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THE EFFECTS OF SAFETY CULTURE AND ETHICAL LEADERSHIP ON SAFETY PERFORMANCE

by

Kevin O'Leary

A Dissertation Submitted to the College of Aviation
in Partial Fulfillment of the Requirements for the Degree of
Doctor of Philosophy in Aviation

Embry-Riddle Aeronautical University
Daytona Beach, Florida
July 2016

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This Dissertation was prepared under the direction of the candidate's Dissertation Committee Chair, Dr. Alan J. Stolzer, Professor, Daytona Beach Campus; and Dissertation Committee Members Dr. Dothang Truong, Associate Professor, Daytona Beach Campus; Dr. Michael O'Toole, Associate Professor, Daytona Beach Campus; and Dr. Benjamin J. Goodheart, External Member, and has been approved by the Dissertation Committee. It was submitted to the College of Aviation in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Aviation

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ABSTRACT

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Institution: Embry-Riddle Aeronautical University

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This dissertation investigated the effects of safety culture and ethical leadership on safety performance in Fractional jet pilots in the United States. The primary objective was to develop a well-fitted model linking these constructs. A composite survey instrument was developed from instruments previously validated in the literature.

There were 305 complete and valid responses from Fractional pilots. The hypothesized factor structure consisted of seven factors. The exogenous factor of safety culture was made up of four sub-factors. The endogenous factors included ethical leadership, pilot commitment, and safety performance. Safety performance was a second order factor consisting of errors and attitudes to violations. The hypothesized model was not well fit for the data; therefore, an exploratory factor analysis was conducted. The new model consisted of three factors: safety culture new, ethical leadership new, and not following procedures.

A structural equation model was developed to test the relationships between constructs. Safety culture new demonstrated a strong and significant positive effect on ethical leadership new. Safety culture new, unexpectedly, did not have a significant negative relationship with not following procedures. Additionally, ethical leadership new did not have a significant negative effect on not following procedures. These findings conflicted with previous studies in the literature that confirmed a significant relationship between both safety culture and ethical leadership with safety behavior. The main finding illuminates the influence of safety culture new on ethical leadership new. Additional findings showed the factor structure for most of the previously validated survey instruments was not maintained in this study with the Fractional pilot data.

DEDICATION

I dedicate this work to my parents, wife, and children.

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I would like to thank my parents for their countless sacrifices. I would like to thank Ms. Cavallo and my other teachers who combined learning with both encouragement and discipline. I would like to thank Major Ed Donnelly and Rich Heckman for their mentorship and friendship.

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CHAPTER I

INTRODUCTION

Flying on U.S. registered private jets for hire (U.S. jets) is considered a very safe endeavor, especially compared to flying on private jets in many other countries (Robert Breiling Annual Aircraft Accident Review, 2014). However, some research states the accident rate in general aviation remains too high and the Federal Aviation Administration (FAA) has lagged in its responsibility to regulate general aviation to improve safety outcomes (Kuhn, 2009). As evidence of the FAA's failure to effectively ensure safety in General Aviation, Kuhn (2009) points to the fact that the FAA has yet to mandate the use of Safety Management Systems (SMSs), with their associated reporting requirements, for either type of for-hire U.S. jet operation: fractional aircraft ownership programs (Fractionals) or 14 CFR air-taxi operations (Charter).

Over the 25-year period from 1990 through 2014, U.S. jets experienced 410 accidents, with only 96 (23%) of those having fatalities (Breiling, 2014). Over the period from 2007 through 2014, inclusive, there were 126 accidents involving U.S. jets with 27 (21%) of those resulting in fatalities. According to the research firm JetNet's website(www.jetnet.com) , the number of U.S. jets at the beginning of 1990 was 7,336, while by the end of 2007 that number had risen 63% to 11,961. Despite the increase in the number of U.S. jets, the average annual rate of both non-fatal accidents and fatal accidents has been on a downward trend. During the period from 1990 through 2006, the annualized mean number of accidents was 16.6 per year with 4.3 of those being fatal accidents. From 2007 through 2014, those rates had declined to 15.8 and 3.4 per year, respectively.

During the period 2007 through 2014, for domestic flights U.S. jets had an average of 1.8 million departures and 2.8 million flight hours. This total does not include the flights taken by U.S. jets abroad. Therefore, since the accident data includes all flights of U.S. jets, the accident per flight hour rate is presumably lower than reported. The average accident rate per 100,000 flight hours for U.S. jets was 0.55 during this period. The fatal accident rate during the same period was 0.12. This equates to one fatal accident involving a U.S. jet about every 800,000 flight hours.

A traveler can arrange for flights on U.S. jets in three predominant service models: chartering a jet for hire (Charter), fractional ownership (Fractional), and ownership. Charter, which is similar to using a taxi or car service, is where an aircraft manager supplies the pilot and aircraft. In U.S. aviation, the operator responsible for these Charter flights is called the aircraft manger. The aircraft manager must maintain a Federal Aviation Regulation 14 CFR part 135 (FAR 135) certificate with the FAA in order to offer charter flights to the public for hire.

A second option, Fractional, is a model in which a consumer buys a share of a specific aircraft and the designated aircraft management company flies the owner whenever a trip is requested. Though regulated under its own section of 14 CFR, namely part 91(k) (FAR 91(k)), these Fractional manager’s flights are often flown under the arguably more stringent FAR 135 rules and regulations, where the management company, rather than the owner, maintains operational control of the majority of the flights.

The final option to fly a jet privately is full ownership, where a person or entity purchases a private aircraft. The private jet owner is responsible for the operation of the aircraft. Many of the owner's responsibilities can be delegated to an aircraft management company; however, the owner maintains operational control under 14 CFR part 91 (FAR 91).

Both Fractional and Charter managers hold the same type of FAR 135 certificate, operate under similar rules and regulations, maintain operational control of the majority of their flights, and are subject to similar scrutiny by the FAA. However, the annual accident totals and accidents per hour flown rates are substantially different between these two groups as shown in Figure 1. Over the 25-year period from 1990 through 2014, the U.S. jet Charter operators have been involved in 188 accidents with 46 (24%) of those being fatal. The U.S. jet Fractional operators were involved in just 26 accidents over the same period with zero fatal accidents. In the period from 2007 through 2014, the U.S. jet Charter operators have averaged a rate of 6.0 accidents with 1.4 (23%) fatal accidents per year, while the Fractional operators have averaged 1.4 accidents per year and zero fatal accidents (Robert Breiling Annual Aircraft Accident Review, 2014).

In the period from 2007 through 2014, the U.S. jet Charter accident rate per 100,000 flight hours averaged .71 (TRAQPak Report, 2014). The fatal accident rate during the same period was .16. The U.S. jet Fractional accident rate during the same period was .27 per 100,000 flight hours with zero fatal accidents. The Charter rate of accidents per 100,000 flight hours of 0.71 is 0.16 (29%) higher than the U.S. jet fleet average of 0.55; conversely, the Fractional rate is 0.28 (51%) lower at 0.27. The fatal accident rate per 100,000 flight hours for Charter (0.16) is .04 (33%) higher than the U.S. jet average of 0.12, while Fractional did not have a fatal accident during this period.

Fractional did not had a single fatal accident during the period of 1990 through 2014 (Robert Breiling Annual Aircraft Accident Review, 2014).

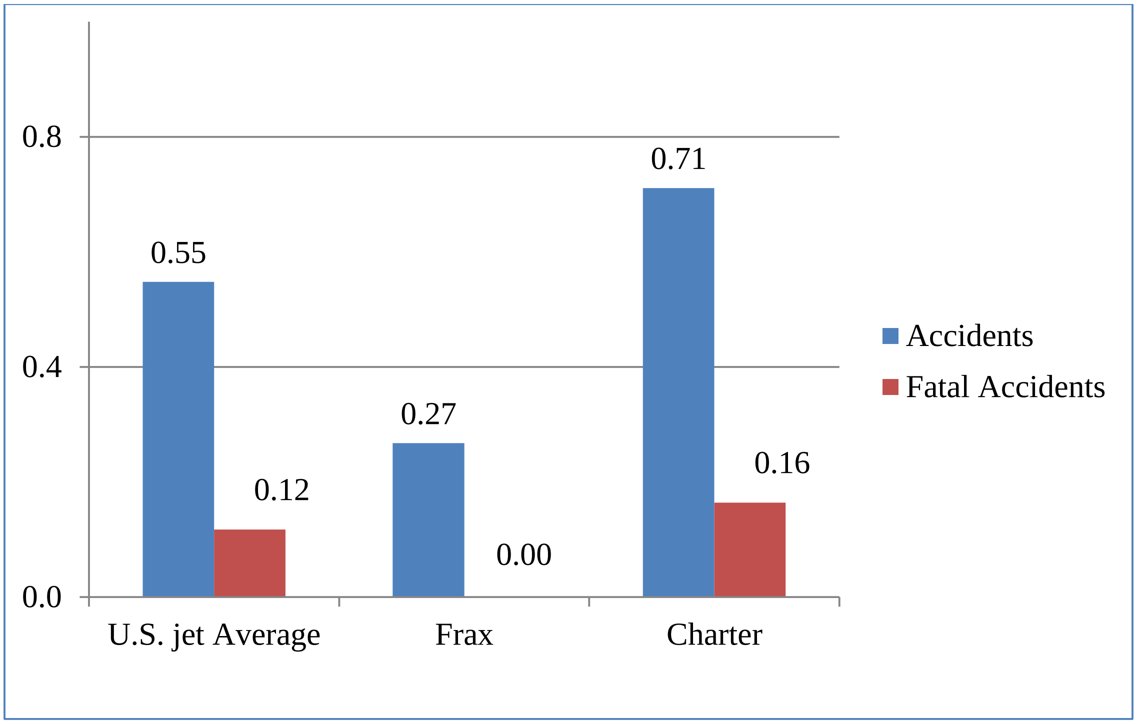


Figure 1. U.S. Jet Accident Rate. The U.S. jet fleet average accident rate per 100,000 flight hours for the period of 2007 through 2014. (Breiling 2014; TRAQpak 2014).

The focus on causation of aircraft accidents has shifted since the early 1990s. The previous research on accident causation concentrated on a very granular search for the final causal or contributing factors that lead to the accident. This causation research often pointed to the last line of defense in the entire safety system: the pilot. Accident investigators diligently searched for the *smoking gun* or the last item in a chain of events that, had it been corrected likely would have changed the course of events and prevented the accident. Because pilots are the last line of defense in the safety system, they were indicated as the main causal factor in the vast majority of aviation accidents (Vincoli, 1990).

In the last 25 years, safety has evolved into its own discipline where processes are designed and implemented to make flying safer (Stolzer & Goglia, 2015). Historically, pilots were blamed as the cause of most aviation accidents; however, in the 1990's, this trend started to evolve. This paradigm shift was the result of the growing understanding of safety as a system and consideration of the multiple causal interactions of accidents. These multiple causal interactions include those that reside within the flight organization, such as group behaviors and culture. Many human factors researchers, such as von Thaden, Wiegmann, & Shappell (2006); Jennings (2008); and Li, Harris, and Yu (2008) have revisited aviation accidents dating back many years and have persuasively demonstrated that the organization and its characteristics strongly influenced the causal factors of the majority of accidents. The aforementioned research results were important because they illuminated the key interrelationships within an organization. This increased understanding of these key interrelationships provided the opportunity to make organizational changes that were likely to further enhance safety.

As a result of this shift in understanding of the importance of organizational characteristics in maintaining and improving safety, the effort to measure the safety culture, organizational commitment, and even ethics of the organization has gained momentum in the literature. Researchers have attempted to develop and validate survey instruments to take these measurements in order to better understand how they influence safety outcomes, such as occupational accidents and safety performance (Alsowayigh, 2014; Freiwald, 2013; Zohar, 1980). If the safety culture or ethics of an organization can be accurately measured and shown to have a predictable influence on future safety outcomes or performance, this could create an opportunity for comparatively low cost interventions that would significantly improve safety in the system (Freiwald, 2013).

Statement of the Problem

To date, the relationship of safety culture, ethical leadership, pilot commitment to the organization, and safety performance has not been measured or investigated in U.S. jet Fractionals. Though these constructs have been studied in many airlines, the Fractionals differ operationally from airlines in many ways. The Fractionals, for example, fly exclusively point to point and do not fly in the hub-and-spoke flight patterns common to most airlines. The historical differences in the total number and rate of both fatal and non-fatal accidents are strong quantitative evidence that suggests there are operational and likely cultural differences between the U.S. jet Fractional and U.S. jet Charter operators.

Purpose Statement

The purpose of this study was to examine: (1) the Fractional pilots’ perceptions of their organizations’ level of safety culture and ethical leadership, and (2) the potential influence of these perceptions on the pilot’s commitment to the organization and their safety performance. Since the Fractional operators have fewer accidents than the Charter operators in the U.S. during the period under review, the practical application of this research could be the identification of a baseline model for safety culture. Future studies would be required to research the safety culture of the Charter companies and compare results.

Research Questions

This research addressed four questions that were derived from the research conducted by Alsowayigh (2014) on Saudi Airline pilots and Freiwald (2013) on aviation and healthcare personnel.

1. How does safety culture influence safety performance at U.S. jet Fractionals?
2. How does safety culture influence ethical leadership at U.S. jet Fractionals?
3. How does safety culture influence pilot commitment to the organization at U.S. jet Fractionals?
4. How do ethical leadership and pilot commitment to the organization influence safety performance at U.S. jet Fractionals?

Delimitations

The survey data collected in this study were comprised of responses from the pilots of major U.S. jet FAR 135 Fractional operators with more than 25 jets under management. The 25 jet minimum was selected because only three companies exceed 25 jets (NetJets, FlexJet, and Executive AirShare) and are estimated to operate 97.6% of the Fractional jet aircraft in the U.S. (www.JetNet.com; November 7, 2015).

It was not within the scope of this research to investigate safety outcomes from the NTSB accident investigation reports, Flight Operations Quality Assurance (FOQA), or other criterion-based data to search for relationships or causation. This is due to the concern in the literature that accident rates are too low to make valid predictions (O’Connor et al., 2011), and criterion based data such as FOQA are not consistently recorded across general aviation aircraft (Cistone et al., 2011); data recording systems are expensive to install and therefore inconsistently deployed in the fleet (Mitchell, Sholy, & Stolzer, 2007); and data that were recorded are not publically available.

This research was not intended to develop the appropriate path to improvement of U.S. jet FAR 135 operations, but rather to determine the relationships between safety culture, ethical leadership, pilot commitment, and safety performance of U.S. jet Fractionals.

Limitations

This study was intended to measure and investigate the relationships between the constructs of safety culture, ethical leadership, and safety performance for U.S. jet Fractional operators. It was assumed that due to the fact the pilots were notified through their unions, nearly all pilots had the opportunity to complete the survey, and therefore the results will likely be generalizable throughout the organization. Additionally, since these pilots represent over 97% of the Fractional pilots in the U.S., the results are likely to be generalizable to all U.S. Fractional pilots. Non-response bias was tested through a comparison of the results between different survey collection dates. The comparison included an analysis of the responses by similar demographic groups across various survey collection dates.

