicants will obtain a temporary remote pilot certificate upon successful completion of TSA security vetting. The FAA anticipates that it will be able to issue a temporary remote pilot certificate within 10 business days after receiving a completed remote pilot certificate application. • Until international standards are developed, foreign-certificated UAS pilots will be required to obtain an FAA-issued remote pilot certificate with a small UAS rating.

Table 1. continued

Overview of Small Unmanned Aircraft rule codified in 14 CFR Part 107 (FAA, 2016j). Public domain document.

	A remote pilot in command must: • Make available to the FAA, upon request, the small UAS for inspection or testing, and any associated documents/records required to be kept under the rule. • Report to the FAA within 10 days of any operation that results in at least serious injury, loss of consciousness, or property damage of at least $500. • Conduct a preflight inspection, to include specific aircraft and control station systems checks, to ensure the small UAS is in a condition for safe operation. • Ensure that the small unmanned aircraft complies with the existing registration requirements specified in § 91.203(a)(2). A remote pilot in command may deviate from the requirements of this rule in response to an in-flight emergency. •
Aircraft Requirements	• FAA airworthiness certification is not required. However, the remote pilot in command must conduct a preflight check of the small UAS to ensure that it is in a condition for safe operation.
Model Aircraft	• Part 107 does not apply to model aircraft that satisfy all of the criteria specified in section 336 of Public Law 112-95. • • The rule codifies the FAA's enforcement authority in part 101 by prohibiting model aircraft operators from endangering the safety of the NAS.

The content of 14 CFR Part 107 is significant, as this rulemaking substantially changes compliance requirements for small UAS operations. A summary of sUAS provisions are presented in Figure 1. Key notable provisions in the proposed sUAS rule include:

- Indefinite UAS operator certificate, issued to individuals who pass an aeronautical knowledge exam with recurrent testing at 24-month intervals
- No requirement for airworthiness certification
- Liberal operating limitations

Operator Certificate. The UAS remote operator certificate allows operators to perform *both* private and commercial, for-profit functions. The rule does include some notable exceptions such as "air carrier operations, external load and towing operations, international operations, foreign-owned aircraft, public aircraft, model aircraft," and other flying objects covered by 14 CFR Part 101 (FAA, 2016f, p. 43).

The new remote operator certificate can be obtained by individuals at least 16 years old, fluent in English, and physically and mentally able to operate a UAS platform (FAA, 2016a). The primary certification method for issuance of the remote operator certificate is to pass an aeronautical knowledge exam administered by an FAA-approved Knowledge Testing Center (FAA, 2016a). The knowledge exam covers the following key topics (FAA, 2016a, p. 1):

- *Applicable regulations relating to small unmanned aircraft system rating privileges, limitations, and flight operation
- Airspace classification and operating requirements, and flight restrictions affecting small unmanned aircraft operation
- Aviation weather sources and *effects of weather on small unmanned aircraft performance
- *Small unmanned aircraft loading and performance
- *Emergency procedures
- *Crew resource management
- Radio communication procedures
- *Determining the performance of small unmanned aircraft
- Physiological effects of drugs and alcohol
- Aeronautical decision-making and judgment
- Airport operations
- *Maintenance and preflight inspection procedures

Upon completing the exam, the applicant will apply for the remote operator certificate using the FAA's Integrated Airmen Certificate and/or Rating Application System (IACRA)(FAA, 2016a). The Transportation Security Administration will complete a background check on all remote pilot candidates, and with a successful screening, a permanent certificate will be mailed to the applicant (FAA, 2016a).

A truncated process is available to pilot certificate holders who have completed a flight review in the previous 24 months. In lieu of taking an aeronautical knowledge test, certificated pilots will complete an online computer-based training course administered from the FAA Safety Team (FAAST) website, Part 107 small Unmanned Aircraft Systems (ALC-451) (FAA, 2016a). This course covers selected material from the remote pilot aeronautical knowledge exam, as indicated by asterisk-marked topics. An FAA representative or Designated Pilot Examiner, Airmen Certification Representative, or Certified Flight Instructor will validate the applicant's identity, course completion certificate, and flight review currency (FAA, 2016a). A temporary certificate can be issued on the spot, unless the representative is a CFI, otherwise, a permanent certificate will be mailed to the applicant (FAA, 2016a).

Under current FAA guidelines, operators conducting civil UAS flights under a FMRA Part 333 Exemption sUAS are required to possess at an FAA-issued pilot certificate (FAA, 2014c; FAA, 2016e). Public UAS operations do not require the operator to possess an FAA-issued pilot certificate (FAA, 2016e).

Medical Certificate. In lieu of requiring an FAA medical certificate, the FAA is proposing sUAS operators "self-certify, at the time of their airmen application, that they do not have a medical condition that could interfere with the safe operation of a small UAS (FAA, 2015f, p. 115; FAA, 2016f, p. 396).

Conversely, FMRA Section 333 rules require civil operators to possess an FAA-issued Medical Certificate or "valid state driver's license, depending on the type of certificate held" (FAA, 2014c; FAA, 2016e, p. 16-4-1-3(B)(4)). Public UAS operations are exempt from this requirement (FAA, 2016e).

Airworthiness. Current rules require civil UAS operators to either obtain airworthiness certification or alternatively submit an FMRA Section 333 Exemption to the FAA's aircraft airworthiness requirements. Under the FAA's proposed rule, sUAS operators that adhere to Part 107 requirements would be exempt from obtaining airworthiness certification. Instead, operators would be required to ensure that the UAS platform is safe for flight by conducting an appropriate pre-flight inspection (FAA, 2015f; FAA, 2016f). This determination significantly relieves operators of regulatory burden, as the FAA estimates the current

certification process for obtaining a type certificate and standard airworthiness certification requires between 3-5 years (FAA, 2015f).

Operational Restrictions. The FAA's 14 CFR Part 107 operational restrictions to sUAS are largely comparable to FMRA Section 333 Blanket COA, with some notable exceptions:

- Elimination of Visual Observer requirement
- Allowance for operations within controlled airspace in close proximity to airports of all classes
- Imposed maximum airspeed limitations of 100 mph
- New weather visibility requirements of 3 SM

Requesting permission to operate in controlled airspace. Prior to operating in controlled class B, C, D, or E airspace, UAS operators must submit an online request via the FAA's UAS website online portal; operators may not contact air traffic control facilities directly (FAA, 2016n).

Requesting a Waiver to Select 14 CFR 107 Operational Requirements. Operators are able to request a certificate of waiver for certain provisions of 14 CFR Part 107 requirements, as indicated by 14 CFR 107.205 (FAA, 2016i):

- 107.25: Operation from a moving vehicle or aircraft (excluding operations that involve the carriage of property of another by aircraft for compensation or hire)
- 107.29: Daylight operation
- 107.31: Visual line of sight operation (excluding operations that involve the carriage of property of another by aircraft for compensation or hire)
- 107.33: Visual observer
- 107.35: Operation of multiple small unmanned aircraft systems
- 107.37(a): Yielding right of way
- 107.39: Operation over people
- 107.41: Operation in certain airspace
- 107.51: Operating limitations for small unmanned aircraft

Certificates of Waiver must be submitted in accordance with instructions contained on the FAA UAS website, www.faa.gov/uas (FAA, 2016i). If an operator wants to conduct operations in a manner not specifically waivable under 14 CFR 107.205, they will need to proceed through the FMRA Section 333 Exemption process to receive flight approval.

Discussion

For some educational institutions, compliance with the existing regulatory framework for UAS operations may seem complicated. Key issues associated with each UAS regulatory method of compliance are summarized below.

Considerations: FMRA Section 334 Public Operation with a Public Aircraft and Certificate of Authorization.

For public institutions, use of FMRA Section 334 provisions may seem to be an attractive option, since they come with few operational restrictions and relatively limited FAA oversight. As long as the institution and flight purpose meet defined eligibility criteria, this method of compliance is ideal for operational approval of large UAS operations and other operational criteria forbidden by Section 333 or 336

guidance. Since this method of compliance requires issuance of a COA, institutions may need to be proactive in requesting modifications to airspace and operational restrictions, based on evolving needs of their respective public function. Moreover, it is also important to note that COAs are generally approved for a limited two-year period. Institutions must carefully manage COA expiration deadlines and renewal procedures to ensure continued applicability. Continued operations in an expired COA could lead to FAA violations, certificate actions, imposed fines, or other adverse sanctions.

Private educational institutions would generally be ineligible for exercising this method of compliance, since they do not have official status as a recognized state or federal agency. Additionally, designation as a public aircraft operation specifically forbids commercial or for-profit operations, which would also largely disqualify private institutions.

Such authorization would be ideal for public institutions wanting to conduct research in one of the defined government function areas. While the list of recognized government functions is limited in scope, the FAA acknowledges the list is not exhaustive. Such a case could be made for inclusion of other critical government functions, especially if they are closely aligned with designated functions.

It is important to segregate such research from other civil or commercial research projects, as this method of compliance specifically prohibits commercial activities, including carriage of equipment or personnel not directly tied to the approved government function being carried out.

As identified previously, this method of compliance does not limit federal or state government agencies from contracting services for approved governmental functions. In this limited case, the educational institution would not be the actual holder of the Certificate of Authorization (Bury & Petronis, 2014c).

Considerations: FMRA Section 333 Civil Operations

Section 333 Exemptions are usually no longer appropriate for most institutions of higher learning, unless they intend to operate a UAS platform that exceeds the eligibility restrictions to comply with 14 CFR Part 107 rules.

The key benefits of this method of compliance is that all educational institutions are eligible for inclusion. More importantly, a Section 333 Grant of Exemption further allows the educational entity to conduct UAS operations for most commercial or for-profit purposes, as defined by their exemption request. This method also provides an option for relief from complicated and time-consuming airworthiness certification and certain provisions of 14 CFR. For most low-risk operations, the FAA has determined that airworthiness certification is not generally necessary. Additionally, this method of compliance generally enjoys a relatively rapid FAA approval timeline of 60 days, but may take longer based on the complexity of the operational request. Like COAs issued for public aircraft operations, approval is generally granted for a period of up to two years, but can usually be renewed as necessary.

The most notable disadvantage of this method of compliance is the requirement that UAS platforms operated under Section 333 must be operated by certificated airmen holding a valid medical certificate. Many institutions may find this provision unnecessarily restrictive, provided the highly automated features of many commercially-available UAS platforms. Nevertheless, compliance with the restrictions and provisions articulated by the blanket COA requires an individual to have a relatively thorough understanding of aeronautical knowledge, comparable to that of a certificated pilot. This method of compliance generally requires the use of visual observers. Succinctly, the manpower and qualification requirements needed to employ this method of compliance are usually high.

Succinctly, this method of compliance is really only appropriate for organizations that are planning to fly a UAS exceeding 55 pounds or holders of existing FMRA Section 333 exemptions. It is important to note

for existing 333 Exemption holders that the FAA does not permit "mixing" issued COA provisions with 14 CFR 107 requirements. For example, an operator with a valid 14 CFR 107 Remote Operator certificate would not be in compliance with FAA requirements if the COA specified that a Private Pilot Certificate was required. To ensure regulatory compliance, operators must ensure that flights are conducted wholly in accordance with their 333 Grant of Exemption/COA or wholly in compliance with 14 CFR Part 107 regulations.

Considerations: FMRA Section 336 Model Aircraft Operations

The FAA's recent May 4, 2016, legal interpretation of Educational Use of UAS for Hobby and Recreational purposes expanded the use of this method of compliance to specifically include certain educational and demonstration purposes. The provisions contained within the FAA's interpretation significantly reduce the compliance burden for limited-scope instructional use of small UAS platforms. Now, both students and instructors can utilize UAS platforms to augment their classroom training, while remaining in compliance with very generous FMRA Section 336 Model Aircraft rules. Compliance under Model Aircraft rules specifically forbids its application for research purposes, but it can be used for classroom educational purposes.

Under the revised educational use interpretation, instructors can provide *de minimis* instruction and intervention for students using small UAS platforms in advancement of their educational courses. Simultaneously, the FAA excludes UAS flight instruction and presumably other UAS instruction in which UAS flight would be regularly expected and performed. The FAA finds that "de minimis" limited instructor participation in student operation of UAS as part of coursework does not rise to the level of faculty conducting an operation outside of the hobby or recreation construct. Unfortunately, the FAA leaves the definition of "de minimis" up to the mind of the operator. In that, the FAA has neither defined "de minimis" nor addressed its definition in previous cases brought before an Administrative Law Judge or the National Transportation Safety Board. The only glimpse into the FAA's definition is a largely unprecedential case brought before the Administrator of Airports in which the Acting Associate Administrator for Airports indicated that the use of the term "de minimis" is subjective and is determined largely upon a case by case basis (Alaska Airlines et al. v. Los Angeles World Airports et al., 2007). The lack of specific guidance or an objective de minimis compliance test make this provision highly subjective to enforcement. Presumably, institutions should be conservative in their application of UAS operations under this rule, assuming that the FAA will take a similarly conservative stance when determining de minimis instructor participation.

This compliance method does not require airworthiness certification, specified pilot qualification, a medical certificate; nor does it mandate the use of visual observers. While the qualification and manpower requirements for compliance under this method are generous, institutions should carefully consider the level of aeronautical knowledge, training, and experience of instructional staff before conducting operations to ensure that UAS flights are conducted safely and in compliance with the Special Rule for Model Aircraft provisions.

Use of the Special Rule for Model Aircraft requires that participants conform to operating within the safety guidelines and programming of a nationwide community-based organization, such as the Academy of Model Aeronautics. Institutions should review organizational and individual membership requirements, as well as recommended operational and safety practices prescribed by such organizations to remain in compliance with this provision, if operations are conducted under Special Model Aircraft rules.

Operations conducted under Special Model Aircraft rules eases regulatory restrictions on UAS flights conducted in proximity to airports, requiring only prior coordination with airport operators or applicable air traffic control facilities prior to commencing operations.

Importantly, the FAA's interpretation implies this method of compliance is also applicable to commercial or for profit, accredited educational institutions. While the FAA does not specifically define accreditation requirements, they presumably correspond to Department of Education standards. This could seemingly apply to all levels and types of recognized primary, secondary, and post-secondary education or technical training institutions. Notably, private or for-profit institutions were previously forbidden from operating under the Special Model Aircraft rules, due to the existing prohibition on commercial operations. The FAA's release of the May 4, 2016, legal interpretation of Educational Use of UAS for Hobby and Recreational Purposes, provides relief for private, or for-profit institutional academic use of UAS platforms under FMRA Section 336 rules. It is important to highlight that the FAA's interpretation did not rescind its prohibition on commercial use or receipt of compensation for UAS flights, merely articulated that certain academic functions are not considered commercial in nature. While not specifically addressed by the FAA, institutions should be wary of adding UAS lab fees to courses that operate under Section 336 rules, as this approach could be seen with an unkind eye by the FAA to be receiving compensation for UAS flight operations.

It is likely that most institutions will benefit from conducting operations under Special Model Aircraft rules by streamlining and increasing student access to UAS learning opportunities. Institutions should be cautious when implementing UAS into their academic programs; however, as the relatively limited regulatory requirements, knowledge, and training required to operate under this method of compliance could result in operators being ill-prepared or trained to conduct flights safely.

Community Based Organization Programming. One required provision for operating under FMRA Section 336 rules is that the individual must operate their aircraft within the safety guidelines and programming of a nationwide community-based organization, such as the Academy of Model Aeronautics (AMA). The AMA offers several categories of membership applicable to educational UAS including:

Individual Membership. There are several benefits to AMA membership; however, access to the program's liability, accident, and medical coverage programs are the most significant.

Model Aviation Student Club (MASC). The AMA describes MASC as a (AMA, n.d.a):

> Club chartering program for school aeromodelling clubs. MASC gives schools the opportunity to teach aeromodelling curriculum in their school. Some of the membership benefits for MASC include free AMA membership for the faculty sponsor and students, full AMA insurance benefits, scholarship opportunities, and access to the AMA's educational resources. (p. 2)

Student members less than 19 years old are free. The AMA also waives MASC club chartering fees (AMA, n.d.d). MASC clubs are eligible to purchase optional site owners insurance (AMA, n.d.d).

University Model Aviation Student Club (UMASC). The AMA started a similar initiative to MASC for university students in 2015, dubbed UMASC. The AMA describes UMASC as (AMA, n.d.a):

> A club charter program for university students with an interest in model aviation to form a club within their college or university. The faculty sponsor or advisor will receive a free AMA membership and monthly hardcopy of *Model Aviation* magazine. Students will receive AMA membership at a discounted rate, and a monthly digital copy of *Model Aviation* magazine. Students will also be eligible for AMA's scholarship opportunities (p. 2)

Student members of UMASC clubs can purchase $15 discounted, annual memberships (AMA, n.d.e). The club chartering fee is $40, annually (AMA, n.d.e). UMASC clubs are eligible to purchase optional site owners insurance (AMA, n.d.e).