The construct for safety performance was self-reported items describing pilot errors and their attitudes to violations. There are concerns in the literature about the potential inaccuracy due to the nature of self-reported items (O'Connor et al., 2011).

Definitions of Terms

AMC	Aircraft Management Companies are those companies managing jet aircraft and offering flights to the public for hire. Both fractional jet managers (Fractional) and U.S. jet FAR 135 aircraft management companies (Charter) are considered AMCs.
Charter	Charter refers to the companies where flights are offered to the public for hire by a certificated FAR 135 aircraft management company.
charter	When not capitalized, this term refers to flights flown by Charter companies for hire.
Fractional(s)	Fractional aircraft management company(ies)
Micro-accidents	These are small workplace accidents such as cuts and bruises.
U.S. jets	Refers to U.S. registered private jets that are used in a Fractional aircraft program or flown by a duly certificated FAR 135 aircraft management company for hire.

List of Acronyms

AMC	Aircraft Management Company (both Fractional & Charter)
ELS	Ethical Leadership Scale

FAA	Federal Aviation Administration
FOQA	Flight Operations Quality Assurance
NTSB	National Transportation Safety Board
PCAMC	Pilot Commitment to AMC
SEM	Structural Equation Model
SCFSS	Safety Culture Formal Safety System
SCISS	Safety Culture Informal Safety System
SCOC	Safety Culture Organizational Commitment
SCOP	Safety Culture Operations Personnel
SPATV	Safety Performance Attitude To Violations
SPERR	Safety Performance Pilot Error Behavior
ZCSQ	Zohar Client Safety Questionnaire

CHAPTER II

REVIEW OF THE RELEVANT LITERATURE

Introduction

The review provided in this chapter begins with a brief history of aircraft accident investigations and how the conduct of these investigations has evolved over the last 40 years. Accident investigation is considered one of the initial steps in aviation history directed toward improving safety through better understanding the causal factors in accidents and applying that knowledge to preventing similar accidents in the future (Stolzer & Goglia, 2015). Accident investigators have, in both past and current investigations, conducted a very granular analysis of each accident to determine the proximate causal factors. Once the causal factors are determined, the results are categorized and analyzed across many accidents to identify themes. The knowledge gained from these accidents and subsequent analyses or themes has inspired the development of new technologies, equipment, and procedures that have contributed to the continued improvements in aviation safety (Stolzer & Goglia, 2015).

With improvements in technology, equipment, and procedures, accident investigators began to find fewer and fewer causal factors attributable to equipment failures (Vincoli, 1990). These improvements in the reliability of both the equipment and procedures led investigators to label the main causal factor in the majority of accidents as pilot or human error (Vincoli, 1990). Since the majority of accidents were and continue to be determined to be pilot error, and the goal in aviation was to continue to improve safety, aviation practitioners needed to better understand the causes of human error, and more specifically the active and latent conditions that contributed to the malfunction of the pilot (Reason, 1990).

As the construct of human error became more fully understood, aviation accident investigators and practitioners still needed to further adapt these concepts to an aviation setting to continue the improvements in safety outcomes. The study of human error provided a framework for scholars to adapt those, along with other concepts, to develop the human factors classification system (HFACS). HFACS provided a common taxonomy that enabled accident investigators, aviation practitioners, and researchers to both identify and categorize human errors (Shappell & Wiegmann, 1997). The errors were labeled active (human mistakes), latent, or organizational factors (training, over scheduling, or procedures errors, etc.) that contributed to accidents that had been labeled as just pilot error in the past (Shappell & Wiegmann, 1997).

Along with the study of HFACS, organizational culture began to emerge as an important construct in the literature as a possible antecedent to safety outcomes (Cox & Flin, 1998; Helmreich & Merritt, 1998; Zohar, 1980). Studies focusing on safety culture, communication, cockpit resource management, employee commitment to the organization, and company leadership began to emerge in the literature as possible constructs that could be measured and had the potential to influence safety outcomes.

This study builds upon previous research focused on the constructs of safety culture (Alsowayigh, 2014), ethical leadership (Freiwald, 2013), and their potential influence on self-reported safety performance, such as a pilot admitting to making occasional errors. If these relationships exist and are significant, this research has the potential to provide insight into a possible safety culture model for Charter operators to follow that could improve safety in U.S. jet FAR 135 operations overall.

Accident Investigation

When aviation accident investigation began, there was a "*fly-crash-fix-fly"* approach (Stolzer & Goglia, 2015, p.15). The investigator's mission was to determine the cause of the accident, publicize the results, and adopt new regulations to prevent future re-occurrences with the same cause. The causes sometimes were related to unforeseen weather conditions, design flaws, structural/mechanical failures, or human error (most often by pilots and sometimes by mechanics) (Stolzer et al., 2011).

An article by Walter Tye published in 1980 demonstrates the major concerns of the day with commercial aviation. Tye wrote, to improve aviation's upward trend in safety, the industry had to focus on new aircraft designs, improvements in avionics to avoid mid-air collisions and controlled flight into terrain (CFIT), and, ultimately, better procedures (Tye, 1980). Tye's research estimated that approximately one-half of the fatal commercial aviation accidents from 1972 until 1980 were the result of CFIT and, additionally, almost 25% were from mid-air collisions (Tye, 1980).

Some examples of accidents include: In 1987 a Learjet 35A sustained substantial damage after a hard landing in rain and heavy winds. The National Transportation Safety Board (NTSB) named wind shear as one of the main contributing factors (NTSB Brief MIA88LA026, 1989). In 1990, a Lear 24 experienced a fire in the cockpit when the wires from the map light chafed together, causing the wires to arc, and resulting in a cockpit fire that precipitated a forced landing (NTSB Brief ATL90LA080, 1992). A different accident which resulted from a gear failure on a Challenger in 1997 (NTSB Brief: ATL96LA073, 1997) could have been avoided through better organizational procedures. The NTSB report suggested that improved procedures at the aircraft management company requiring use of the emergency gear extension checklist may have prevented the accident. The NTSB recommendation centered on the pilot neglecting to verify the gear was down and locked after an initial indication that the gear was not locked in place, which is the proper procedure as published in the aircraft's operating handbook.

Tye's suggestions from 1980 have all been adopted; first by the commercial aircraft manufacturers and later by the private jet manufacturers. Avionics improvements included ground proximity warning systems, traffic collision avoidance, and ground based and cockpit based wind shear detection systems. Additionally, procedural improvements were made such as the adoption of crew resource management (CRM) programs. Aircraft designs improved structural soundness and systems reliability. As Tye's published suggestions have been implemented in aviation, the accident rates have continued to decline.

Pilot Error Causing Accidents

The reliability of aircraft as well as of the air transportation system itself improved in the 1980s (Vincoli, 1990). As suggested in later research, the main causal factor in most aviation accidents was pilot error (Vincoli, 1990). In the previous 20 years, the NTSB had identified pilot error as the primary cause for 66% of aviation accidents (Vincoli, 1990). The U.S. Army conducted a study and concluded that over

80% of Army aviation accidents during the years 1958-1976 were the result of pilot error (Vincoli, 1990). This led to the NTSB seemingly declaring pilot error as its default finding, as evidenced by two cases where independent investigators reviewed the evidence and found conclusive proof of mechanical failures previously missed by the NTSB that were major causal factors (Vincoli, 1990).

Vincoli went on to warn the industry and the investigators that safety of flight is the responsibility of the aircraft manager or airline, and this responsibility cannot be delegated to the pilot (Vincoli, 1990). Vincoli also warned that if the trend of disproportionately identifying pilot error as the primary cause in the vast majority of accidents continued, the industry would not be able to move forward to improve safety, nor to prevent future accidents effectively.

Human Error

In 1982, Rasmussen wrote his seminal paper describing human error, attempting to bring structure to the construct and foster proper collection of data. In his work, he described the characteristics and definitions associated with human failure. It was asserted that most inadequate results or outright systems failures could be traced back to human failure in design, operation, or maintenance (Rasmussen, 1982). The author also pointed out that quite often the system failure was the result of a latent condition that existed prior to the actual system failure (Rasmussen, 1982).

Reason’s 1990 book *Human Error* furthered the body of knowledge on the topic of human malfunctions and continued to provide understanding of where humans are likely to fail in a complex safety system such as those comprising aviation. Reason postulated that there were two main types of human errors: active and latent. Active errors occur when the operator of a system, such as the pilot of an aircraft has the wrong reaction to a stimulus or situation and proximately causes the system failure. Conversely, a latent error may occur far away from and long before the system failure, such as an aircraft manager over-scheduling a crew which contributes to the pilot's fatigue and reduced effectiveness (Reason, 1990). Since most pilots overestimate their personal capabilities, they are unlikely to acknowledge or admit their reduced abilities when stressed or fatigued (Helmreich & Merritt, 1998).

Human Factors Analysis and Classification System (HFACS)

Building upon the research from Rasmussen and Reason, Shappell and Wiegmann published *Human Error Approach to Accident Investigation: The Taxonomy of Unsafe Operations* in 1997. This research contributed to what is now known as HFACS. The authors' objective was to develop a common taxonomy for accident investigators to use when classifying types of human errors. A common taxonomy allows researchers and practitioners to communicate more effectively. The goal of HFACS was to determine both the active (human) errors and the latent (organizational) errors. Shappell & Wiegmann attempted to determine the true root cause of aviation accidents in order to take the next step toward improving aviation safety (Shappell & Wiegmann, 1997).

In the 1990s, there was a paradigm shift in the literature in which aviation accidents were considered to be the result of a chain of events rather than being due to a single, proximate cause. The root causes, which had often been blamed on just the pilots, were expanded to include the latent failures of the aviation organization (McFadden &

Towell, 1999). Aviation accidents that were classified as pilot error have been re-examined using the HFACS perspective, and many latent or organizational errors have been identified (Wiegmann & Shappell, 2001). These findings have motivated a fundamental shift toward proactive system improvement to enable aviation organizations to reduce the incidence of latent errors and thereby forestall accidents (McFadden & Towell, 1999).

Culture

Culture is commonly associated with national culture and has its roots in anthropology. It is concerned with the core values of a group (Cox & Flin, 1998). Pilots experience three distinct cultures in their work: national, professional, and organizational (Helmreich & Merritt, 1998). In January of 1990, Avianca Flight 52 crashed in New York as a result of fuel starvation. The flight engineer was aware of the criticality of the situation but failed to make those concerns known to the captain. In this situation, all three forms of culture, national (deference to authority), professional (not questioning the higher ranking captain), and organizational (lack of CRM) contributed to the chain of events that resulted in an otherwise avoidable aviation accident (Helmreich & Merritt, 1998).

Aviation professionals have a distinct culture. In that professional culture, pilots have a specialized skill that provides prestige and high pay, which encourages some pilots to feel overconfident (Helmreich & Merritt, 1998). This feeling of overconfidence can lead to poor decision making, such as skipping routine checklists and taking unnecessary risks (Helmreich & Merritt, 1998). In the Avianca case, the crew had many options to divert the aircraft; however, poor crew communication led to the continuation of the flight to the point of fuel exhaustion.

The development of CRM was motivated by a desire to address both organizational and pilots' professional culture factors that had been shown to contribute to accidents. As it has been implemented in aviation organizations, CRM has demonstrated success at increasing communications in the cockpit and breaking down several barriers to optimally safe and efficient aircraft operation (Helmreich & Merritt, 1998). CRM is implemented in part by creating a subculture in the overall organizational culture comprised of a set of values and norms required to support the effective use of CRM operational practices.

National culture is a broader term related to those values, norms, and beliefs held by particular nationalities (Helmreich, 1998). The Avianca flight is an example of the consequences of poor or absent CRM practices. The flight engineer knew the aircraft was critically low on fuel; however, the flight engineer neglected to communicate that situation clearly to the captain. A combination of the flight engineer's national culture, Avianca's organizational culture, and the flight engineer's professional culture did not provide the flight engineer with the confidence to communicate a critical safety issue to the captain (Helmreich & Merritt, 1998). Though this flight's mishap can correctly be assigned a proximate cause of pilot error, HFACS would identify the latent organizational, professional, and cultural issues as major contributing factors.

Subsequent research into culture asserted that culture surrounds the organization and is intertwined with leadership and its behavior (Schein, 2004). Therefore, a leader can engineer culture by attempting to insert values into the organization that will influence and govern employee behavior and interactions (Schein, 2004). Because of the stable nature of the values set forth in organizational culture, it has been called the *personality* of the organization (Cox & Flin, 1998, Schein, 2004).

Safety Culture

"A safety culture is more than a group of individuals promulgating a set of safety guidelines, it is a group of individuals guided in their behavior by their joint belief in the importance of safety (Helmreich & Merritt, 1998, p. 133)."

Safety culture is a subset of the overall culture in an organization. The term safety culture first came to prominence from the report on the Chernobyl nuclear disaster from the International Atomic Energy Agency (Cox & Flin, 1998). The report discussed the poor safety culture that was present in the Russian nuclear plant. Safety culture is comprised of beliefs and values held in an organization regarding employee safety, hazard reduction, and a safe work environment (Cox & Flin, 1998). These values are stable, meaning they do not fluctuate in the short term (Cox & Flin, 1998). Initially, some researchers expressed concerns that the importance of safety culture was overstated and that it was not a proven theoretical concept (Cox & Flin, 1998). In contrast, other research in CRM fully supported the concept of culture as relevant to understanding and motivating positive change in the larger organizational culture, and showing that changes in culture had the ability to improve or reduce safety (Helmreich et al., 1997).

Safety Climate

The concept of organizational climate dates back to the 1930s; however, the measurement of the character of an organization did not start until the 1960s (Cox & Flin, 1998). Safety climate is the subset of the organizational climate that focuses on safety (Neal et al., 2000). The literature often treats the constructs of culture and climate interchangeably (Mearns & Flin, 1999). The difference between culture and climate has been compared to the differences between personality and mood of a person. A person's personality is based on the person's own core values and principles, and though it can be changed, it cannot be changed quickly; like culture, it is stable and enduring. Organizational climate, conversely, is more closely associated with a person's mood, which can change quickly based on the environment and the day's activity; therefore, it is short term and more variable, and measurements of climate are similar to a snapshot at one point in time (Cox & Flin, 1998).

The construct of safety climate was enhanced by the research of Zohar in the early 1980s. The research included a 40-item survey that was randomly distributed to 20 workers in 20 different industrial organizations (Zohar, 1980). The researcher then compared the results of the survey with the results of an independent safety inspector's evaluation of the safety effectiveness of each industrial organization. There was a high correlation between the inspector's evaluations of the effectiveness of safety programs at the different companies and the survey results from the workers (Zohar, 1980). The highest level of correlation was between the worker's perceptions of management's attitudes about safety and the rated effectiveness by the inspectors (Zohar, 1980).