Flying Site Assistance Program. One valuable service offered by the AMA includes a specialist and resources to help new member clubs obtain a flying site. This includes instructions about site selection, planning, organizing, and coordinating with site owners (AMA, 2016a). The AMA also provides recommendations for safety flying rules and operational rules that address topics such as flying times, required permitting, and emergencies (AMA, 2008).

The AMA also offers additional programs to support flight sites, such as the Flying Site Development & Improvement Grant Program, which provides 10% matching funds to site improvements on a competitive application basis (AMA, 2016a). The AMA also furnishes grants to AMA chartered clubs to defray the cost of site cleanup in the event of a natural disaster (AMA, 2016a).

Site Ownership Liability Insurance. The AMA provides the opportunity for site owners, which can include clubs based at educational institutions, to purchase highly affordable liability insurance coverage (AMA, n.d.c):

> The AMA General Liability Insurance Program insuring the AMA, members, and clubs for liability resulting from aeromodelling activities includes a broad and unique coverage for site owners. AMA recognizes the importance of providing site owners with insurance to protect them for potential liability for injury or damage resulting from club activities on a flying site and has negotiated a custom policy with a major insurer to provide such coverage. (p. 1)

Site owner's insurance is issued through Westchester Surplus Lines Insurance Company and provides site owners with up to $2,500,000 of coverage per occurrence with a maximum claim payout of $5,000,000 per site each year (AMA, n.d.c). Site owners are issued certificates of insurance naming them as additional insured parties (AMA, n.d.c). More importantly, site owner's coverage is primary insurance, providing liability protection prior to other site owner policies (AMA, n.d.c). Most importantly, site owner's coverage remains in-force, even if an AMA member or AMA club conducts an activity that voids the club's coverage (AMA, n.d.c). Yearly coverage is issued for $80 or alternatively, date-constrained, single-event coverage can be purchased for $25 (AMA, n.d.b).

In addition to providing valuable safety and operational resources, membership in the AMA provides members and institutions access to very inexpensive liability insurance coverage. It is for this key reason that the authors recommend that whenever possible and appropriate, institutions conduct UAS operations within the membership guidelines and programming of the AMA and in accordance with FMRA Section 336 rules.

Considerations: Small UAS 14 CFR Part 107

Operations under 14 CFR 107 provide institutions with maximum flexibility in which to conduct UAS operations. Remote pilot certification and is relatively simple and easy to obtain for most individuals. Flight restrictions are very generous and should accommodate most educational requirements. Operating under 14 CFR 107 rules largely eliminates the potential consequences for inadvertently conducting illegal commercial operations under FMRA Section 336 rules.

Many institutions will likely prefer to operate under 14 CFR 107 rules, as opposed to continued operations under an existing FMRA Section 333 exemption, due in large part to the simplified operator certification, medical, platform and airworthiness provisions. Moreover, the regulation provides a simple mechanism for requesting an operational waiver for selected 14 CFR 107 provisions.

Succinctly, these proposed provisions offer significant relief from many burdensome 14 CFR provisions that apply to manned aircraft and FMRA Section 333/COA holders. Since pilot certification under 14 CFR 107 does not require a UAS flight evaluation, institutions should be aware of the aeronautical

knowledge, training, and experience of operators to ensure they are adequately prepared to conduct safe flight operations.

Conclusions

How can educational institutions legally incorporate use of Unmanned Aircraft Systems?

This research determined that there are currently five methods for educational institutions to appropriately comply with existing FAA UAS regulations:

- Operation as a Public Aircraft with an approved COA
- Operation under FMRA Section 333 with Airworthiness Certification and a COA
- Operation under FMRA Section 333 with Airworthiness Exemption and a COA
- Operation under FMRA Section 336 Special Rule for Model Aircraft
- Operation in accordance with 14 CFR Part 107

It is expected that the 14 CFR 107 process will largely replace the vast majority of operations currently certified under FMRA Section 333. Only UAS platforms that exceed 55 pounds and those that are not waivable under 14 CFR 107.205 are likely to continue certification under the FMRA Section 333 Exemption Process.

What legal or operational conditions or limitations are associated with educational use of Unmanned Aircraft Systems?

The key legal issues that arise from educational use of UAS include:

- Potential for illegal commercial operation under FMRA Section 336 rules
- Potential for personal or institutional liability (or vicarious liability) for injuries or damage resulting from faculty, staff, or student use of UAS
- Potential for FAA non-compliance/violation, possibly resulting in civil enforcement or operator certificate action

What legal issues are left unanswered by the FAA's guidance on educational use of UAS?

It is clear that existing regulations and legal interpretations leave several unclear lingering legal issues. Foremost is the FAA's "de minimis" requirement for educational use of UAS under FMRA Section 336 rules. The lack of a formal de minimis testing process coupled with the limited interpretation of its applicability to certain courses is likely to lead to wide differences in implementation. Clearly the FAA needs to provide further clarifying guidance in this area.

Recommendations

Decision Matrix

To aid educational administrators in selecting the most appropriate method of compliance under existing FAA rules, the authors have included a summary decision matrix in Figure 1 that codify the most important aspects of each method of compliance.

UAS Institutional Review Board & Steering Committee

The operation of UAS platforms carries the potential for significant legal liability, if not carefully managed. Individual employees could be subjected to substantial lawsuits for personal injury or damage

resulting from UAS operations. Institutions can be subject to vicarious liability for UAS operation conducted by their employees. Vicarious liability is defined as "a legal doctrine that assigns liability for an injury [or damage] to a person who did not cause the injury [or damage] but who has a particular relationship to a person who did act negligently"; one such example of this relationship is between an employer and employee ("Vicarious Liability," n.d., p. 1). The legal theory known as "respondeat superior" opens the door for an employing institution to be vicariously liable for the omissions or negligent acts by instructors or professors acting within the scope of their employment. In other words, an institution could potentially be held liable for the damages caused by an instructor/professor when piloting or using an unmanned aerial system in the classroom. The question within this theory of liability is always whether at the time the employee committed the negligent act or omission the employer had the "right of control" over the employee. Essentially, this asks whether the institution had the authority to direct the conduct of the employee in the performance of the negligent act. The question of whether a principal-agency relationship exists is generally one of fact, a question left for a jury. This liability would likely extend to contingent faculty members, as well, since many institutions employ adjunct faculty members as part-time employees rather than individual contract employees. Moreover, operators could also be subjected to civil penalty or other administrative action from violation of FAA regulations.

As a result, the authors propose that institutions planning to conduct UAS operations establish a Review Board and Steering Committee composed of UAS experts, college administrators, instructors and other applicable parties to formulate policy and guidance for instructor, staff, and student use of UAS. The goal of the committee would be to provide guidance to ensure UAS use is conducted safely, legally, and in a manner that best protects the institution and its members from potential liability.

The authors suggest that such a committee's specific duties may include, but are not limited to:

- Provide expert advice to college administrators in establishing UAS campus use policies
- Develop designated campus UAS operations areas and coordinate with external entities to develop MOU/LOAs with airport operators, air traffic control facilities, and other applicable agencies
- Establish training and flight practice opportunities for college faculty and staff wanting to use UAS platforms in their programs or courses
- Ensure college compliance with UAS registration requirements
- Evaluate department or program requests to use UAS to ensure compliance with 14 CFR 107 or PL 112-95 Section 336 rules.
- Compile and maintain a list of college staff members qualified to operate UAS platforms for educational activities that cannot be conducted under PL 112-95 Section 336 hobby and recreational use rules
- Provide safety and training opportunities for institutional UAS users
- Track institutional and individual Academy of Model Aeronautics memberships, in accordance with PL 112-95 Section 336 requirements
- Ensure compliance with 14 CFR 107 accident reporting requirements
- Promote the benefits and potential uses of UAS in education
- Evaluate risk associated with 14 CFR 107 operational waivers; Assist operators with submitting 14 CFR 107 Certificate of Waiver requests
- Assist in managing compliance with institutional, primary, and supplemental liability insurance requirements for UAS operation

  Institutions with existing FMRA Section 333 Exemptions/COAs or operating under public aircraft rules/COAs may also task the steering committee as follows:

- Assess planned UAS operations to ensure compliance with assigned COA provisions, such as operational restrictions, pilot qualifications, notification requirements, etc.
- Ensure currency of assigned FMRA Section 333 Exemption/COA(s) and facilitate biennial renewals, as required

Additional Research

The authors recommend additional research regarding risk mitigation and liability protection for teachers and institutional operation of UAS platforms. Additional research is also required to codify state or local laws and ordnances that may impact educational use of unmanned aircraft systems.

Disclaimer

Unless otherwise specifically cited, information and commentary throughout the document represent the views opinions and interpretations of the authors alone and may or may not represent those held by the Federal Aviation Administration. Readers should not use information contained in this document in lieu of legal advice from a qualified attorney with knowledge of FAA regulations and existing UAS rules.

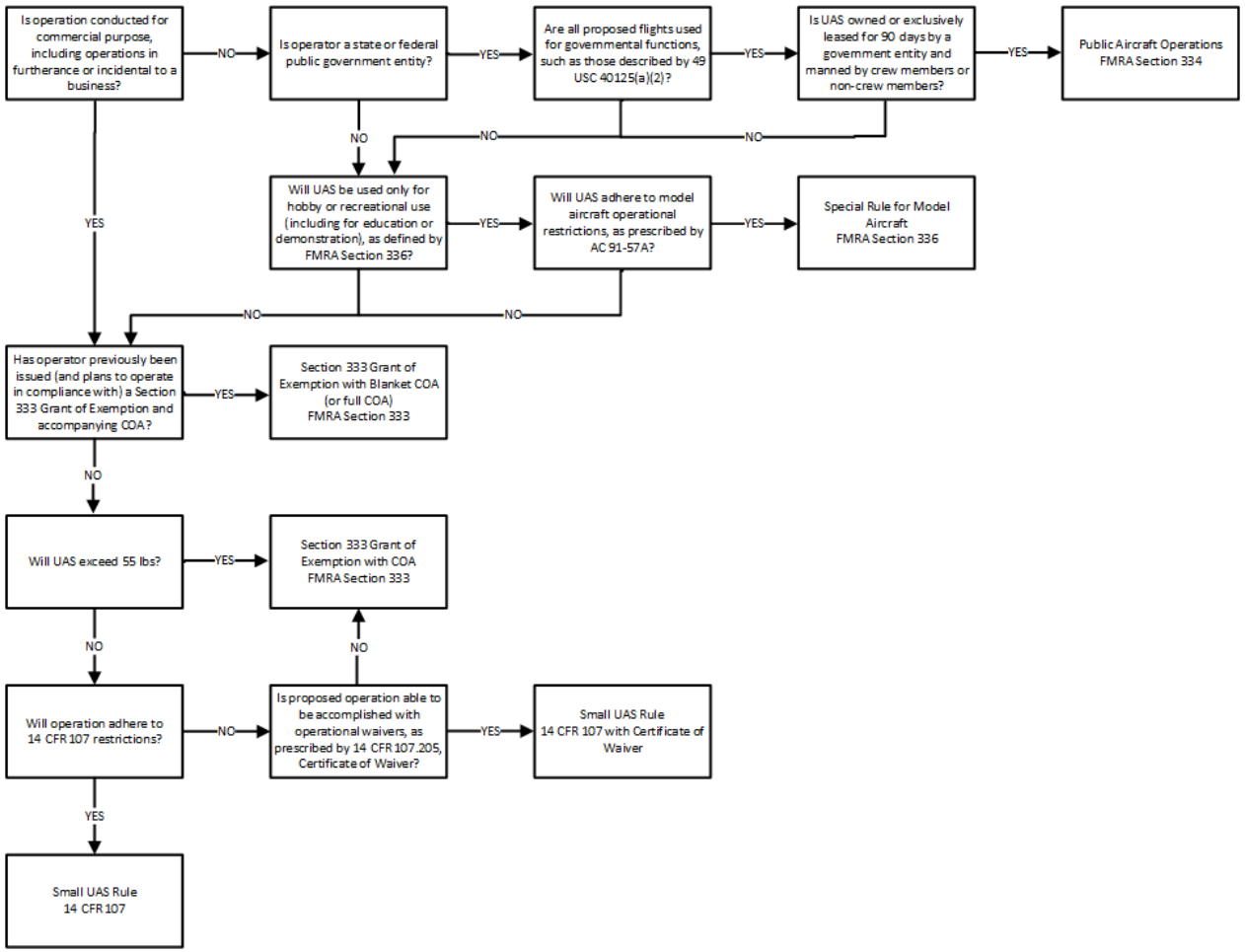

Figure 1. UAS Regulatory Compliance Decision Matrix.

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The Impact of Public Law 111-216: Perceptions of U.S. Collegiate Flight Students

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Abstract

This national research study is the second part of a three-part study examining the perceptions and effects of Public Law 111-216. Part one examined the perceptions of U.S. collegiate flight programs and part three will examine the perceptions of pilots employed with a part 121 U.S. air carrier operator. This research study examined the perceptions of United States collegiate flight students regarding the impact of Public Law 111-216 after its implementation to determine how Public Law 111-216 will affect collegiate flight students and the U.S. airline industry. This study was conducted to determine if a relationship exists between collegiate flight students' perceptions of PL 111-216 and the possible effects it may have on collegiate flight students' desires and ambitions to become U.S. commercial pilots and the U.S airline industry. The findings of this research study impact collegiate flight students, collegiate flight programs, and the U.S. airline industry. This research provides collegiate flight programs and the U.S. airline industry insight into flight students' perceptions of PL 111-216. This insight may help forecast future trends in prospective enrollments and retention rates of current students in collegiate flight programs due to the significant increase of unanticipated flight costs. This study has the potential to also provide a vision of future pilot supply. The findings provide an avenue for collegiate flight programs and the U.S. airline industry to address possible areas of concerns as a result of PL 111-216 changes in pilot qualification standards.

Since the birth of manned powered flight in 1903, aviation related fatalities and crashes are not new throughout the U.S. It is reported that the first national aviation casualty occurred just five short years after the Wright brothers made their historical powered flight in Kittyhawk (The Wright Brothers First Flight 1903, 2003 para. 2).

After the highly publicized crash of Colgan Flight 3407, also referred to as codeshare Continental Flight 3407, U.S. legislators questioned adequate pilot training qualifications and overall aviation safety in the nation. As an outcome of the deadly 2009 crash and a combination of efforts to decrease the associated risks with flight, the Colgan Flight 3407 tragedy triggered a substantial overhaul of airline safety and pilot qualification. This overhaul was particularly impactful to U.S. collegiate flight students by changing pilot qualification standards.

Colgan Flight 3407 crashed five miles from its intended destination airport in Buffalo, New York. The aircraft, a Bombardier Dash-8 Q400, was approaching the destination airport when its speed became too slow and the aircraft stick shaker automatically pushed forward to keep the aircraft from stalling. The captain immediately initiated the wrong reaction and pulled back on the stick, which caused the aircraft to go into a full aerodynamic stall. Unfortunately, due to pilot error, once the aircraft stalled, the aircraft was never

recovered by the captain or first officer and crashed into a New York neighborhood. The two pilots, two flight attendants, and 45 passengers aboard the airplane were killed in the crash. Additionally, one person on the ground was killed and the airplane destroyed on impact by destructive forces and post-crash fire (National Transportation Safety Board, 2010 p. 1).

The crash of Colgan Flight 3407 brought immediate attention to the U.S. airline industry, primarily regarding safety concerns. Garrison (2010) explains that Colgan Flight 3407 crash received an unusual amount of media scrutiny; partly, because of what the National Transportation Safety Board's (NTSB) report revealed about the captain and the first officer. The NTSB revealed the flight failed due to the captain's flight control errors, and also commented on the unique lifestyle of the first officer. Garrison (2010) remarked about the first officer's lifestyle, living in Seattle and traveling a long commute across the country for work; while existing on a salary of a little more than $15,000 a year. Additional information about the captain and first officer of Colgan Flight 3407 also brought scrutiny to the U.S. airline industry regarding the following aviation safety concerns: fatigue due to long pilot commutes, inadequate training in the cockpit, and insufficient government oversight. Colgan Flight 3407 is a fundamental prompt of the massive overhaul of airline safety and pilot qualification that now affects the entire U.S. airline industry including U.S. collegiate flight students.

After the 2009 fatal crash, family members of the victims of Colgan flight 3407 came together creating unity out of tragedy. The victim's family members formed the group called, Families of Continental Flight 3407. This group operates and maintains a website (3407memorial.com) that shares stories from loved ones, pictures, slideshows, recent news, along with other things pertinent to Colgan Flight 3407. Victim's family members, with support from the U.S. Congress, believed that Colgan Flight 3407 and previous U.S. regional airline crashes could have been avoided with improved aviation safety; emphasizing increased pilot qualification standards.

Extensive national media coverage combined with victim's family members uniting, resulted in political pressure being applied to Congressional representatives. The push was for improved airline safety legislation; predominantly by increasing minimum pilot flight hours and requiring Air Transport Pilot (ATP) certification for first officers. It took family members approximately fifteen months, twenty congressional hearings, and more than forty personal visits to Washington, DC, before President Barack Obama signed Public Law 111- 216 (PL 111-216) into law in August 2010 (Families of Continental Flight 3407, 2013).