Safety Climate and Culture as Predictors of Safety Performance (Outcomes)

The Zohar safety climate research was instrumental in developing the concept of safety climate though the use of an independent measurement to validate the results. Helmreich et al. used a similar validation technique in 1986; the research measured pilot attitudes and compared those responses to their performance evaluations from experienced check airmen. The study showed an attitude-performance linkage (Helmreich et al., 1986).

The Zohar and Helmreich et al. studies were important because they not only validated the construct of safety climate, they also established there was a link to performance. The accident rate in aviation is very low; therefore, it lacks the sensitivity to establish the predictor variables for safety performance or accidents (O’Connor et al., 2011). The importance of measuring both safety climate and safety culture lies in the potential to harness their predictive capability to improve safety performance and reduce accidents.

Before 2000, there were few research studies on the connection between safety climate and safety behavior, though many studies have shown a correlation between safety climate and safety outcomes (Neal et al., 2000; O’Toole, 2002). Researchers hypothesized that organizational climate would exert influence on safety climate, and safety climate would exert influence on safety performance (Neal et al., 2000). Neal et al. (2000) defined safety performance as compliance with procedures and promotion of safety. It should be noted this research relied on self-reporting of safety performance, which has been criticized in the literature as potentially biased (Barling et al., 2002). Zohar asserted “safety climate research has been hampered by a lack of criterion data”

(Zohar, 2000, p. 589). O'Connor et al. (2011) suggested using objective data such as FOQA to evaluate safety performance.

The findings of the Neal et al. (2000) research support the hypothesis that organizational climate had a significant impact on safety climate. Safety climate had a significant impact on self-reported safety compliance, and safety climate is a predictor of safety performance (Neal et al., 2000).

Additional criterion-based safety climate research was conducted to predict the effect of group climate on *micro-accidents* in the manufacturing industry (Zohar, 2000). This research used a newly developed scale to estimate the perception of safety climate of factory workers. The data on micro-accidents was recorded during the five-month period following the safety climate survey. The results established an empirical link between safety climate and micro-accidents where the group safety climate predicted the safety outcomes (Zohar, 2000). Zohar's research suggested that an increase in micro-accidents was a predictor of larger or catastrophic accidents (Zohar, 2000). In 2004, there was a study conducted in Japan on the track maintenance train operators' attitudes versus objective accident data. The findings suggested that operator attitudes were significantly correlated with accidents, and the recommendation called for proactive improvements in attitudes in order to improve safety (Itoh et al., 2004).

Cooper & Phillips (2004) conducted a safety climate study before and after a behavioral safety initiative. Their findings concluded the relationship of safety climate to safety behavior though the relationship between safety behavior and accidents was not as strong as other similar findings in the literature. Though the researchers concluded that the statistical relationship between safety climate and accidents was neither direct nor significant, the research suggested that safety climate measurements are useful in assessing the effectiveness of how safety is operationalized in an organization (Cooper & Phillips, 2004).

A case study was undertaken to evaluate the safety culture of a large construction company and its influence on safety performance. The construction company had implemented safety initiatives that had varied in success across different regions. The case study employed a mixed method analysis consisting of in-depth interviews, safety surveys, and qualitative observations. The results indicated that safety culture had a mediating role over safety performance (Cai, 2005). One main concern that was identified was the construction company was found to be taking the human error position when determining the cause of accidents rather than an organizational error approach, which is harmful to safety culture and safety reporting (Cai, 2005).

Clarke published a meta-analysis of criterion-based research of the relationship between safety climate, safety performance, and accidents in 2006. The research showed that, in all studies, the relationship between safety climate was found to be positive, though weak, and with a large standard deviation; therefore, the safety climate link to accidents was not strongly supported (Clarke, 2006). In the case of prospective research designs where the safety climate measurement takes place before the safety data were collected, the link between safety climate and accidents was found to be valid and generalizable (Clarke, 2006). The link between safety climate and safety performance was positive, and overall the research supported the concept that improving safety climate would improve safety performance (compliance and participation) and help to reduce accidents (Clarke, 2006).

Few multi-year studies have been conducted, but one exception is the research by Neal and Griffin in 2006. This study was conducted over a five-year period with safety climate measures from two separate sampling frames compared with criterion accident data. The researchers were attempting to determine a link between safety climate and safety motivation as well as the link between safety motivation and behavior, under the hypothesis that safety motivation plays a mediating role between safety climate and safety performance. The researchers found that there is a reciprocal relationship between safety motivation and safety participation (safety participation is a component of safety performance), which indicates that participating in safety tasks that benefit the organization leads to higher motivation (Neal & Griffin, 2006). Additional findings showed that, at the group level, self-reported safety behavior has predictive validity for accidents (Neal & Griffin, 2006).

Despite all of the positive results cited above, Johnson opined that the predictive validity of safety climate had not yet been firmly established in the literature (Johnson, 2007). Johnson conducted a study that used the 16 item Zohar Safety Client Questionnaire (ZCSQ) on 292 workers at three manufacturing facilities and subsequently monitored the accident experience data for the following five-month period. The results showed that the ZCSQ could be reduced to 11 items with little loss of explanatory power, and the predictive validity of safety climate to predict accidents was confirmed (Johnson, 2007).

The research result of safety climate as a valid predictor of safety performance was further supported by Chang and Lu (2009) and then by Kao et al. (2009). However, the predictive validity of safety climate and patient outcomes were not supported in

Wilson’s (2007) and Lyon’s (2007) dissertations. Lyon’s dissertation on the relationship between safety culture and infections found contrary evidence that safety climate was low when infections were low (Lyon, 2007). Goodheart & Smith (2014) suggested that safety climate predicting safety performance might not be generalizable to aviation from other industries.

O’Connor et al. (2011) conducted an in-depth meta-analysis of safety climate studies in the aviation industry. The research analyzed 23 studies conducted in aviation. Pilots and mechanics made up nearly 65% of the respondents, while 17% had a mixed target, and the remainders were either cabin crew or ground handlers. Half of the respondents were military personnel. O’Connor argues that safety climate research needs to continue to focus less on developing and validating new survey instruments and more on the ability of the existing instruments to discriminate among groups (O’Connor et al., 2011). The construct validity of safety climate as a social measure is reasonable, though there is a lack of agreement in themes across aviation safety climate questionnaires (O’Connor et al., 2011). There would be a benefit to consolidating the themes in the literature and to have more consistency. The greater problem with the extant research is the lack of testing of discriminant validity (O’Connor et al., 2011). If the existing instruments are not able to discriminate among groups with differing safety performance scores, the instruments will be of little usefulness as a leading indicator of safety issues (O’Connor et al., 2011).

Gibbons, von Thaden, and Wiegmann designed a survey instrument in 2006 with the intention of being more comprehensive than the existing safety climate and safety culture instruments available. The authors named this improved survey the Commercial

Aviation Safety Survey (CASS). The questionnaire started as an 84 item tool but after confirmatory factor analysis (CFA), was later revised to 55 items with four general factors (Organizational Commitment, Operations Personnel, Informal Safety System, and Formal Safety System) and 12 sub-factors as shown in Figure 2 (Gibbons et al., 2006; O'Connor et al. 2011; Alsowayigh, 2014). The CASS has been chosen for this research because it has been deployed in several airlines worldwide, including Saudi Airlines in 2014 and has maintained consistent results.

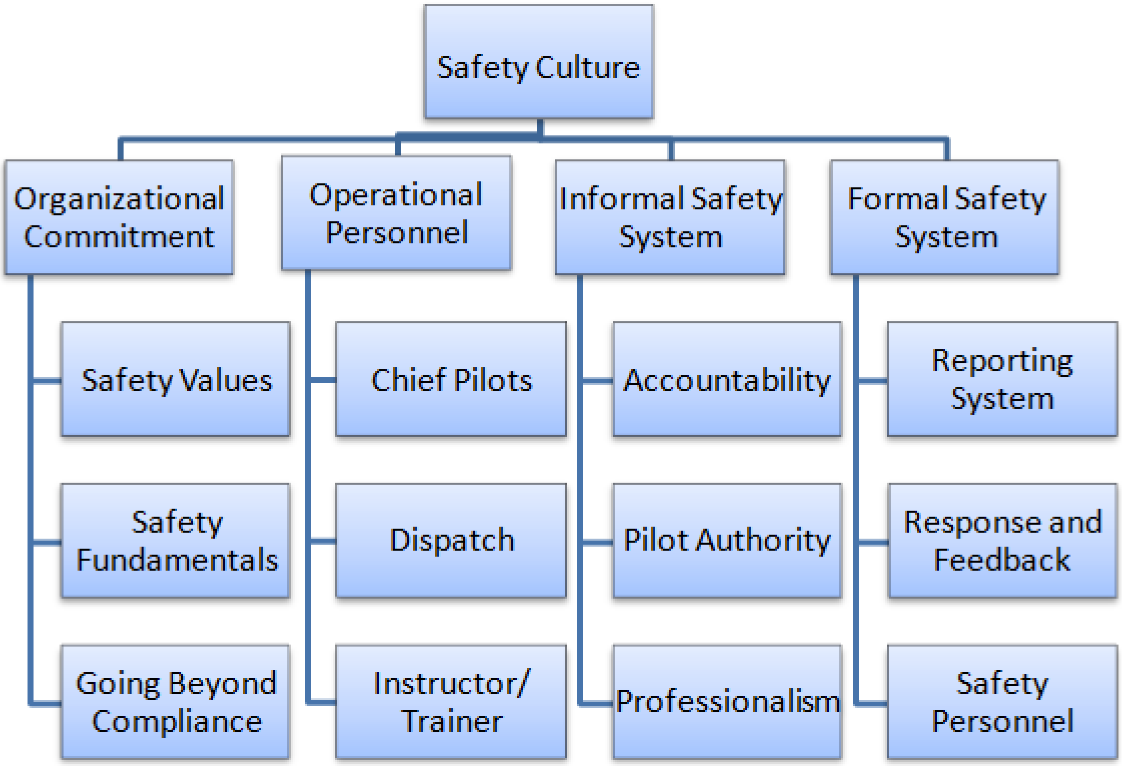


Figure 2. Commercial Aviation Safety Survey Factor Structure (Alsowayigh, 2014 p.30).

The Saudi Airlines study used the CASS and compared it with self-reported safety performance, which was measured by pilot attitude to violations and pilot error behavior (Alsowayigh, 2014). The study included 247 voluntary responses which represented a 29% response rate from active Saudi Airlines pilots. The results were validated with CFA, and the relationships among variables were analyzed using structural equation modeling (SEM) (Alsowayigh, 2014).

The Saudi Airline results showed that safety culture had a direct and significant influence over pilot's own attitudes to violations and had a mediating role on pilot error behaviors (Alsowayigh, 2014). Safety culture was found to have neither a direct nor a significant influence over pilot error behavior, though this relationship was mediated by pilot's attitude to violations (Alsowayigh, 2014). Pilot's commitment to the airline did not have a significant relationship with either pilot error behavior or attitude to violations, which suggests that a pilot's safety performance, as measured by these self-reported variables, is not strongly related to the characteristics of the organization where the pilot is employed (Alsowayigh, 2014).

The CASS was designed to be a comprehensive instrument to measure the safety culture for aviation organizations (Gibbons et al., 2006). Other multi-use instruments, such as Zohar's safety climate scale are significantly shorter than the CASS and were designed to take a quick view or snap shot of safety climate of many types of organizations, whereas the CASS was developed specifically for the aviation industry. Additionally, the CASS has also been deployed in many airlines worldwide, and the constructs have remained stable. The comprehensive nature of the CASS does make it longer than other instruments, which requires respondents to spend more time completing the survey.

Employee Commitment to the Organization

In the past, the commitment to the organizations was measured to determine the likelihood of employee retention. In a longitudinal study over a six-year period, Sheridan (1992) studied the organizational commitment by young accountants entering the profession. The researcher controlled for changes in the economy and for labor market fluctuations to evaluate the role of organizational culture and its relationship to employee retention.

At about the same time the Sheridan (1992) six-year longitudinal study was concluding, Meyer & Allen (1991) were researching the causal implications of employee commitment to an organization. Their research showed that employee commitment to an organization was related to how the employee was involved in decision making (Meyer & Allen, 1991; Walton, 1985) in the organization and how their company decisions aligned with their own values (Meyer & Allen, 1991). The researchers during this period began to analyze the construct of employee commitment to the organization as a causal factor; the researchers agreed that the existing structural equation models only showed evidence of directional relationship without any conclusive findings (Meyer & Allen, 1991).

Researchers interested in the construct of employee commitment to the organization continued to search for directional relationships. Alsowayigh (2014) researched the pilot’s commitment to the Saudi Airlines, not as a casual factor, but as a mediator between safety culture and safety performance (Alsowayigh, 2014). The pilot commitment to Saudi Airlines was measured with the Porter et al. (1974) nine-item Organizational Commitment Questionnaire (OCQ). The OCQ has a 14-item version and nine-item version; the nine-item version was suggested in the literature (Commerias & Fournier, 2001) and was used in the Alsowayigh (2014) study. The OCQ measured the employees' willingness to go above and beyond for their organization and to what extent employees associated themselves with the company's success (Commerias & Fournier, 2001).

Alsowayigh's results (2014) showed that the pilot's commitment to Saudi Airlines did not play a mediating role between safety culture and safety performance as measured by self-reports of pilot error behavior and pilot attitude to violations (Alsowayigh, 2014). However, it did reveal that safety culture was a statistically significant predictor of the pilot commitment to the airline (Alsowayigh, 2014).

Ethics

"Ethics is the area of philosophy that deals with values and customs of a person or society—essentially how one determines what is right or wrong. As far back as Aristotle, ethics has been considered a fundamental driving force of human behavior" (Kapp & Parboteeah, 2008, p. 28). Despite being labeled a fundamental driving force of human behavior, there are relatively few studies about ethics as a construct and the role it plays in the behavior of employees (Freiwald, 2013; Kapp & Parboteeah, 2008).

The question of what is and what is not ethical is often judged by others. There are numerous popular media references to stories of politicians, professionals, athletes, and average citizens who commit acts that are judged by the writers to be wrong or unethical (Brown, Treviño, & Harrison, 2005). The concept used in this research to determine what is right/ethical or wrong/unethical is closest to the rule-based utilitarianism concept (Rachels, 2002). Those acts that are considered wrong or unethical are the ones that primarily benefit the person committing the acts while at the same time actually or potentially harming others (Rachels, 2002). Those acts that are considered altruistic and benefit others or society as much as or more than the person committing the acts are considered right or ethical (Rachels, 2002).

There are rare acts that may benefit others far more than, or even risk injury to, the person committing the acts; these acts are considered supererogatory, such as entering a burning building to search for those in need of help (Craig & Gustafson, 1998; Freiwald, 2013). Supererogatory acts are considered above and beyond what society considers socially responsible, just, or ethical behavior; therefore, acts do not have to be supererogatory to be considered ethical or right for the purposes of this research.

Ethical Leadership

Ethical leadership is "the demonstration of normatively appropriate conduct through personal actions and interpersonal relationships, and the promotion of such conduct to followers through two-way communication, reinforcement, and decision-making" (Brown, Treviño, & Harrison, 2005, p. 120). Ethical leadership is a dimension of both ethics and leadership. In the literature, there has been little empirical research into either the construct of ethical leadership or the outcomes influenced by ethical leadership (Brown, Treviño, & Harrison, 2005; Craig & Gustafson, 1998; Freiwald, 2013). The construct of ethical leadership was researched by Howell and Avolio in 1992, though their research focused primarily on charismatic leadership. Their results supported the theory that ethical leaders were those willing to listen to subordinates, and unethical leaders refused to listen to them (Howell & Avolio, 1992). Other research studies have showed that employees who perceive their leaders to have high ethical standards are more willing to report problems without fear of reprisal (Brown et al., 2005).

Ethical leaders are considered to be altruistic as judged by their employees; these ethical leaders are the ones acting for the betterment of others, such as other employees (Brown et al., 2005). The literature has shown that leaders should be concerned with their employees' view of their ethics (Craig & Gustafson, 1998). If their employees view these leaders as "attractive, credible, and legitimate" (Brown et al., 2005, p. 120), their actions and behaviors will be emulated by their subordinates. A separate article stated these leaders need to have and maintain a high level of integrity (Craig & Gustafson, 1998). If leaders maintain these qualities, they will hold their employees' attention and influence their behavior (Brown et al., 2005).

Ethical Leadership Scale (ELS)

The ethical leadership scale (ELS) is a survey instrument that was developed by Brown, Treviño, and Harrison in 2005. Their hypothesis stated ethical leadership was an important component of both transformational and charismatic leadership (Brown et al., 2005). The ethical leadership component is the one that relates to the ability of the leader to inspire, and influences to what degree employees want to emulate the leader's behavior

(Brown et al., 2005). Brown et al. demonstrated that the construct of ethical leadership influenced behavioral outcomes such as job satisfaction, dedication, or commitment to the organization and the employee's willingness to communicate issues (Brown et al., 2005).

Brown, Treviño, and Harrison developed the ELS by initially researching the existing literature for extant measurement instruments of charismatic, transformational, and ethical leadership. The researchers independently developed two versions of a measurement instrument before subsequently comparing them and eliminating their overlap (Brown et al., 2005). The researchers then conducted in-depth interviews with 20 MBA students with professional work experience (Brown et al., 2005) to further refine the ELS. The initial result was a 48-item survey instrument on a five point Likert scale that measured ethical leadership.

Brown, Treviño, and Harrison conducted seven studies with the ELS. Study one was conducted on 154 MBA students that were, on average, 29.3 years of age, 68.9% male, and had 6.3 years of professional work experience (Brown et al., 2005). After Brown et al. conducted an Exploratory Factor Analysis (EFA), principal factor analysis, with an oblique rotation (direct oblimin), and scree plot, the eigenvalues showed one primary factor accounted for 60.1% of the variation (Brown et al., 2005). Further analysis and consultation with construct experts revealed the ELS could be reduced to a 10-item scale with little loss of explanatory power (Brown et al., 2005). Studies three through six were conducted with the revised 10-item ELS. The tests included CFA and discriminant analysis that contributed to the confirmation that the ELS had both construct and discriminant validity. Study seven was conducted with the ELS and included structural equation modeling (SEM) for the analysis of in-group agreement. The results indicated the ELS predicted several items, including the employees' willingness to report problems to leadership (Brown et al., 2005).

Ethics as a Predictor of Behavior

The literature on the relationship between ethics and safety performance has not been clearly defined or well researched (Freiwald, 2013; Kapp & Parboteeah, 2008). There is a belief that management has an ethical obligation to maintain safety (Erikson, 1997). Research has suggested that if employees believe that management values safety, then safety performance is enhanced (Erikson, 1997). Other studies have asserted that ethical climate has a strong influence on safety behavior (Kapp & Parboteeah, 2008). Freiwald's (2013) research showed a strong positive relationship between ethical leadership and workplace injuries. The results of the survey and subsequent SEM showed a statistically significant relationship between employees' perceptions of ethics in their company leadership and fewer injuries (Freiwald, 2013). Additionally, Brown, Treviño, and Harrison's ELS (2005) demonstrated the ability to predict the employee's willingness to discuss problems with organizational leadership (Brown et al., 2005).

Criterion or Self-Reported Outcomes

There are many studies in the literature that support the theory that safety climate influences safety behavior, though some concerns exist about possible confounding variables. Theoretically, the relationship between safety climate and safety behavior may be caused by other factors such as the social exchange theory (Vroom, 1964) where the company’s concern for the employees is reciprocated through the employees trying to provide value in return by adhering to safety policies or alternately, by the expectancy-valance theory where the employees want to participate in the safety program due to a belief that it will lead to an outcome valuable to themselves (Neal & Griffin, 2006). Additionally, there were other concerns in the literature about reverse causality in the relationship between safety climate and safety behavior / safety performance, though the reverse causality concerns were rejected by both Clarke (2006) and Neal and Griffin (2006).

Despite the aforementioned concerns, there have been a series of safety climate or safety culture studies that indicate a strong and statistically significant relationship between safety climate or culture and safety behavior (Neal & Griffin, 2006; O’Toole, 2002). These results have led to an ongoing debate on the superiority of criterion-based safety outcomes versus self-reported safety outcomes.

In 2000, Zohar wrote that safety climate research was being hampered by a lack of criterion data (Zohar, 2000). Johnson’s study in 2007 supported the predictive validity of safety climate as characterized by criterion data. More recently, both Freiwald (2013) and Alsowayigh (2014) supported the concept that safety culture influenced directly or indirectly self-reported injuries and safety performance, respectively. Both methodologies have their merits and their issues. The concern with criterion-based reports is that there is bias in the reporting, where many minor occurrences such as smaller injuries or minor violations can go unreported, therefore tainting the results (Thompson et al., 1998). These minor occurrences have the potential to be leading indicators for a decline in safety performance, but only if reported (Thompson et al., 1998). Self-reported survey results on safety climate also may contain bias from the respondents based on having been in an accident or witnessing one (Neal & Griffin, 2006).

Criterion Based Outcomes in Aviation

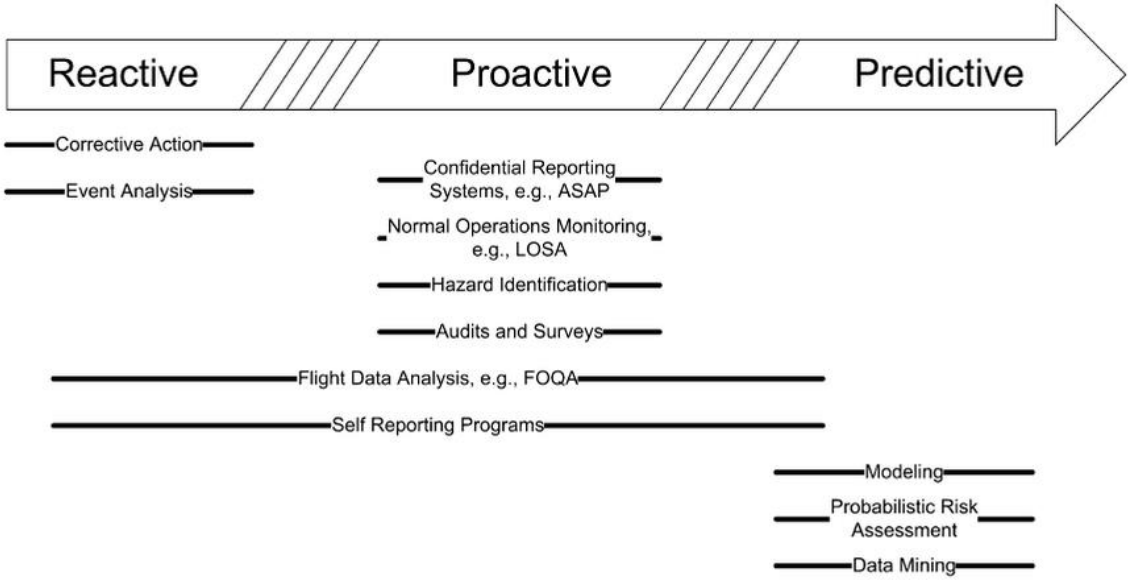


Figure 3. Safety Management Continuum. (Stolzer et al., 2011, p. 235).

There are several scholars such as Zohar and O'Connor et al. that support quantitative criterion data superiority versus forms of data such as survey results from self-reports of errors or violations. Zohar's (2000) research on micro-accidents was evidence of the predictive value of safety climate, though the researcher relied upon smaller accidents that were properly documented. Thompson et al. (1998) suggests that many smaller accidents go unreported, which has the potential to bias future studies without the controls employed by Zohar.

In Figure 3, Stolzer and Goglia's Safety Management Continuum illustration (Stolzer & Goglia, 2015, p. 2015) shows that in an SMS, many of the sources of data are criterion based. Examples include data from flight data analysis / FOQA, most of the predictive sources of data from data mining, probabilistic risk assessment, and modeling are inherently criterion-based data that are quantitative and not self-reported. O'Connor et al. also suggested FOQA would be a possible criterion data source for the prediction of aviation accidents (O'Connor et al., 2011). Despite the potential benefits, FOQA data in general aviation aircraft can be very expensive (Mitchell, Sholy, & Stolzer, 2007), and the use of data from those devices would raise many privacy and autonomy concerns.

O'Connor, et al. stated the accident event rate in aviation is already too low to generate valid predictive models based solely on accidents themselves (O'Connor et al., 2011); therefore, aviation needs reliable and affordable measures of the deterioration of safety performance before the chain of events that leads to accidents begins.

Criterion Measurement Variability and Reliability

Criterion, or hard quantitative based data, is unlikely to be comprised of comparable measurements across diverse aviation organizations. The measurements of parameters will be calibrated differently and therefore have different meaning from organization to organization. For example, the accelerometer is designed to measure the amount of gravity or g-forces applied to the aircraft upon landing. During one study conducted by Cistone et al. (2011), many inconsistencies were discovered in the measurement of the g-forces experienced by one airline's fleet. The variability of the measurements, even within a single aviation organization, was such that it made it difficult to derive valid results. Sources of variability included that accelerometers were not all placed on the aircraft in the same location, the levels of calibration varied from accelerometer to accelerometer, and the manufacturer of the accelerometers varied. Additionally, the variation among aircraft types and the different levels of g-force tolerance for those different types made cross comparisons of the importance of specific g-force measurements significantly more difficult. This example illustrates the challenge of deriving useful comparable data even when measurements were all conducted within the same aviation organization. The same type of research, if attempted across many diverse aviation organizations with over 100 different aircraft types, would suffer even more from this problem. Therefore, a useful cross comparison of hard data on some measures may be nearly impossible.

Self-Reporting Outcomes

Many studies have shown that safety climate either directly or indirectly influences both self-reported and criterion-measured safety behavior. Alsowayigh (2014) and Freiwald's (2013) research results supported safety culture / climate and ethical leadership as a viable mechanism to predict self-reported safety outcomes. Clarke (2006) concluded that safety culture predicted safety performance, and safety performance was a valid and generalizable predictor of accidents when accident involvement was measured after the safety climate measurement.

Consistent Methodology

O’Connor et al. (2011) have suggested as a best practice that researchers use consistent measurements in order to compare results with similar themes. Yet, there are few replicated studies in the literature conducted regarding safety culture and self-reported safety performance of different organizations such as Fractionals. This research has the potential to re-confirm the relationship of safety culture, pilot commitment to their organization, and safety performance of similar organizations. This cross comparison would be an inexpensive measure to implement and monitor, yet the findings could have a meaningful impact on improving safety in other U.S. jet FAR 135 companies.

Hypotheses

A structural equation model was used to evaluate the relationship among the variables used in this study. Previous studies found in the extant literature were analyzed to develop the conceptual framework for the model. This study augments previous work by evaluating the relationship of safety culture with pilot commitment to the organization, ethical leadership and self-reported safety performance. The assumptions were based on the findings from the more recent studies by Alsowayigh (2014) and Freiwald (2013), though the foundations of the assumptions date back to long established constructs. The hypotheses shown in Figure 4 were tested in this research.

H_1: A *positive* s*afety culture has a positive influence on pilot commitment to the organization.*

Safety culture was found to have a direct and significant influence over pilot commitment to the airline in the Alsowayigh (2014) study. This relationship is likely to remain consistent with the pilots of the U.S. jet Fractionals.

H_2: *A positive safety culture has a positive influence on ethical leadership.*

H_3: *A positive safety culture has a negative influence on safety performance.*

The findings from Alsowayigh (2014) showed there was no significant direct effect between safety culture and pilot error behavior. Previous research (Alsowayigh, 2014) has shown a significant and direct negative relationship between safety culture and own attitude to violations. The same research also demonstrated the relationship between safety performance and safety culture was not mediated by pilot commitment to the airline (Alsowayigh, 2014). The relationship in this study is unlikely to be mediated by the Fractional pilot commitment to the organization.

H_4: *A positive pilot commitment to the organization has a positive influence on safety performance.*

Previous research (Alsowayigh, 2014) has shown that pilot commitment to the airline did not have a significant relationship with the pilot's performance in the cockpit. Alsowayigh (2014) suggested that safety performance in the cockpit was driven by their professionalism as a pilot.

H_5: *A positive ethical leadership has a negative influence on safety performance.*

Ethical leadership has been shown to be related to the safety outcomes subcomponent of safety climate construct (Freiwald, 2013). This study has the potential to find a relationship between ethical leadership and safety performance.

H_6: A positive ethical leadership has a positive influence on pilot commitment to the organization.

Ethical leadership has been correlated to employee commitment to the organization (Trevino et al., 1998). This study has the potential to find a relationship between ethical leadership and pilot commitment to the organization.