Statement of the Problem

In 2010, President Barack Obama signed the Airline Safety and Federal Aviation Administration Extension Act of 2010, one of the most comprehensive aviation safety regulations, more commonly referred to as Public Law 111-216 or PL 111-216.

Overall, PL 111-216 outlines numerous requirements in an attempt to improve the safety of the American flying public (Families of Continental Flight 3407, 2013). Specifically, Section 216 changes the qualification requirements for all Part 121 pilots; requiring every Part 121 pilot to hold an Airline Transport Pilot (ATP) certificate. This mandatory requirement was implemented three years after PL 111-216 was signed into law in 2010; becoming effective in August 2013.

Prior to PL 111-216 section 216, Part 121 commercial pilots could possess a commercial pilot license with multi-engine and ratings with significantly fewer flight hours (less than 500 earned flight hours) and still be qualified as a first officer for Part 121 air carriers. Also prior to PL 111-216, pilots operating as first officers, under Part 121 carriers, were not required to have earned an ATP certificate. Therefore, as a result of PL 111-216, all first officers are now required to earn considerable more flight hours and an ATP certificate for employment with a U.S. air carrier. These additional flight hours represent a significant financial expense not previously experienced by collegiate flight students.

Section 217, of PL 111-216, states that an ATP certificate requires a minimum of 1,500 hours of total flight time. However, an exception to these 1,500 hours now exists for collegiate flight students. Students can now earn a restricted-ATP (R-ATP) certificate with only 1,000 hours of total flight time. Even though there is a 500 flight hour reduction from an ATP to a R-ATP. PL 111-216 still requires the collegiate flight student to accumulate several hundred additional flight hours beyond current academic requirements before he/she can sit in the right seat (first officer) of a U.S. air carrier.

Overall, the impact of sections 216 and 217 of PL 111-216 on collegiate flight programs in the U.S. may include: (1) an increase in student flight costs, (2) a decrease in student enrollment and/or student retention issues in collegiate flight programs, (3) a decrease in post-graduate job placements such as first officers, and (4) the increased risk of financial viability of U.S. collegiate flight programs.

A recent published research study (Bjerke and Malott, 2011) concerning PL 111-216 determined that the career progression of aspiring airline pilots could be negatively affected as a result of this new legislation. Other research studies also suggest similar significant concern with PL 111-216. Research by Depperschmidt (2013) found that collegiate aviation training institutions are concerned with increased program and training cost as a result of PL 111-216. Similarly, Depperschmidt, Bliss, and Casebolt (2015) discovered that as a result of the new legislation, collegiate flight students will begin to pursue flight careers (non-US airline or corporate aviation) that are not directly impacted by PL 111-216.

Purpose of the Study

The purpose of this national research study focused on the impact of PL 111-216 on collegiate flight students, after its implementation, by exploring the influence this law has had on collegiate flight student's perceptions. This study demonstrates if a relationship exists between U.S. collegiate student's perceptions of PL 111-216 and the possible effects it will have on collegiate flight students ambitions to continue to become flight professionals. As well as examining collegiate flight students' perceptions, this national research study examined how their perceptions could affect their professional aspirations. Specifically, this study determined the extent to how PL 111-216 will affect collegiate flight students and the U.S. airline industry after implementation. Soliciting the perceptions of collegiate flight student's regarding PL 111-216 could provide insights for addressing problems for U.S. collegiate flight programs, legislators, academicians, regional airline carriers, and the U.S. aviation industry.

Research Questions

In order to achieve the purpose of this study the following research questions were formulated to guide this study:

1. How will Public Law 111-216 affect collegiate flight students?
2. How will Public Law 111-216 affect the U.S. airline industry?

Methodology

To better understand the perceptions of collegiate flight students concerning the effects and challenges associated with PL 111-216, the following research questions were used to guide this study:

1. How will Public Law 111-216 affect collegiate flight students?
2. How will Public Law 111-216 affect the U.S. airline industry?

Selection and Description of the Research Population

To answer the two research questions, this study sought the perceptions of U.S. collegiate flight students of four-year public and private universities located in the U.S. which offered comprehensive aviation curriculums, and awarded a bachelor's degree in professional pilot/flight professional. The four-year universities were also institutional members of the University Aviation Association.

In March 2015, the authors requested participation from 17 universities; all meeting the following requirements created by the author's: (1) institutional membership in the UAA, and (2) four-year public or private university offering a comprehensive aviation curriculum awarding a bachelor's degree in professional pilot/flight.

The flight center managers and/or aviation faculty members employed by these universities were contacted by email asking for their willingness and participation in disseminating the research questionnaire to their collegiate flight students. The initial email sent to the flight center managers and/or aviation faculty members explained the academic and professional importance of the study and included instructions in administering the research questionnaire. To participate, each flight center manager and/or aviation faculty member was asked to reply to the email and send the authors their complete contact information including their name and address as well as the approximate number of collegiate flight students currently enrolled in their flight program. After receiving this information, the authors mailed the research questionnaires and a pre-paid postage return envelope to the flight center manager and/or aviation faculty member. All participating flight center managers and/or aviation faculty members were mailed a packet of stapled research questionnaires to distribute, in person, to their collegiate flight students. After two weeks, the authors sent an email reminding the participating flight center managers and/or aviation faculty members to encourage them to return all completed questionnaires in the provided pre-paid postage envelope to the researcher. Within two months, all research questionnaires were returned and analyzed by the authors. Seven of the seventeen invited universities participated in the study resulting in a 41% overall response rate. From these seven participating universities, a total of 283 collegiate flight students completed the research questionnaire.

Research Questionnaire

The research questionnaire for this study was developed by the authors. The research questionnaire, *The Effect of Public Law 111-216: Perceptions of U.S. Collegiate Flight Students* (Appendix) consisted of three specific sections. The first section of the questionnaire generated demographic information identifying collegiate flight students: logged flight hours, flight ratings and/or certifications, financial resources to pay for flight training costs and college tuition, and career/professional aspirations regarding flight. The second section of the research questionnaire listed a series of Likert-scale statements with ordinal measurement pattern options ranging from: (1) Strongly Disagree, (2) Disagree, (3) Agree, and (4) Strongly Agree. For this study, the authors used a 1-4, forced-response, Likert-Scale. The forced-response Likert-scale does not offer a central or neutral choice and forces the respondents to agree or disagree with the statement (Trochim, 2006). The personal information questions and Likert-scale statements intended to gain meaningful insight into collegiate flight students' perceptions related to PL 111-216. The final section was for participants' personal comments. In this section, participants were provided a blank text box at the end of the research questionnaire to provide personal comments regarding the effect PL 111-216 may have on collegiate flight students and the U.S. airline industry. Permission to conduct this study and solicit this research questionnaire was approved by the Institutional Review Board at Oklahoma State University (approval # ED-15-49).

Limitations of Study

Although this was a national research study, the findings were limited to the volunteer participation of collegiate flight students currently enrolled in a four-year public or private university offering comprehensive aviation curriculums, awarding a bachelor degree in professional pilot/ flight professional;

and holding institutional membership in the University Aviation Association. This research study did not include flight students receiving training from two-year public or private educational institutions, as well as non-collegiate flight programs or military flight training programs. Results of this study reflect the responses of 283 participating respondents who were available and willing to complete the research questionnaire.

The double-barreled statements on the Likert-scale caused some interrelation problems associated with the research questionnaire. A double-barreled statement contains more than one question, yet the respondent only has the option to respond to one of the two questions, and cannot indicate which question is being answered. The respondent could agree with one question but not the other, which makes an overall response more difficult. Although the double-barreled statements on the Likert-scale potentially caused some interrelation problems with the research questionnaire, no participants expressed concern in the personal comments on the research questionnaire.

Statistics and Measures

The Likert-scale statements were analyzed using Cronbach's alpha (α) reliability test to measure internal consistency. To measure internal consistency, Cronbach's α determines how all items on a test are related to all other items and the total test (Gay, Mills, & Airasian, 2006). George and Mallery (2003) established the following Cronbach's α acceptance scale: " ≥ .9 – Excellent; ≥ .8 – Good; ≥ .7 – Acceptable; ≥ .6 – Questionable; ≥ .5 – Poor; and ≥ .5 – Unacceptable" (p. 231). To analyze the results of this study, all data was input into IBM SPSS software.

Findings

Demographics

Participants were asked to identify their total number of flight hours they logged during flight training. Table 1, Collegiate Flight Students Total Logged Flight Hours, indicates that of the N=283, 18% logged 0- 49 flight hours, 16% logged 50-99 flight hours, 28% logged 100-199 flight hours, 20% logged 200-299 flight hours, 10% logged 300-399 flight hours, and 8% logged 400 & over flight hours.