Hypothesized SEM Model

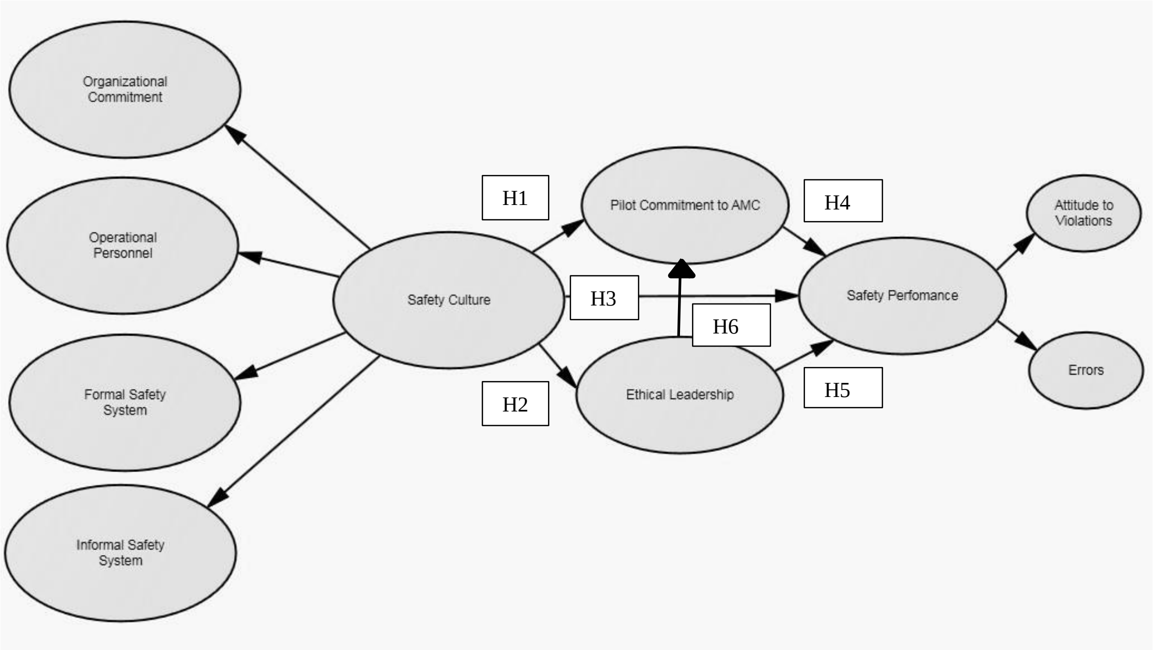


Figure 4. Hypothesized SEM Model.

Summary

There exists a material gap in the literature of research focused on Fractional and Charter jet operations. Fractional and Charter operations are dissimilar to airline operations in several key areas. One such area is the amount of airports served by Fractional and Charter far exceeds those served by the airlines. This means that Fractional and Charter operators often use second and third tier airports that have shorter runways with less safety equipment and possibly no operating control tower. Another area that is dissimilar to most airline operations many Fractional and Charter flights encounter is autonomy. This means the pilots for many Fractionals and Charters perform the majority of their duties autonomously without the benefit of direct supervision.

There is an opportunity to advance aviation research using consistent methodologies (O'Connor et al., 2011) through the study of corporate jet operations. There are distinct differences in the historical safety performance between Fractionals and Charters despite operating under similar FAA regulations. This study determined a baseline of safety culture and ethical leadership for the Fractionals. These baselines can be used in future research to search for differences between Fractionals and Charters to begin to draw inferences of causation. If causal inferences can be drawn and operational changes enacted, the historical safety gap between these two groups can potentially be narrowed. In addition to safety in corporate jets being enhanced, the lessons learned may be applied to other sectors of aviation.

CHAPTER III

METHODOLOGY

A review of the available literature on safety culture, ethical leadership, and safety performance supports that structural equation modeling (SEM) is an appropriate method to determine the relationships among variables and is an effective means of investigating the hypotheses of this study. Freiwald (2013) used this approach in the determination of the relationship among ethical workplace climate, safety climate, and occupational injuries. SEM was also employed by Alsowayigh (2014) when establishing the relationship among safety culture, pilot commitment to the airline, and safety performance.

Research Approach

SEM is a methodology that tests hypotheses in a confirmatory manner. The underlying regression equations in SEM determine a structure to the relationships under study and display these relationships graphically for better understanding. SEM tests these hypothesized relationships simultaneously. If the model is adequate, the underlying relationships may be determined to be both directional and possibly causal. SEM is used for confirmatory analysis and not for exploratory analysis (Byrne, 2010).

The naming of the factors was based on the previous construct names used in the literature, abbreviated due to the space constraints, and adapted for improved recognition. As shown in Table 1, the exogenous variable is Safety Culture, and the endogenous variables are Pilot Commitment to Aircraft Management Company (AMC), Ethical Leadership, and Safety Performance.

Table 1

Study Variables

Variable	Dimension	Abbreviation	Description
Exogenous Variable			
Safety Culture	Organizational Commitment	OC	How the AMC values safety and if the AMC goes above and beyond the minimum requirements.
	Operations Personnel	OP	This evaluates AMC personnel (chief pilot, dispatch, trainers).
	Informal Safety System	IS	This evaluates the support and encouragement among AMC pilots toward safety.
	Formal Safety System	FS	This rates the safety reporting and feedback loop and AMC's safety personnel.
Endogenous Variables			
Ethical Leadership	Ethical Leadership	EL	This evaluates the perception of AMC leadership's moral and ethical behavior.
Pilot Commitment to AMC	Pilot Commitment to AMC	PC	This evaluates the pilot's willingness to go above and beyond for the AMC.
Safety Performance	Pilot Error Behavior	ER	This is a self-report of mistakes made by AMC pilots during operations.
	Pilot Own Attitude Toward Violations	AT	This is a self-report of AMC pilot's attitude toward the regulations and their willingness to bend the rules.

Design and Procedures

The survey instrument was modeled after the instrument in the Alsowayigh (2014) study with minor adaptations to adapt from commercial aviation to general aviation vernacular. The ELS was added to the end of the survey to preserve the question order from the Alsowayigh (2014) study. The survey was constructed and facilitated in Survey Monkey® online service. The Survey Monkey® online service was selected based on previous studies found in the literature.

All pilots who were invited to take the research survey and allowed access to the research survey were verified with FAA records to hold an Airline Transport Pilot certificate (ATP), a current First Class Medical certificate, and a type rating consistent with those aircraft types flown by U.S. Fractional companies. The prequalification process (Pre-Qual) included verifying the credentials of each respondent before the respondents were allowed access to the survey.

Prior to employment at Flight Options, Flexjet, and Net Jets, each pilot was required to meet the aforementioned minimum pilot standards. Therefore, all Fractional pilots on the union message boards met the Pre-Qual standard and were allowed immediate access to the research survey.

A separate pre-qualification survey was set up in Survey Monkey® requiring pilots who did not undergo the Pre-Qual process to provide their name, home town, level of medical certificate, level of pilot certificate, and type ratings held. A research assistant verified the credentials for each pre-qualification survey respondent with the FAA database. If the respondent's answers were not verified, the respondent was not sent the research survey.

The Fractional pilots who were invited to take the research survey by direct mail and ERAU alumni emails were pre-qualified by a research assistant prior to receiving the invitation to participate. These pre-qualified pilots who opted to participate were allowed immediate access to the research survey.

There were three other sources of pilots who volunteered to participate in the research study. Aviation International News (AIN) has a bi-weekly newsletter that ran three solicitations in its newsletter asking Fractional pilots to participate in a research study. Of the estimated 1,000 plus Fractional pilots who may have seen the solicitation, 50 pilots were verified through the Pre-Qual process and invited to take the research survey. Of the pilots who passed the Pre-Qual process, 37 completed the research survey. This process was repeated in the Flight Safety Information (FSI) newsletter, where 20 additional fractional pilots volunteered to participate, 8 pilots passed the Pre-Qual process, and 6 pilots completed the survey. In addition to the newsletter solicitations, a former Flight Safety Instructor for Net Jets invited several current Net Jets' pilots to take the survey. The pilots who responded were required to go through the Pre-Qual process before taking the research survey.

All pilots who volunteered to participate were directed to an informed consent form (see Appendix B) prior to taking the survey. The pilots who consented were prompted to also confirm their position as a current Fractional pilot for a U.S. based Fractional program. The survey was constructed to terminate if the pilot did not confirm his or her current status as a pilot at a U.S. Fractional AMC. The pilots then continued to the demographics portion of the survey and were then asked to provide their perceptions of their company's safety culture, their own commitment to the organization, ethical leadership qualities of their organization, and their safety performance.

The survey software was constructed to limit the pilots to one answer for each item within the instrument. All incomplete surveys were excluded from the study. The data received through the Survey Monkey® software were exported directly to IBM SPSS 23 software for further analysis. A confirmatory factor analysis and full structural equation model were conducted with IBM AMOS 23.

Apparatus and Materials

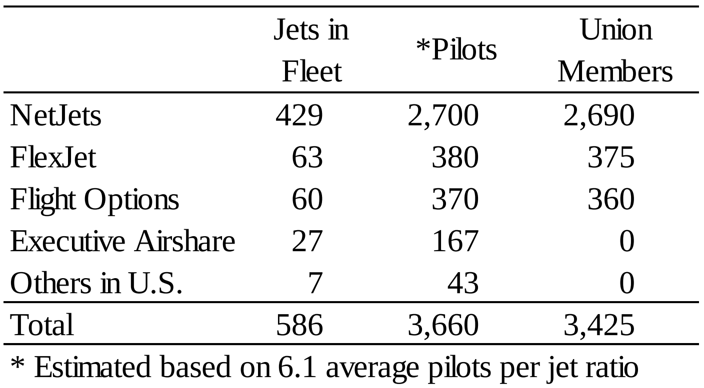
The survey was facilitated electronically and could be taken on most smart phones, tablets, or computers. The survey was developed, delivered, and data were collected through the Survey Monkey® online platform. The survey consisted of 93 total questions. The response to the first question determined if the respondent was qualified to participate in the study. The subsequent five questions were demographic questions referring to the primary aircraft flown, year of birth, company position, flight experience, and tenure with the AMC. The remaining 87 questions were adapted from previously validated surveys with necessary modifications to adapt from commercial aviation vernacular to that of general aviation. The last question was added based on a question inserted in the Alsowayigh (2014) research, and because it applied similarly to this study.

Population/Sample

The population of Fractional jet pilots in the United States, as shown in Table 2, is estimated to be 3,660, with 3,425 of those pilots being unionized. This estimate is based on a ratio of 6.1 pilots per aircraft managed by the Fractional companies. These figures are derived from the ratio of union members to aircraft managed by their respective Fractional companies. NetJets is the largest Fractional company with 429 aircraft in the United States (JetNet Fractional Program Summary, 2015) with an estimated 2,700 pilots. Net Jets' pilots are unionized, and an estimated 2,690 (99.8%) are represented by the Net Jets Association of Shared Aircraft Pilots (NJASAP). Flight Options has 60 aircraft in the United States with an estimated 385 pilots. Flight Options' pilots are unionized with an estimated 380 (99%) that are represented by the International Brotherhood of Teamsters #1108. FlexJet was recently acquired by Flight Options and has 66 aircraft in the United States with 350 pilots. FlexJet and Flight Options' pilots voted to unionize in December of 2015, and the FlexJet pilots became members of the Flight Options' union (IBT 1108). The remaining Fractional pilots are employed at Executive AirShare and several small regional Fractional programs, which have an estimated total of 150 additional non-union Fractional jet pilots.

Table 2

Fractional Pilots in U.S.



	Jets in Fleet	*Pilots	Union Members
NetJets	429	2,700	2,690
FlexJet	63	380	375
Flight Options	60	370	360
Executive Airshare	27	167	0
Others in U.S.	7	43	0
Total	586	3,660	3,425

* Estimated based on 6.1 average pilots per jet ratio

The sampling frame consisted of an estimated minimum of 3,460 Fractional pilots. There were the 3,425 union pilots who have access to their union message boards plus an additional 35 Fractional pilots who were contacted directly through U.S. mail (See Appendix F) or email. Each of the 3,460 pilots had a non-zero chance of participating in the research survey. The sampling frame, therefore, consisted of 95.2% or more of U.S. Fractional pilots. The remaining 4.8% (175 pilots) of Fractional pilots may have seen the multiple invitations in both Aviation International News (AIN) alerts and / or the Flight Safety Information Newsletter. Due to these newsletter invitations, many of the remaining non-union Fractional pilots had a non-zero chance to participate in the survey, therefore minimizing coverage error (Dillman et al., 2009).

The SEM methodology requires the sample size to vary with the complexity of the model under study (Westland, 2010). Determination of the appropriate sample size for the SEM model is non-trivial (Westland, 2010) and must meet the requirements considered acceptable in the available literature. Presented in Table 3 are several researchers and their suggested sample sizes based on the hypothesized SEM in this study. This study has 87 observed variables and 10 latent variables with a targeted significance level of .05 ($p = .05$), effect size of .1, and statistical power of .8. The sample size based on the majority of the literature is 200 respondents or greater. The current study has over 300 completed and valid responses ($n = 305$). The current study's sample size of 305 responses satisfies the requirements of Ding et al.'s (1995) ($n = 150$), Kline's (2005) ($n > 200$), and Boomsma & Hoogland (2001) ($n > 200$) as shown in Table 3.

Table 3

SEM Sample Size Requirements

	Researcher(s)	Year
N: 100-150	Ding, Velicer, and Harlow,	1995
N: > 200	Kline	2005
N: > 200	Boomsma & Hoogland	2001
N: 579 to 3,231	Westland	2010

Sources of the Data

The data used in this study were obtained through the online survey responses received by pilots who volunteered to complete the survey. The survey is a compilation of five different instruments. The survey questions seen by the respondents are displayed in Appendix B.

The respondents from electronic solicitations were presented a link in a newsletter, email, or on their union message board. The respondents from the post card in Appendix F were directed to a web domain (www.safetyculturesurvey.org) that connected them to the research survey. All respondents provided their informed consent, shown in Appendix B, before advancing to the research survey. No direct emails of any of the recipients were provided by any of the organizations targeted for this study. Union members posted a direct link to the survey on their union message boards. Additional controlled invitations were sent via direct email, email, a posted link on controlled websites, or electronic newsletters.

Prior to conducting this research, initial training from the Collaborative Institutional Training Initiative (CITI) was completed and an application was submitted to the Institutional Review Board (IRB) at Embry-Riddle Aeronautical University. The application received approval prior to start of data collection. The IRB approval letter is presented in Appendix A.

Data Collection Device / Survey Design

The study included six demographic variables plus 87 observed variables (see Appendix B) that represented ten constructs that were derived from five instruments that had been used extensively in the literature. The instruments were:

Safety culture (SC). The Commercial Aviation Safety Survey (CASS) was developed and validated by Gibbons et al. (2006). Initially, the instrument was an 84 item scale that consists of five constructs; however, during validation, the instrument was reduced to a 55 item scale with four constructs. Each question is measured using a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The main factors include organizational commitment (OC), operational personnel (OP), formal safety systems (FS), and informal safety system (IS) (Gibbons et al. 2006). Organizational commitment (OC) items include, “management expects pilots to push for on-time performance, even if it means compromising safety.” Operational personnel (OP) items include, management “inappropriately uses the MEL (e.g., use when it would be better to fix equipment).” Formal safety systems (FS) items include, “the safety reporting system is convenient and easy to use.” Informal safety system (IS) items include, “management shows favoritism for certain pilots.”

Pilot commitment to AMC (PC). The Organizational Commitment Questionnaire (OCQ) was initially developed by Porter et al. (1974) and has two versions: a long and short version. The long version has 15 questions and is multi-dimensional, whereas the short version, which is recommended by Commerias and Fournier (2001), has 9 questions and is considered uni-dimensional. The questions are measured on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). Items include, “I talk up this organization to my friends as a great organization to work for,” and this aircraft management company “inspires the best in me in the way of job performance.”