Table 1
Collegiate Flight Students Total Logged Flight Hours

Number of Flight Hours	Percentage of Responses
0-49	18% n=51
50-99	16% n=44
100-199	28% n=80
200-299	20% n=56
300-399	10% n=29
400 & Over	8% n=23

In addition, the research questionnaire asked respondents to identify if they are currently a Certified Flight Instructor (CFI) and logging hours to meet the restricted ATP requirement of 1,000 flight hours. Of the N=283, (n=41) 15% of participants identified that they were Certified Flight Instructors, as indicated in Table 2.

Table 2
Students Identified as Current Certified Flight Instructors

Response Yes or No	Percentage of Responses
Yes	15% n=41
No	85% n=242

The third demographic question asked participants to identify the percentage of their flight costs that are supported by financial aid (student loans) and/or scholarships. Table 3 shows that a majority of respondents (56%) indicated 0-24% of their flight costs are supported by financial aid (student loans) and or scholarships; whereas, 30% answered that 75-100% of their flight costs are supported by financial aid (student loans) and/or scholarships. Only 14% of students indicated that between 25% and 74% of their flight costs were supported by financial aid (student loans) and/or scholarships.

Table 3
Percentage of Flight Cost Support by Financial Aid and/or Scholarships

Percent of Flight Cost Support	Percentage of Responses
0-24%	56% n=157
25-49%	7% n=21
50-74%	7% n=20
75-100%	30% n=85

The last demographic question asked participants to identify their career aspirations regarding flight. Students were given four choices to select from: commercial pilot, military aviator, corporate pilot, and other. Table 4 illustrates participants' career aspirations regarding flight. Over half (65%) of the participants indicated their future career aspiration was to become a commercial pilot. Forty-five (16%) participants responded that their career aspiration was to fly for a corporation, and only eight percent chose the military as a career path. Participants (11%) selecting "Other" identified their career aspiration as the following: missionary pilot, aviation attorney, agriculture pilot, pipeline survey pilot, recreational pilot, or test pilot.

Table 4
Career Aspirations Regarding Flight

Career	Percentage of Responses
Commercial Pilot	65% n=185
Military Aviator	8% n=22
Corporate Pilot	16% n=45
Other	11% n=31

Likert-Scale Statements

The second section of the research questionnaire explored the personal perceptions of each participating collegiate flight student. Fourteen Likert-scale statements requested participants to indicate their perception of each statement by selecting one of four response options: strongly disagree (SD), disagree (D), agree (A), and strongly agree (SA).

Table 5, Collegiate Flight Students' Knowledge and Concern of Public Law 111- 216, presents data obtained from three Likert-scale statements revealing participants' perceptions of: (1) student's knowledge of PL 111-216 and its potential effect on collegiate flight students, (2) student's concern of PL 111-216 as a collegiate flight student and (3) student's perception of financial concern of attaining a minimum of 1,000 flight hours required by PL 111-216.

Table 5
Collegiate Flight Students' Knowledge and Concern of Public Law 111-216

Likert-Scale Statements	SD	D	A	SA
I am knowledgeable of PL 111-216 and its potential effect on collegiate flight students.	24 9%	31 11%	142 50%	86 30%
PL 111-216 is of significant concern to me as a collegiate flight student.	14 5%	27 10%	111 39%	131 46%
Attaining the required 1,000 flight hours specified by PL 111-216 is a significant financial concern to me as a collegiate flight student.	18 6%	40 15%	77 27%	148 52%

Adapted from: Casebolt, Mallory, K. (2015). *The Impact of Public Law 111-216: Perceptions of US Collegiate Flight Students*. Unpublished doctoral dissertation, Oklahoma State University, Stillwater.

Responding to the Likert-scale statement, "I am knowledgeable of PL 111-216 and its potential effect on collegiate flight students", over three-fourths (80%) of participants strongly agreed or agreed that they are knowledgeable of PL 111-216 and its potential effects. The remaining 20% indicated that they were not knowledgeable of PL 111-216. When responding to the Likert-scale statement, "PL 111-216 is of significant concern to me as a collegiate flight student", 242 participants (85%) strongly agreed or agreed that PL 111-216 was a significant concern; whereas, 15 percent of participants' stated that PL 11-216 was not a personal concern. The majority of participants, 79%, strongly agreed or agreed with the statement, "Attaining the required 1,000 flight hours specified by PL 111-216 is a significant financial concern to me as a collegiate flight student". Only 21 percent of participants strongly disagreed or disagreed that the increase of flight hours was a financial concern for them. Agreeing with the majority, one participant commented in the comment section, "It's not just the hourly requirement that's hurting upcoming pilots, it's the $20,000 ground course we're required to take just to qualify for taking the ATP written. The entire law was a reaction to an incident that the ramifications of the law would not have prevented in the first place. The decision to put it into law obviously wasn't made considering how it would affect upcoming pilots." The participant continued by stating, "Sitting in a single engine aircraft watching my students fly for 1,500 hours will not prepare me for the airlines or make me any safer once I get there, if you want us (collegiate flight students) to be safer in large aircraft, enable us cheaper and quicker access to train in them, so we can gain that experience."

Table 6 presents data obtained from four Likert-scale statements involving the participants' perceptions of: (1) student's motivation to earn a Bachelor of Science degree compared to average initial salary for Part 121 first officers, (2) prospective student's enrollment with new flight hour and restricted ATP requirements (3) retention rate of collegiate flight students due to increased flight hours, and (4) increase in current collegiate flight students pursuing other non-professional pilot aviation degrees as a result of PL 111-216.

Table 6
Collegiate Flight Students' Motivation and Employment Perceptions of Public Law 111- 216

Likert-Scale Statements	SD	D	A	SA
The additional flight hours required by PL 111-216 affects my motivation to earn a Bachelor of Science flight degree compared to the starting salary for First Officers employed by Part 121 air carriers is only $25,000.	21 7%	55 19%	103 37%	104 37%
PL 111-216 (restricted ATP and increased number of flight hours) will adversely affect the recruitment of prospective students enrolling in collegiate flight programs.	9 3%	41 14%	124 44%	109 39%
PL 111-216 will have a negative effect on the retention rate of collegiate flight students due to the increased mandatory flight hours (restricted ATP requires 1,000 flight hours).	8 3%	62 22%	119 42%	94 33%
PL 111-216 will cause an increase in current collegiate flight students pursuing other non-professional pilot aviation degrees (management, avionics, etc.).	14 5%	65 23%	124 44%	80 28%

Adapted from: Casebolt, Mallory, K. (2015). *The Impact of Public Law 111-216: Perceptions of US Collegiate Flight Students*. Unpublished doctoral dissertation, Oklahoma State University, Stillwater.

The majority of participants (74%) either strongly agreed or agreed with the statement, "The additional flight hours (minimum of 1,000 flight hours) required by PL 111-216 affects my motivation to earn a Bachelor of Science flight degree, since the average starting salary for first officers employed by Part 121 air carriers is only $25,000". The remaining participants (26%) strongly disagreed or disagreed with the statement. An overwhelming 83 percent of participants strongly agreed or agreed with the statement, "PL 111-216 (restricted ATP and increased number of flight hours) will adversely affect the recruitment of prospective students enrolling in collegiate flight programs"; while 17 percent of students strongly disagreed or disagreed that the R-ATP will affect the recruitment of prospective collegiate flight students.

Regarding the statement, "PL 111-216 will have a negative effect on the retention rate of collegiate flight students due to the increased mandatory flight hours (restricted ATP requires 1,000 flight hours)", the majority of participants (75%) strongly agreed or agreed that this new legislation will impact the retention rate of collegiate flight students. In regards to the retention rate, one participant indicated, "My two best friends dropped out of flight because of this. I also almost did. School is already over $100,000 and starting jobs make very little money, as do flight instructors. This is quantity over quality." Over seventy percent of participating students strongly agreed or agreed with the statement, "PL 111-216 will cause an increase in current collegiate flight students pursuing other non-professional pilot aviation degrees (management, avionics, etc.)", with one student indicating, "…as a student I decided not to pursue a career in flying due to PL 111-216. I felt that 1,000 hours was a financial hardship that was not worth it. I also feel that the new rule no longer encourages quality training, it encourages flight time no matter the quality."

Participants were also asked about their perceptions regarding whether their institution's aviation department should be concerned about PL 111-216 and the possibility of a U.S. pilot shortage due to the requirement of the R-ATP and/or less students enrolling in collegiate flight programs. Table 7, Collegiate Flight Students' Perceptions of Institutional Concern and Pilot Shortage, details the responses regarding these two concerns of PL 111-216.