Ethical leadership (EL). The ethical leadership scale (ELS) was developed by Brown et al. (2005) and originally consisted of 48 items. After Brown et al. (2005) conducted Exploratory Factor Analysis (EFA), the ELS was reduced to a 10 item instrument. This instrument used a 5-point Likert scale from 1 (Strongly Disagree) to 5 (Strongly Agree). Items include, management “makes fair and balanced decisions” and management “can be trusted.”

Pilots’ own attitude to violations (AT). The own attitude to violation scale was developed by Fogarty (2004) as a self-reported scale and included nine items. These items were measured on a 5-point Likert scale. Items include, “bending a procedure is not the same as breaking it” (Fogarty, 2004).

Pilot error behavior (ER). The error scale questionnaire was developed by Fogarty (2004) and included three items. This survey was initially developed as a self-reported scale for airline maintenance personnel. Alsowayigh stated, “The questions are general and can be applied to airline pilots” (Alsowayigh, 2014, p .38). The questions are measured on a 5-point Likert scale. Items include, “I make errors in my job from time to time” (Fogarty, 2004).

Construct Validity

The items in the study were measured to confirm they represented the latent constructs they were expected to measure based on the available literature (Hair et al., 2010). The four components of construct validity are Convergent, Discriminant, Face, and Nomological (Hair et al., 2010). The model diagnostics of each component was tested in this study.

The five instruments selected to create the composite instrument in this research have all have been used repeatedly in the literature. Each instrument has had its construct validity demonstrated in the literature, and many of these instruments have been used in multiple studies.

Convergent validity. There are several measures used to estimate the convergent validity of the items in a research study (Hair et al., 2010). The factor loadings and average variance extracted (AVE) were each checked in the model (Hair et al., 2010).

The AVE is a summary measure of convergent validity, and the formula is shown in Figure 5. The standardized factor loadings for each item on each construct were squared and then a construct average variance was established (Hair et al., 2010).

$$\text{AVE} = \frac{\sum_{i=1}^{n} \lambda_i^2}{n}$$

Figure 5. Average Variance Extracted (Hair et al., 2010).

Reliability. Reliability was tested using Cronbach’s alpha (1951). Before inclusion in the study, each of the five instruments employed to create the composite survey was previously tested for internal consistency. In each case, the instruments used in this study satisfied the minimum suggested value of .7 (Hair et al., 2006) as measured by Cronbach’s alpha (1951), with the exception of the pilot error scale, which had been measured at .6 in one study (Fogarty, 2004).

In recent SEM studies, construct reliability (CR) has been tested by comparing the square of the summed standardized factor loadings with the error variances (Hair et al., 2010) for each factor as shown in Figure 6. CR values over .7 suggest good reliability (Hair et al., 2010).

$$CR = \frac{(\sum_{i=1}^{n} \lambda_i)^2}{(\sum_{i=1}^{n} \lambda_i)^2 + (\sum_{i=1}^{n} \delta_i)}$$

Figure 6. Construct Reliability Formula (Hair et al., 2006, p. 777).

Discriminant validity. The discriminant validity is a measure by which each construct is truly distinct (Hair et al., 2010). This is tested through a comparison of the variance-extracted percentages of two constructs with the squared correlation between the two constructs. (Hair et al., 2006). Kline (2005) suggested that a model has discriminant validity if no two factors have correlations higher than .85.

Nomological & face validity. Nomological validity was analyzed by reviewing the correlations between the constructs to determine if they made sense (Hair et al., 2010). The face validity was analyzed by a review of the content of the items in each construct to ensure they measured what was intended. Face validity of the items of each construct was also analyzed by two experienced general aviation pilots. These two pilots had a combined experience of more than 40 years and had both been employed in a Fractional program.

Treatment of the data

Demographic Data. Descriptive statistics were computed from the survey data based on pilot tenure at the AMC, weight of equipment flown, position, and age. The pilot demographic data were also collected for potential inclusion in future research to compare group differences.

Missing data. The survey was constructed to require one answer for each question prior to continuing the survey. A not applicable choice was not presented in the instrument. All 52 incomplete responses were excluded from the analysis; therefore, there were no surveys with missing data used in the study.

Outliers. The Mahalanobis distance (D^2) was calculated for each of the variables searching for significant outliers. The literature suggests that outliers should be retained unless their retention is particularly detrimental to the model (Hair et al., 2006). The model was tested with and without the outliers, and the model fit deteriorated with the outliers removed. The determination was made to retain all significant outliers in the model.

Normality. Multivariate normality was analyzed with particular consideration for kurtosis because SEM is sensitive to kurtosis (Byrne, 2010). In the assessment of multivariate normality, items that were determined to be more than slightly skewed (>1.0) or kurtotic (> 7.0) (Byrne, 2010) were evaluated. The content of these non-normal items was reviewed and a determination of their importance to the model was made. Items that were non-normal, contributed little to the model, and their temporary removal benefitted the model fit were permanently removed from the study.

Confirmatory Factor Analysis (CFA)

CFA was used to confirm the latent variables for each of the 10 factors in the model (Byrne, 2010). The CFA was conducted with IBM SPSS AMOS 23 software in order to validate the measurement model and confirm the factors measured as intended (Byrne, 2010). The model was checked for covariance, outliers, and cross-loading. Model re-specification was conducted by changing one item per iteration.

The model was evaluated using Normed Fit Index (NFI), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and normed Chi-square (CMIN/df) (Byrne, 2010). According to Vandenberg and Scarpello (1990), the fitness of a model should be analyzed with more than one fitness index, so the NFI, GFI, AGFI, CFI, RMSEA, and CMIN/df were used in the present study.

The first analysis of model fit was conducted with the Normed Fit Index (NFI). The NFI is a non-centrality based index (Byrne, 2010) that tests the hypothesized model against the null hypothesis (Byrne, 2010). If the NFI analysis returns a value close to .95 (Byrne, 2010; Hu & Bentler, 1999), it is considered a good fit, with values from .90 to .949 still considered acceptable. The NFI has been known to underestimate fit in smaller sample sizes (Byrne, 2010); therefore, the Comparative Fit Index (CFI) was also used to evaluate the model fit.

The subsequent analysis of model fit was conducted with both the Goodness of Fit Index (GFI) and the Adjusted Goodness of Fit Index (AGFI). The GFI measures the relative amount of variance and covariance in the sample data that the hypothesized model can explain (Byrne, 2010). The GFI was developed to be less sensitive to large sample sizes (Hair et al., 2006). The AGFI is very similar, except that the AGFI accounts for the degrees of freedom in the model (Byrne, 2010). If the GFI and AGFI indices are greater than .9 (> .9), then model fit is considered acceptable (Hair et al., 2006). The closer the value is to 1.0, the better the fit (Byrne, 2010; Jöreskog & Sörbom, 1993)

Additional analysis of model fit was conducted with the comparative fit index or CFI which, like the NFI, is a non-centrality based index (Byrne, 2010) that tests the proposed model against the null hypothesis (Byrne, 2010). The CFI is chosen frequently in studies because it demonstrates insensitivity to model complexity (Hair et al., 2010). As with the NFI, if the CFI analysis returns a value close to .95 or greater, it is considered a good fit (Byrne, 2010; Hu & Bentler, 1999). If the CFI returns values from .90 to .949, the fit is still considered acceptable.

A further metric employed was the Root Mean Square of Error Approximation (RMSEA). The RMSEA is considered a badness of fit index, which means that lower values indicate a better fitting model (Byrne, 2010). RMSEA is recommended for studies with a large number of observed variables because other χ^2 Goodness of Fit (GOF) test statistics tend to reject acceptable models with a large number of observed variables, such as the current study (Hair et al., 2010). A value of the RMSEA of .6 or below is considered a good fit for the data (Byrne, 2010; Hu & Bentler, 1999).

The final fit metric was the χ^2 statistic (CMIN/df), which computes the model's distance from a theoretically perfectly fitted model divided by the degrees of freedom (Hu & Bentler, 1999). The lower the CMIN/df value is, the better the model fitness. The chi-square is sensitive to sample size (Hair et al., 2006). The CMIN/df is a comparative ratio and is considered to be acceptable if value is below three (Byrne, 2010; Hair et al., 2006).

Exploratory Factor Analysis (EFA)

The model did not achieve the fit criteria in Table 10; therefore, an EFA was conducted on the data (Byrne, 2010). A principal component analysis (PCA) was conducted with Varimax rotation. The PCA was chosen because the results were considered easier to interpret. The PCA is designed to reduce the number of variables down to the items that explain the largest amount of variance in a given model (Grimm et al., 2000). An oblique rotation was considered due to its advantage with cross-loading items (Hair et al., 2006); however, the Varimax rotation was selected because it was more frequently chosen in the safety culture and safety climate literature, such as Freiwald's (2013) study.

The EFA was run, and the Kaiser-Meyer-Oklin (KMO) measure of sampling adequacy was analyzed (Hair et al., 2006). This is the measure of the ratio of squared correlations between variables and the partial squared correlations between variables. KMO measures above .9 (> .9) are considered very good (Field, 2009).

The Measure of Sampling Adequacy (MSA) was analyzed for the appropriateness of conducting an EFA. All variables (> .5) were considered appropriate (Hair et al., 2005). The variables below .5 were removed from the model, and the model was re-run.

The EFA was conducted with IBM SPSS 23 software. All factors that returned eigenvalues greater than 1.0 (> 1.0) and had a contribution percentage of greater than 1% (> 1%) of the variance in the model (Grimm et al., 2000) were analyzed. The EFA results displayed many more than the eight first order factors in the proposed model; therefore, after evaluation, the model was re-run with a constraint for seven factors. The seven-factor constraint was chosen based on grounded theory to reduce the complexity in the model. All items with similar factor loadings on multiple factors were evaluated for removal. Factors with no basis in grounded theory were analyzed for removal from the study.

Model 2 (M2) Confirmatory Factor Analysis (CFA)

The CFA was conducted on M2 model. Based on a review of the available literature, the M2 constructs were evaluated against the validated instruments chosen for the study. Based on grounded theory of the latent factor structure, items that were loading near or below .7 (Hair et al., 2006), non-normal, or loading on a latent factor not supported by previous studies were evaluated for removal.

Post hoc analysis. Post hoc analysis was conducted based on the Modification Indices (MIs). Model re-specification is by nature exploratory because the researcher is re-specifying the hypothesized model for methods to improve the model (Byrne, 2010). A model with good fit indices and also with high MIs can be an indication of multi-collinearity in the model (Kline, 2005) rather than causal significance. MIs were reviewed, and those that exceeded 5.00 were co-varied when on the same factors.

The CFA for the M2 required additional regressions constraints on each of the items in the ERN and ATN constructs. Hair et al. (2006) recommend the use of at least three items for each factor when the sample size is below 300 ($n < 300$). There is a concern that factors with less than three items will not have the appropriate level of degrees of freedom to determine a solution that fits the data (Hair et al., 2006). The current research study had over 300 (n = 305) completed and valid responses; therefore, additional regression constraints were added before conducting the SEM.

Structural Equation Model & Hypotheses Testing

The previously mentioned model fit indices were re-evaluated by comparing them to the model fit in the final CFA and additionally to the fit criteria in Table 10. The model fit in SEM was similar to the final CFA and met all the criteria in Table 10. The AGFI was the only fit criteria below the target level (> .9). As previously stated, it was determined to be acceptable.

The six hypotheses were evaluated by reviewing the SEM regression weights, standardized estimates, and p values. The analysis was conducted using IBM SPSS AMOS 23 software. The maximum likelihood estimation was employed for the analysis (Byrne, 2010). The elimination of the PC factor in the EFA precluded the testing of three of the six hypotheses. The model fit was determined to be adequate, and the remaining three hypotheses were tested.

CHAPTER IV

RESULTS

This study explored the relationship between Safety Culture, Ethical Leadership, Pilot Commitment to the AMC, and Safety Performance. Based on the available literature, a model was developed to determine the effect of Safety Culture on Ethical Leadership, Pilot Commitment, and Safety Performance. Additionally, the effect of Ethical Leadership on Safety Performance was also tested.

This chapter shows the results of the CFA on the proposed model, subsequent EFA, final CFA, and SEM. The model fit history of the CFA is shown with nine revisions in Table 12 and the SEM model fit shown in Table 14. The results of the hypothesis testing are included in this chapter. The descriptive statistics for each of the items is displayed in Appendix C. The SC & PC constructs were measured on a seven-point Likert scale. The remaining constructs of ER, AT, and EL were each measured on a five-point Likert scale.

Demographic Data

Three hundred fifty-seven respondents participated in the research survey; all respondents completed the survey electronically. Table 4 shows there were 305 (*n* = 305) complete and valid responses used in the study, representing 8.3% of the estimated 3,660 Fractional jet pilots in the United States.

Table 4

Completed Responses

Source	Estimated Views	Pre-Qual	Completed Surveys	Percentage
Direct Mail to Prequalified Pilots	1,759	All	111	36.4%
NJASAP Message Board	2,660	All	80	26.2%
FlexJet/FO Message Board	780	All	46	15.1%
Aviation International News	1,000	50	37	12.1%
Embry-Riddle Alumni Email	249	All	16	5.2%
Flight Safety Instructor	180	9	9	3.0%
Curt Lewis Newsletter	160	8	6	2.0%
Total	6,788		305	

Table 5 shows the pilots' ages ranged from 28 years old to 74 years old, representing a range of 46 years between the youngest and oldest pilot. The median age was 49, and the mean age was 49.14 years old. The proximity of the mean age to the median age of the data showed the age data was not skewed. The mode was 43 years of age.

Table 5

Pilot Age (Years)

	Frequency	Percentage	Cumulative Percentage
20-29 years	1	0.3%	0.3%
30-39 years	37	12.1%	12.5%
40-49 years	131	42.9%	55.4%
50-59 years	97	31.8%	87.8%
60-69 years	35	11.5%	98.7%
70-79 years	4	1.3%	100.0%
Total	305		

The most frequent position held by 54.8% of the respondents was Pilot In Command (PIC), often called Captain, followed by First Officer or Second in Command (SIC), which represented 27.8% of the respondents. Table 6 shows there were 15.4% of pilots who were Captains with additional duties such as Check Airman, and 2% of the respondents were part of the management team at the AMC.

Table 6

Position at AMC

	Frequency	Percentage	Cumulative Percentage
0-4 years	11	3.6%	3.6%
5-9 years	39	12.8%	16.4%
10-14 years	121	39.7%	56.1%
15 or more years	134	43.9%	100.0%
Total	305		

The type of equipment flown by the pilots in Table 7 was split evenly among Light Jet (29.5%), Mid-Sized Jet (25.6%), Super Mid-Sized Jet (24.3%), and Large Jets & Long Range Jets (20.7%). The data contained a well-balanced mix of pilots flying a wide range of equipment.

Table 7

Aircraft Type Flown (Max Takeoff Weight)

	Frequency	Percentage	Cumulative Percentage
Light Jet (up to 19,999 lbs)	90	29.5%	29.5%
Mid-sized Jet (20,000 - 29,999 lbs)	78	25.6%	55.1%
Super Mid-sized Jet (30,000 - 39,999 lbs)	74	24.3%	79.3%
Large Jet (40,000 - 49,999 lbs)	32	10.5%	89.3%
Long Range (50,000 lbs or greater)	31	10.2%	100.0%
Total	305		

Table 8 shows the majority of respondents (51.5%) had over 10,000 hours of flight experience with 27.5% having between 7,500 and 9,999 hours of flight experience, 18.7% had between 5,000 and 7,499 hours, and just 2.3% had below 5,000 hours. In contrast to commercial pilots, general aviation pilots do not accumulate flight hours at the same pace; therefore, having the majority of pilots with over 10,000 hours of flight experience is uncommonly high for a general aviation organization.

Table 9 shows that 3.6% of respondents had been with their AMC less than 5 years, 12.8% had been with their AMC between 5-9 years, 39.7% between 10-14 years, and 43.9% had been with their respective AMC for 15 years or more. The tenure with the AMC indicates that the Fractional pilots that completed the survey stay with their respective companies for many years.

Table 8

Pilot Experience (Hours)

	Frequency	Percentage	Cumulative Percentage
2,500 - 4,999 hours	7	2.3%	2.3%
5,000 - 7,499 hours	57	18.7%	21.0%
7,500 - 9,999 hours	84	27.5%	48.5%
10,000 hours or more	157	51.5%	100.0%
Total	305		

Table 9

Tenure at AMC

	Frequency	Percentage	Cumulative Percentage
0-4 years	11	3.6%	3.6%
5-9 years	39	12.8%	16.4%
10-14 years	121	39.7%	56.1%
15 or more years	134	43.9%	100.0%
Total	305		

Normality & Outlier Checks

The outliers were checked by analyzing the Mahalanobis D^2. There were 57 cases that were considered outliers that were significant to the .05 level ($p < .05$). The model fit was checked with the outliers, and the model fit indices were CMIN/df = 1.777, NFI = .715, GFI = .669, AGFI = .649, CFI = .85, and RMSEA = .051. After the outliers were removed, the model fit indices deteriorated with CMIN/df = 1.704, NFI = .701, GFI =

.637, AGFI = .615, CFI = .849, and RMSEA = .053. The outliers were retained in all future models.

The multivariate normality was analyzed, and it was determined there were several variables that had a skewness over 1.0 and/or a kurtosis greater than 7.0 (See Appendix C). The content of the items was reviewed, and items critical to the model were retained. ER62 (3.844) (I make errors in my job from time to time.) and ER64 (4.553) (I have made errors that have been detected by other pilots.) had acceptable, though noticeably high kurtosis values. The content of both questions led to one common answer; therefore, kurtosis was to be expected, and the items were retained. The remaining non-normal items were retained until the CFA was conducted and the model fit analyzed. If an item was determined to have a combination of loading below .5 (< .5) (Hair et al., 2006) and high skewness or kurtosis, it was temporarily removed from the model. If the model fit improved after the item was removed, and it was determined that the content of the item was not critical to the model, it was removed permanently from the model.

Confirmatory Factor Analysis

In Figure 7, the proposed CFA factor structure is shown with OC, OP, FS, IS, PC, EL, AT, and ER. The proposed model consists of the original 55 items of the CASS (Gibbons et al., 2006). The CASS was hypothesized to have a four-factor structure (OC, OP, FS, IS) with a second order factor for SC. The 9 items of Porter et al.'s PC scale (1974), 10 items from the Brown et al. (2005) ELS, and Fogarty's (2004) Maintenance Environment Survey comprised the items in both AT and ER.

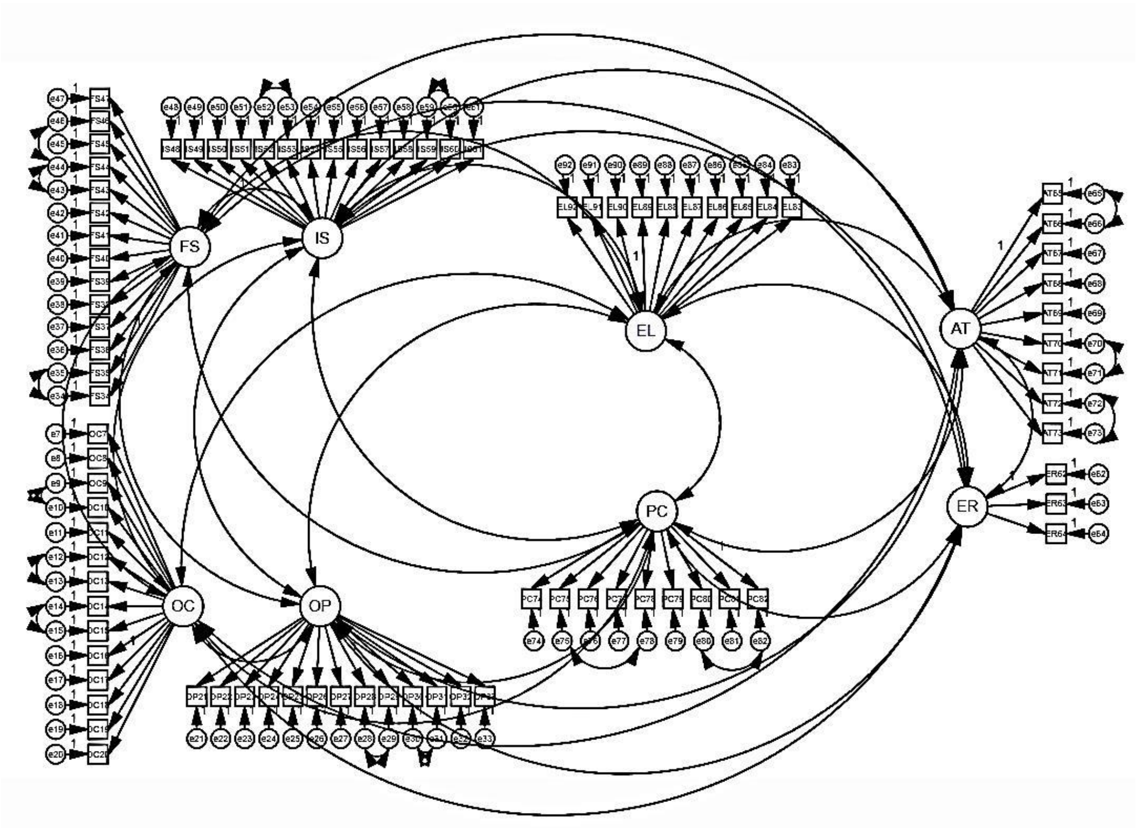


Figure 7. Proposed CFA Model.

The proposed model had model fit indices of CMIN/df = 2.019, NFI = .675, GFI = .626, AGFI = .605, CFI = .803, and RMSEA = .058 as displayed in Revision 1 of Table 12. The CMIN/df and RMSEA were considered acceptable as shown in the fit criteria in Table 10; however, the GFI of .626 was less than the .90 targeted fit criteria, AGFI of .605 was less than .90 targeted fit criteria, and CFI of .803 was less than .95 targeted fit criteria (Hair et al. 2006). The Modification Indices (MIs) were checked for values over 20. For each of the MI values over 20 that loaded on the same factor, a covariance was established. There were 20 iterations conducted, and the model fit improved, though the model fit remained unacceptable. The model fit indices were CMIN/df = 1.777, NFI =

.715, GFI = .669, AGFI = .649, CFI = .85, and RMSEA = .051. The model was then tested with the outliers removed from the data. After outliers were removed, the model fit further deteriorated with CMIN/df = 1.704, NFI = .701, GFI = .637, AGFI = .615, CFI = .849, and RMSEA = .053. The outliers were returned to the data and remained in the model.

Table 10

Fit Criteria

	Model Fit	Fit Criteria		Reference	Acceptable
CMIN/df	1.399	below	3.00	(Byrne, 2010; Hair et al., 2006)	Yes
NFI	0.939	close to	0.95	(Byrne, 2010; Hu & Bentler, 1999)	Yes
GFI	0.905	close to	1.00	(Byrne, 2010; Jöreskog & Sörbom, 1993)	Yes
AGFI	0.879	close to	1.00	(Byrne, 2010; Jöreskog & Sörbom, 1993)	Yes
CFI	0.982	close to	0.95	(Byrne, 2010; Hu & Bentler, 1999)	Yes
RMSEA	0.036	less than	0.60	(Byrne, 2010; Hu & Bentler, 1999)	Yes

The items with low factor loadings (< .4) were removed from the model (Byrne, 2010). There were 14 additional model revisions conducted to improve the model fit. The model fit improved, though the model fit remained unacceptable with values of CMIN/df = 1.778, NFI = .77, GFI = .705, AGFI = .683, CFI = .884, and RMSEA = .051. The model fit for the proposed model was determined to be unacceptable based on the target model fit indices in Table 10. It was determined that an exploratory factor analysis (EFA) should be conducted based on the poor model fit.

Exploratory Factor Analysis

The measurement model was analyzed with the survey data collected, and the model fit remained unacceptable due to a poor model fit indices. An EFA was initiated on the full dataset. Before the EFA was conducted, the data was confirmed to meet the assumptions for an EFA. A review of the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) showed that it was strong at .953. The Bartlett's Test of Sphericity was significant ($p < .000$). The Measure of Sampling Adequacy (MSA) was analyzed. After the removal of one item (A93); the MSA was determined to be satisfactory because a review of the Anti-Image Matrix showed all items were above .5 (>.5). The KMO also improved to .965 after the removal of item A93.

Based on Hair et al. (2010), a Principal Components Analysis (PCA) with Varimax rotation was conducted on all items. The initial result showed the items loading on 16 different factors with eigenvalues greater than 1.0 which explained 68.3% of the variance in the model.

Based on the proposed model developed from the research conducted by Alsowayigh (2014) and Brown et al. (2005), the PCA was run again with a factor constraint of seven. The scree plot in Figure 8 shows the results of the CFA with the constraint of seven factors. The eigenvalues, located in Appendix D1, shows the seven factor model explained 67.959% of the variance in the model. The first component was named Safety Culture New (SCN), and it consisted of 24 items from the original Safety Culture (SC) second order factor. The second component was named Ethical Leadership Pilot Commitment (ELPC) due to 13 of the 18 items coming from the previous factors of Ethical Leadership and Pilot Commitment to the AMC (PC). The remaining five items were from SC. The third factor was labeled Pilot Commitment New (PCN) with four low loading items exclusively from the previous PC factor. The fourth component consisted of three low loading items from SC and PC. The fifth component was labeled Reporting (REP) and consisted of two items from the original SC factor. The sixth component was labeled Safety Performance 1 (SP1), which consisted of five items from the original Attitude To Violations (AT). The seventh component was labeled Safety Performance 2 (SP2) and consisted of five items from ER and AT.

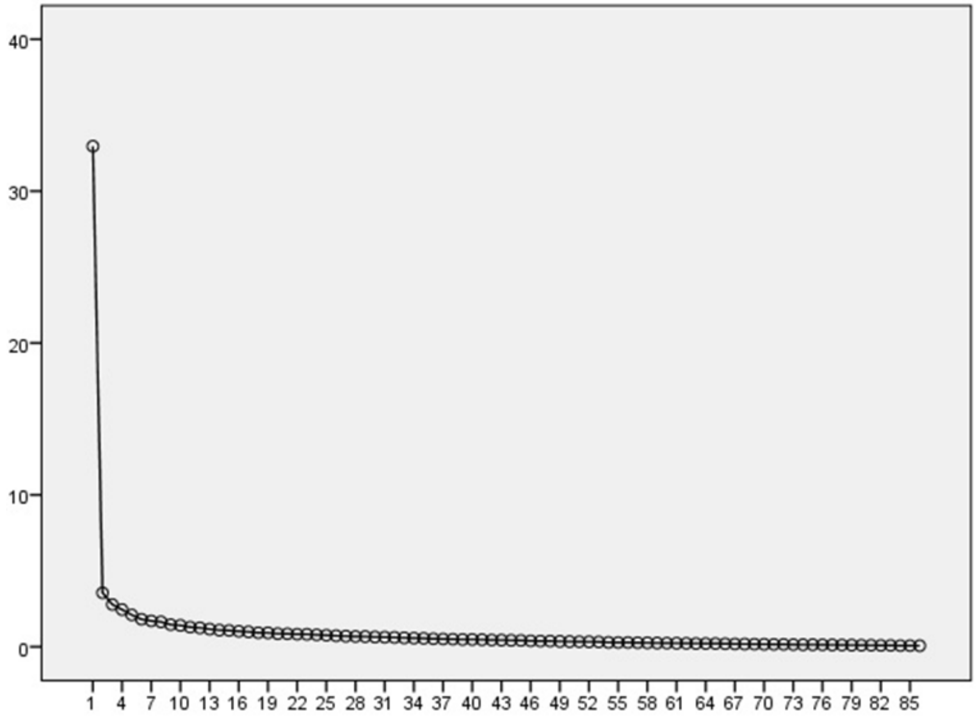


Figure 8. EFA Final Scree Plot.

After reviewing the loadings below .7 (< .7) alongside item content, further model revisions were made. The third factor (PCN) was removed because the average loading was (below .7) .573, with 25% of the items cross-loading to ELPC. Factor 4 was removed due to low average loading of .566. Factor 5 (REP) was also removed due to poor average factor loading of .573. Additionally, several items were removed with low loading (below .6) or cross-loading concerns. Cross-loading concerns arise when one item has similar loading values on multiple components; this may cause model fit and discriminant validity issues. Items with cross-loading issues were reviewed and removed from the model.

The original PC factor was eliminated from the model due to poor factor loading and cross-loading concerns. The elimination of PC reduced the hypotheses in the study from six to three. The remaining factors shown in Table 11 were SCN (20 items), ELPC (11 items), ATN (2 items), and ERN (2 items). The model could still test hypotheses H_2, H_3, and H_5.

Table 11

Model Factors for Hypothesis Testing

Proposed Model		Model 2 (M2)	
First Order	Second Order Factors	Post EFA Factors	Final Factors
OC OP FS IS	SC	SCN	SCN
EL PC		ELPC	ELN
AT ER	SP	SP1	NFP

Confirmatory Factor Analysis Model 2 (M2)

Model 2 (M2) was analyzed with the survey data collected and the model fit improved from the model fit in the CFA conducted prior to the EFA; though the model fit shown in Table 12 was still not acceptable with CMIN/df = 2.237, NFI = .865, GFI = .793, AGFI = .766, CFI = .92, and RMSEA = .064. The M2 was checked for normality, and five items were slightly skewed with skewness values above 1.0. There was one item (OP31) with a skewness of 1.3 that was removed from the model after review of the content. Two items (ER62, ER64) had elevated kurtosis values (> 7.0). After a review of the content, it was determined the format of both items led to a justifiable common answer; therefore, the items remained unchanged in the model. A review of the Mahalanobis D^2 values indicated there were 57 cases where the respondents' answers were outliers and were significant ($p < .05$). The model was checked with the outliers removed and the model fit eroded; therefore, the outliers remained in the model permanently.