Table 7
Collegiate Flight Students' Perceptions of Institutional Concern and Pilot Shortage

Likert-Scale Statements	SD	D	A	SA
PL 111-216 should be a primary concern of the aviation department at my college/university.	8 3%	38 13%	108 38%	129 46%
PL 111-216 will cause a US pilot shortage due to the increase in required flight hours and/or the decrease in students enrolling in a collegiate flight program.	6 2%	49 17%	113 40%	115 41%

Adapted from: Casebolt, Mallory, K. (2015). *The Impact of Public Law 111-216: Perceptions of US Collegiate Flight Students*. Unpublished doctoral dissertation, Oklahoma State University, Stillwater.

When asked if, "PL 111-216 should be a primary concern of the student's aviation department", 84 percent of participants strongly agreed or agreed; similarly, 81% of the participating students strongly agreed or agreed that, "PL 111-216 will cause a pilot shortage in the U.S. due to the increase in required flight hours and/or a decrease in collegiate flight student enrollments". One participant stated on their comment section, "Smaller regional carriers will encounter a shortage of pilots in the next five years."

Table 8 presents data identifying participants' perceptions of the restricted ATP and the effect it will have on first officers. The responses from the Likert statement, "A 'restricted ATP' (minimum 1,000 flight hours) should be required for a first officer to be employed with a Part 121 U.S. air carrier operator", indicated that the majority of participants (58%) strongly disagreed or disagreed that a R-ATP should be required for a first officer; however, when asked to respond to the statement, "restricted ATP' requirement in PL 111-216 will make newly employed first officers more qualified and capable pilots", a majority of participants (54%) strongly agreed or agreed that the R- ATP will make them more qualified and capable first officers. Regarding these two statements, one of the participants indicated, "1,000 hours will make a more capable FO, however with financial issues involved it is definitely an incentive to discontinue flight training as I've had many close friends go that route. I believe 1,000 hours is a lot of time and even though the law was designed to prevent pilot error, there will always be external/internal pressures to cause pilot error because we are all human. Also the fact that most flight students were not born rich and school is expensive, many of us do not look forward to $25,000 a year and expect to pay off loans as well as bills, food expenses, etc. There are other ways to become a more effective pilot, such as pairing an FO with an experienced captain because really an FO learns from the captain."

Table 8
Collegiate Flight Students Perceptions of Restricted ATP

Likert-Scale Statements	SD	D	A	SA
A "restricted ATP" (minimum 1,000 flight hours) should be required for a First Officer to be employed with a Part 121 US air carrier operator.	59 21%	107 37%	87 31%	30 11%
The "restricted ATP" requirement in PL 111-216 will make newly employed First Officers more qualified and capable pilots.	53 18%	79 28%	115 41%	36 13%

Adapted from: Casebolt, Mallory, K. (2015). *The Impact of Public Law 111-216: Perceptions of US Collegiate Flight Students*. Unpublished doctoral dissertation, Oklahoma State University, Stillwater.

Lastly, three Likert-Scale statements asked participants if PL 111-216 will create a safer flight environment, will decrease the number of fatal accidents due to pilot error, and will have a significant impact on the overall U.S. commercial aviation industry. Table 9, Collegiate Flight Students' Perceptions of Overall Impact of PL 111-216, provides data obtained from these three statements.

Table 9
Collegiate Flight Students' Perceptions of Overall Impact of PL 111-216

Likert-Scale Statement	SD	D	A	SA
New regulations as a result of PL 111-216 will create a safer environment for Part 121 US air carrier operators.	41 15%	91 32%	119 42%	32 11%
Fatal accidents involving US airlines (due to "pilot error") will decrease as a result of PL 111-216.	62 22%	123 43%	79 28%	19 7%
Overall, the effects of PL 111-216 will have a significant impact on pilots, as well as the entire US airline industry.	6 2%	19 7%	106 37%	152 54%

Adapted from: Casebolt, Mallory, K. (2015). *The Impact of Public Law 111-216: Perceptions of US Collegiate Flight Students*. Unpublished doctoral dissertation, Oklahoma State University, Stillwater.

Approximately half (53%) of the participants strongly agreed or agreed with the statement, "New regulations as a result of PL 111-216 will create a safer environment for Part 121 U.S. air carrier operators". Sixty-five percent of students strongly disagreed or disagreed with the statement, "Fatal accidents involving U.S. airlines (due to "pilot error") will decrease as a result of PL 111-216". One participant indicated that, "Fatal accidents could happen for any pilot even if he/she had one million hours of flying experience." And yet, an overwhelming ninety-one percent of participants strongly agreed or agreed that "the effects of PL 111-216 will have a significant impact on pilots, as well as the entire U.S. airline industry".

Using data from N=283 participants, the internal reliability of the questionnaire resulted in an alpha coefficient of .644. Given the previous scale outlined by George and Mallery (2003), the internal reliability of the questionnaire was rated as questionable.

Discussions

Based on the overall perceptions of collegiate flight students, PL 111-216 was determined to be a primary concern of collegiate flight students, collegiate flight programs, and the U.S. airline industry. When participants were asked to identify their career aspirations regarding flight, over 65% of students indicated they sought to become commercial pilots; however, many of the participants expressed their concern with the additional time and finances (flight costs) involved in obtaining the new R-ATP certificate and the amount of flight hours associated with PL 111-216.

Overall, collegiate flight students perceived that PL 111-216 will affect both collegiate flight students and the U.S. airline industry. According to the results from 283 collegiate flight students, PL 111-216 will affect the collegiate flight environment, collegiate flight students, students pursuing careers as Part 121 commercial pilots, and the U.S. airline industry.

Collegiate flight students' primary concern was the financial difficulties as a result of PL 111-216. Students perceive that PL 111-216 will create an issue for students obtaining a Bachelor's degree concerning paying for flight training cost and the time it takes to reach the required flight minimums. As a result of high tuition, flight costs, and the availability of time, students also perceived that PL 111-216 will affect the ambition of remaining motivated to complete their college degree.

Students unable to meet the flight hour requirements due to finances or the increased amount of time it takes to reach the 1,000 flight hour minimum could be a concern to the U.S. airline industry. Sixty-one percent of students surveyed identified that they have logged less than 200 flight hours which represents a substantial difference between the previous requirement of a certified commercial pilot certificate and the new 1,000 flight hours required for an R-ATP certificate.

Students also believe that as a result of PL 111-216 there will be a decrease in collegiate flight student enrollment and/or retention in collegiate flight programs.

Collegiate flight students also perceive that the implementation of increased flight hours and R-ATP certificate will not create a safer environment for commercial aviation or decrease fatal accidents due to pilot error. Because the perceived direct effect on collegiate flight students, the U.S. airline industry will also be affected by PL 111-216 which could be shown in numerous possibilities. These possibilities could include a decrease in regional service, a decrease in qualified pilots to fill retirement gaps, and a decrease of collegiate aviators to make up for military aviators staying in the service.

Historically, the U.S. airline industry obtains its pilot supply from sources such as collegiate flight programs, trained military pilots, and civilian sources. "Until the 1990s, roughly 90 percent of the pilots hired by major US carriers came from the U.S. military. Today however, hiring percentage have nearly reversed due to military active duty training commitments rising from six to almost twelve years" (Duggar, Smith, and Harrison, 2009, p. 2). To hold on to its trained pilots, the military has offered incentive programs such as wage increases, signing bonuses, and retirement packages; thereby contributing to the decrease of military pilots transitioning into commercial airline service. The result of a decrease in military pilots entering commercial service leaves civilian sources such as collegiate flight programs as the bulk of future professional pilot replacements to fill any anticipated pilot shortages. The military keeping qualified pilots longer creates an increased need for qualified collegiate flight students that meet the new requirements set forth by PL 111-216. If collegiate flight students that identified their career aspirations to become a commercial pilot are unable to meet the new R-ATP certification requirements, the U.S. airline industry could suffer professional pilot replacement problems regarding future pilot shortages.

According to the perceptions of participating collegiate flight students, since the majority of the U.S. commercial pilot supply is now coming from the collegiate flight environment, PL 111-216 creates a flight time and financial issue for students which could result in a student's decision to pursue other college degree options. If collegiate flight students no longer pursue professional pilot degrees or aviation related degrees' it could persuade collegiate flight programs to reevaluate their flight cost and could create a new financial dynamic for the collegiate flight program.

The results collected from this national study indicated 91% of collegiate flight students strongly agree or agree that overall the effects of PL 111-216 will have a significant impact on pilots, as well as the entire U.S. airline industry. Overall, collegiate flight students perceived that PL 111-216 will affect collegiate flight students and the U.S. airline industry. According to 283 collegiate flight students, PL 111-216 will affect the collegiate flight environment, collegiate flight students, students pursuing careers as Part 121 commercial pilots, and the U.S. airline industry.

Recommendations

Based on the findings and conclusions of this study, the author's offer the following recommendations.

Collegiate Flight students should familiarize and educate themselves on the new qualification requirements and all pertinent information related to PL 111-216, since 80% of responding students agreed the new 1,000 flight hour requirement is a significant financial concern. Students should consider the time, commitment, and financial aspect it takes to obtain an R-ATP certificate with the minimum requirement of 1,000 flight hours. Students should also take into consideration how they plan to obtain the 1,000 flight hour minimum required to obtain an R-ATP certificate. While considering time, commitment, and finances students should also consider the average starting salary for an entry level position as a first officer employed by a Part 121 commercial carrier compared to the average tuition cost to complete a four-year bachelor degree in flight.

Seventy-five percent of students believe that PL 111-216 will have a negative effect on the retention rate of collegiate flight students due to the increase in mandatory flight hours. Seventy-two percent of students believe PL 111-216 will cause an increase in current collegiate flight students pursuing other non-professional pilot aviation degrees. Therefore, collegiate flight programs need to make efforts, to make flight cost more affordable for collegiate flight students. Collegiate flight programs should take into consideration the cost for the average student to finish a Bachelor degree in flight with the new flight hour minimums. This may allow programs to make adjustments to encourage students to complete their degree. Although, each program is different and has different flight cost and degree requirements, each collegiate flight program could provide more financial aid through the college/university or increase the availability of scholarships. If collegiate flight programs can adjust for high flight cost experienced by collegiate flight students it can help deter students pursuing other non-flight related degrees.

Ninety-one percent of collegiate flight students indicated that PL 111-216 will have a significant impact on pilots as well as the entire U.S. airline industry. Although PL 111-216 is a fairly new legislation, the U.S. aviation industry should examine any decrease in coming years in qualified pilots or any negative effects on the industry as a result of PL 111-216. If the industry begins to see any problems with pilot shortage because of lack of collegiate flight students entering the future pilot pool, perhaps aviation stakeholders can present the problem to congress to reconsider the amount of flight hours required by PL 111-216 to obtain an R-ATP.

Recommendations for Further Research

Further research studies are needed to determine if collegiate flight students receive outside financial support from parents or other sources for collegiate flight cost other than examples listed on the research survey: financial aid, student loans, and/or scholarships. Research should be conducted that will gather information on specifically how the majority of students (56%) that identified 0-24% of flight cost are supported by financial aid, scholarships, and or student loans support flight cost. Results from the research could determine the significance of student financial resources and its potential effect to a perceived decline in future pilot numbers and effects on collegiate flight students.

A further study is recommended to explore the perceptions of the U.S. airline industry regarding PL 111-216. This research study should seek to answer if experts within the U.S. airline industry perceive any problems as a result of PL 111-216, specifically involving a decline in qualified pilots from collegiate flight programs. The study should attempt to seek if the U.S. airline industry perceives that PL 111-216 will create a safer environment for commercial aviation in the U.S., if PL 111-216 will reduce pilot error related fatal accidents, and if the R-ATP will make newly employed first officers more qualified and capable pilots. This type of research could benefit from personal interviews from industry leading experts and aviation professionals. Answers to these questions could offer a comprehensive explanation regarding the perceptions of the U.S. airline industry.

As another recommendation for future research, the majority of respondents indicate negativity to PL 111-216, its affects to them and the industry. Research that identifies what changes to PL 111-216 would improve these issues would be beneficial.

The authors believe future research is needed and would be beneficial to examine and calculate the average financial cost as well as the average time it takes a collegiate flight student to meet the new requirements set forth by PL 111-216. This information would be beneficial in determining any further issues with PL 111-216.

Since only two years have passed since the enactment of PL 111-216 at the time of this study, future research should reevaluate these same issues after five or ten years. This study gathered the initial responses and reaction of effects from new legislation and student perceptions may change over time as students and collegiate flight programs adjust and adapt to this issue.

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Appendix

Research Questionnaire

The Effect of Public Law 111-216:
Perceptions of US Collegiate Flight Students

Please provide all requested information. Your responses will be kept confidential.

I. Overview of Public Law 111-216

In 2010, the US Congress passed a bill titled the *"Airline Safety and Federal Administration Extension Act of 2010"* requiring first officers in FAR Part 121 operations to hold an Airline Transport Pilot (ATP) certificate requiring a minimum of 1,500 flight hours. This bill, which was signed into law as **Public Law 111-216**, gave US airlines three years to comply with this new provision, so it took effect on August 2, 2013.

Accordingly, pilots not holding an ATP by this 2013 deadline would not be permitted to fly for an air carrier in Part 121 operations. FAA recently enacted a rule which allows for some reduced flight time requirements and the creation of a new type of certificate known as a "restricted ATP." A "restricted" ATP certificate will require the pilot to have reached age 21 (versus age 23 for an "unrestricted" ATP), and a minimum flight experience of 1,000 hours for pilots who have completed a professional pilot curriculum from an accredited college or university.

II. Collegiate Flight Students Characteristics

1. Approximately how many total flight hours have you logged?

   [ ] 0-49 [ ] 100-199 [ ] 300-399
   [ ] 50-99 [ ] 200-299 [ ] 400 & Over

2. Are you currently a Certified Flight Instructor; logging hours to meet the "restricted ATP requirement" of 1,000 flight hours?
   [ ] Yes
   [ ] No

3. What percentage of your flight costs are supported by financial aid (student loans) and/or scholarships?
   [ ] 0-24% [ ] 50-74%
   [ ] 25-49% [ ] 75-100%

4. What is your career aspiration regarding "flight"?
   [ ] Commercial Pilot [ ] Corporate Pilot
   [ ] Military Aviator [ ] Other

III. Collegiate Flight Students Perceptions of Public Law 111-216

Please indicate your perceptions using the following scale:
SD=Strongly Disagree, D=Disagree, A=Agree, or SA=Strongly Agree

	SD	D	A	SA
I am knowledgeable of PL 111-216 and its potential effect on collegiate flight students.	[ ]	[ ]	[ ]	[ ]
PL 111-216 is of significant concern to me as a collegiate flight student.	[ ]	[ ]	[ ]	[ ]
Attaining the required 1,000 flight hours specified by PL 111-216 is a significant financial concern to me as a collegiate flight student.	[ ]	[ ]	[ ]	[ ]
The additional flight hours (minimum of 1,000 flight hours) required by PL 111-216 affects my motivation to earn a Bachelor of Science flight degree, since the average starting salary for First Officers employed by Part 121 US air carriers is only $25,000.	[ ]	[ ]	[ ]	[ ]
PL 111-216 (restricted ATP and increased number of flight hours) will adversely affect the recruitment of prospective students enrolling in collegiate flight programs.	[ ]	[ ]	[ ]	[ ]
PL 111-216 will have a negative effect on the retention rate of collegiate flight students due to the increased in mandatory flight hours (restricted ATP requires 1,000 flight hours).	[ ]	[ ]	[ ]	[ ]
PL 111-216 will cause an increase in current collegiate flight students pursuing other non- professional pilot aviation degrees (management, avionics, etc.).	[ ]	[ ]	[ ]	[ ]

Please indicate your perceptions using the following scale:

SD=Strongly Disagree, D=Disagree, A=Agree, or SA=Strongly Agree

	SD	D	A	SA
PL 111-216 should be a primary concern of the aviation department at my college/university.	[ ]	[ ]	[ ]	[ ]
PL 111-216 will cause a pilot shortage in the US due to the increase in required flight hours and/or the decrease in students enrolling in a collegiate flight program.	[ ]	[ ]	[ ]	[ ]
A "restricted ATP" (minimum 1,000 flight hours) should be required for a First Officer to be employed with a Part 121 US air carrier operator.	[ ]	[ ]	[ ]	[ ]
The "restricted ATP" requirement in PL 111-216 will make newly employed First Officers more qualified and capable pilots.	[ ]	[ ]	[ ]	[ ]
New regulations as a result of PL 111-216 will create a safer environment for Part 121 US air carrier operators.	[ ]	[ ]	[ ]	[ ]
Fatal accidents involving US airlines (due to "pilot error") will decrease as a result of PL 111-216.	[ ]	[ ]	[ ]	[ ]
Overall, the effects of PL 111-216 will have a significant impact on pilots, as well as the entire US airline industry.	[ ]	[ ]	[ ]	[ ]

IV. Personal Comments

Please indicate any additional comments you may have regarding PL 111-216 and its effects on collegiate flight students and the US airline industry.

UAA UNIVERSITY AVIATION ASSOCIATION

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