The M2 went through four additional iterations to improve the model fit with CMIN/df = 1.93, NFI = .885, GFI = .828, AGFI = .804, CFI = .941, and RMSEA = .055. The model fit remained unacceptable. The proposed factor structure in the literature was reviewed, and based on grounded theory, the ELPC factor was reduced to more closely match the original EL factor. The items loading from the former factors of SC and PC (PC75, IS48, IS49) were deleted from the ELPC construct. ELPC was renamed ELN and maintained 80% of the items from the EL construct. After the deletion of these three items in ELPC, the model fit continued to improve with CMIN/df = 2.026, NFI = .891, GFI = .837, AGFI = .812, CFI = .941, and RMSEA = .055.

Three additional items with standardized estimates below .65 were removed from the model, and the overall fit improved with CMIN/df = 2.059, NFI = .903, GFI = .848, AGFI = .766, CFI = .947, and RMSEA = .059. The CMIN/df increased slightly from 2.026 to 2.059, and the RMSEA increased from .055 to .059, though both values were still considered good after the items were removed.

Table 12

CFA Model Fit History

Revision	CMIN/df	NFI	GFI	AGFI	CFI	RMSEA
1	2.019	0.675	0.626	0.605	0.803	0.058
2	1.777	0.715	0.669	0.649	0.850	0.051
3	1.778	0.770	0.705	0.683	0.884	0.051
4 (M2)	2.237	0.865	0.793	0.766	0.920	0.064
5	1.930	0.885	0.828	0.804	0.941	0.055
6	2.026	0.891	0.837	0.812	0.941	0.058
7	2.059	0.903	0.848	0.822	0.947	0.059
8	1.390	0.940	0.906	0.880	0.982	0.036
9	1.399	0.939	0.905	0.879	0.982	0.036

The MIs were analyzed further and adjustments were made to co-vary appropriate error terms that exceeded 4.0. The standardized regressions were analyzed for each of the subsequent 29 model revisions to improve the model fit. The final model fit values were CMIN/df = 1.39, NFI = .94, GFI = .906, AGFI = .88, CFI = .982, and RMSEA = .035. According to Byrne (2010), each of the model fit values were acceptable. The AGFI = .88 remained marginal, though concerns with the AGFI under-reporting in complex models similar to the model in this current study allowed for the AGFI to be deemed acceptable.

In Figure 9, the final factor structure is shown with SCN, ELN, and NFP, which is a second order factor comprised of ERN and ATN. The final M2 model consists of one first order factor for SCN, which is made up of 17 of the original 55 items of the Gibbons et al. (2006) CASS. The CASS was hypothesized to have a four-factor structure with a second order factor for SC. ELN is made up of 80% of the items from the Brown et al. (2005) ELS. The PC factor was completely removed. The NFP second order factor consists of the remaining four items from the original 12 items in Fogarty's (2004) Maintenance Environment Survey. A Heywood case (Hair et al., 2006) was discovered in the CFA model. The regression weights for the ERN and ATN were equalized (Hair et al., 2006) to allow for the model to run properly.

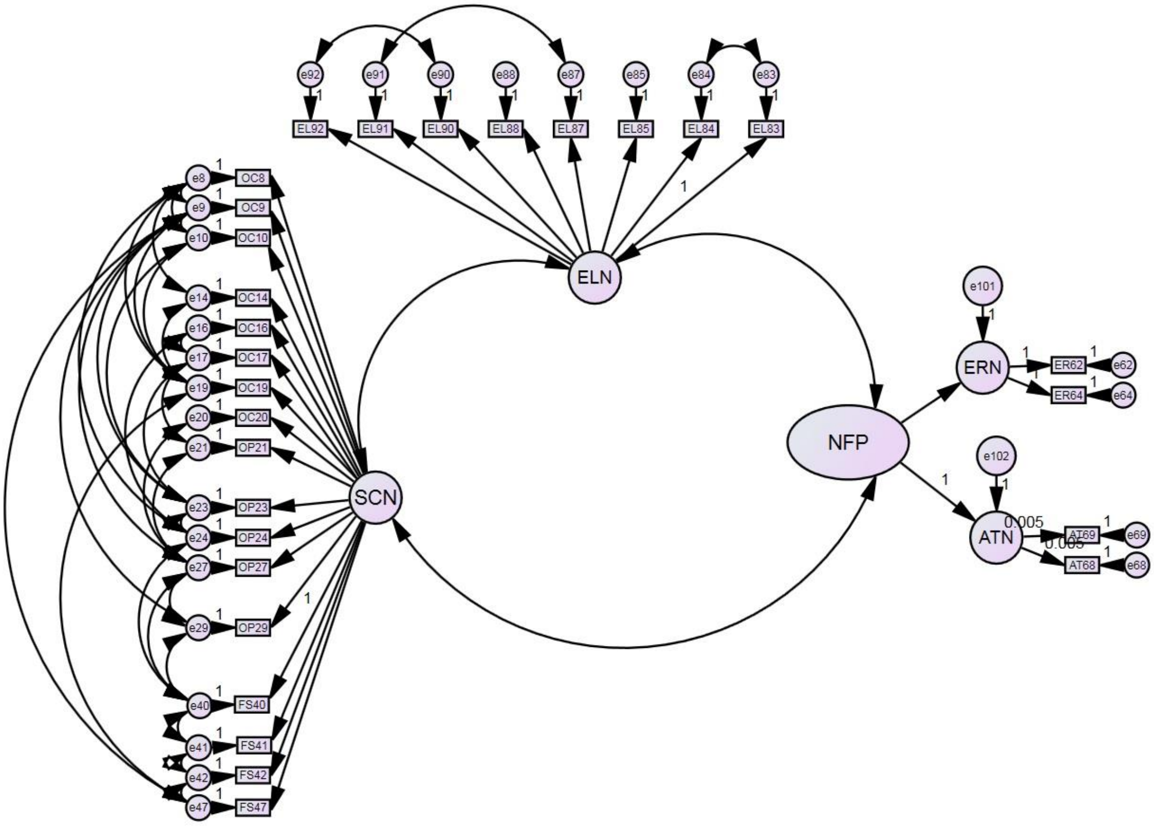


Figure 9. Final CFA Model.

Construct Reliability

Each factor was analyzed for construct reliability (CR) using the formula in *Figure 6.* The CR values for the factors in the model were SCN = .905, ELN = .945, ATN = .919, and ERN = .795. Due to reverse worded items, SCN values were converted to absolute numbers prior to calculating the CR value. The factors in this model all have achieved acceptable construct reliability with values greater than .7 (> .7) (Hair et al., 2010). The Cronbach's alpha (1951) for the factors were SCN = .911, ELN = .950, ATN = .903, and ERN = .788.

Convergent Validity

Convergent Validity was calculated using the Average Variance Extract (AVE) by taking the standardized factor loading squared for each item in each factor and then calculating the average. The AVE values for the factors in the model were SCN = .599, EL = .710, ATN = .823, and ERN = .650. According to Hair et al. (2010), any factors with an AVE greater than .5 are considered to have convergent validity; therefore, all the factors in the final model had convergent validity.

Discriminant Validity

Discriminant Validity was assessed using two methodologies. The first, shown in Table 13, was assessed by comparing the squared factor correlations with the AVE for each factor. The AVE for SCN = .599, and the squared correlations between SCN and EL = .677, SCN and ERN = .024, and SCN and ATN = .063. The AVE for ELN = .710, and the squared correlations between SCN and ELN = .677, ELN and ERN = .012, and

ELN and ATN = .079. The AVE for ERN = .650 and the squared correlations between ERN and SCN = .024, ERN and ELN = .012, and ERN and ATN = .011. The AVE for ATN = .823 and the squared correlations between ATN and SCN = .063, ATN and ELN = .079, and ATN and ERN = .011. According to Hair et al. (2010), discriminant validity within the model was confirmed between all factors except between SCN and ELN. A subsequent methodology was employed to confirm discriminant validity between SCN and ELN. According to Kline (2005), correlations below < .85 are considered to have discriminant validity. The correlation between SCN and ELN was below .85 at .824; therefore, the model has discriminant validity (Kline, 2005).

Table 13

Discriminant Validity Test

Factor	AVE.	Squared Correlations		Confirmed
SCN	0.599	0.677	(SCN:ELN)	N*
		0.024	(SCN:ERN)	Y
		0.063	(SCN:ATN)	Y
ELN	0.710	0.677	(ELN:SCN)	Y
		0.120	(ELN:ERN)	Y
		0.079	(ELN:ATN)	Y
ERN	0.650	0.024	(ERN:SCN)	Y
		0.120	(ERN:ELN)	Y
		0.011	(ERN:ATN)	Y
ATN	0.823	0.063	(ATN:SCN)	Y
		0.079	(ATN:ELN)	Y
		0.011	(ATN:ERN)	Y

*Discriminant validity confirmed with alternate methodology

Structural Equation Model

The SEM displayed in Figure 10 shows the proposed relationships of SCN on ELN, SCN on NFP, and ELN on NFP. Due to the removal of the PC factor, three other hypotheses were no longer testable in the study and were removed from the SEM.

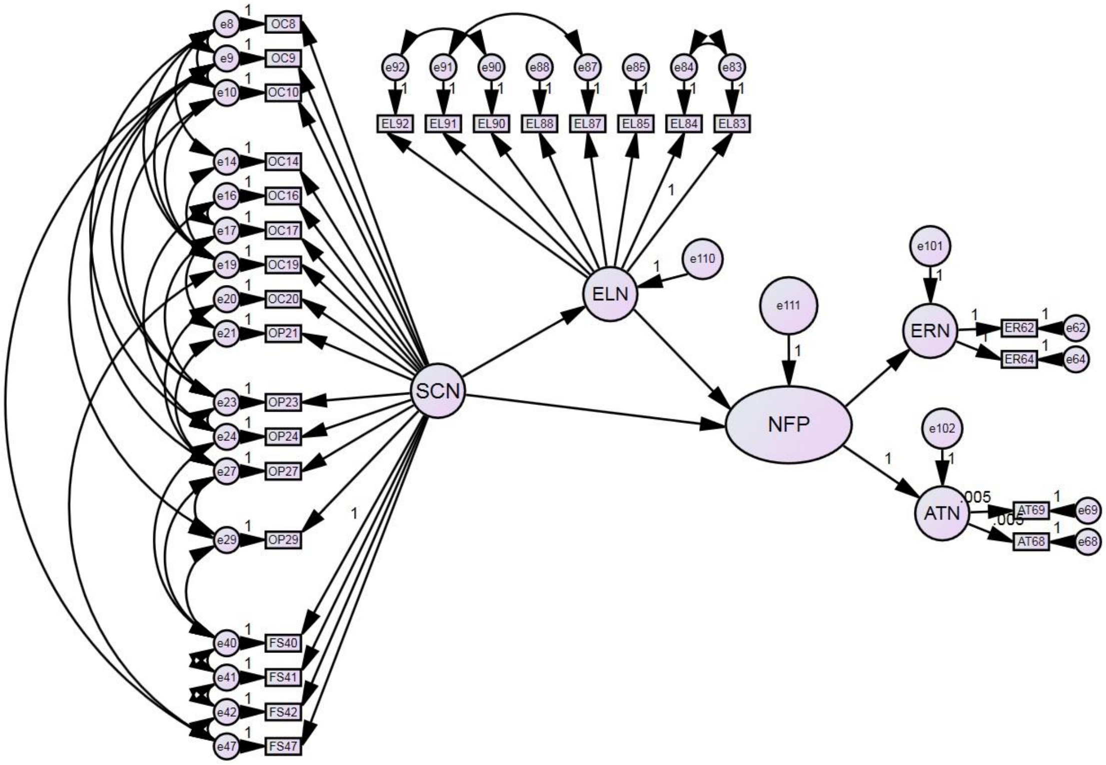


Figure 10. Final SEM Model.

Table 14 shows the model fit values for the SEM were acceptable with CMIN/df = 1.387, NFI = .94, GFI = .906, AGFI = .881, CFI = .982, and RMSEA = .036. (Hair et al., 2010). These model fit values are similar to the final CFA and as mentioned previously, determined to be acceptable.

Table 14

Final SEM Model Fit

Revision	CMIN/df	NFI	GFI	AGFI	CFI	RMSEA
SEM	1.399	0.939	0.905	0.879	0.982	0.036

The results of the EFA reduced the number of factors in the proposed model from eight first order factors to four. The proposed model consisted of four first order factors (FS, IS, OP, OC) loading onto one second order factor SC. After the EFA, SC was reduced to one first order factor renamed SCN. SCN is one first order factor made up of 17 of the original 55 items from SC. Of the seventeen items, eight items were from OC, five items were from OP, four items were from FS, and zero items remained from IS. Two of the items from IS loaded onto the ELPC factor; however, after review of the extant research, the two IS items were removed from the factor ELPC. ELPC was re-named ELN after the removal of two IS (IS48, IS49) items and removal of one PC item (PC75).

PC was eliminated from the model due to low to moderate loading and cross-loading on many different factors. The factor was determined to no longer be testable; therefore, it was eliminated. This elimination of PC from the model precluded the testing of Hypotheses H_1, H_4, and H_6 in the SEM model.

The 33% in ER and 78% in AT factors led to the renaming of the SP second order factor to NFP (Not Follow Procedures) based on the content of the items remaining. EL was reduced by 20% and was renamed ELN in the final model.

In Figure 10, the final factor structure is shown with SCN, ELN, and NFP, which is a second order factor comprised of ERN and ATN. The final SEM model tests the direct relationship between SCN on ELN (H_2), SCN on NFP (H_3), and ELN on NFP (H_5).

Hypothesis Testing

Hypothesis 1

H_1 *A positive Safety culture has a positive influence on pilot commitment to the organization.*

This hypothesis can no longer be tested due to the elimination of the PC factor during the EFA.

Hypothesis 2

H_2: *A positive safety culture (SCN) has a positive influence on ethical leadership (ELN).*

As shown in Table 15, this hypothesis is supported.

Table 15

SEM Hypothesis Testing

	VAR	DIR	VAR	Std Est	S.E.	C.R	P	Supported
H_1	n/a							
H_2	ELN	<---	SCN	0.824	0.036	11.565	***	Yes
H_3	NFP	<---	SCN	-0.330	14.910	-1.442	0.149	No
H_4	n/a							
H_5	NFP	<---	ELN	-0.317	30.471	-1.327	0.184	No
H_6	n/a							

The results of the SEM analysis confirmed the relationship between SCN and ELN was both strong (Estimate = .824) and significant ($p < .001$). This study supports that there is a significant relationship and positive relationship between SCN and ELN.

Hypothesis 3

H_3: *A positive safety culture (SCN) has a negative influence on safety performance (NFP).*

As shown in Table 15, this hypothesis is not supported. The results of the SEM analysis determined SCN does not have a negative influence on NFP, and that relationship is not significant. The relationship between SCN and NFP did not materialize as hypothesized; the relationship between SCN and NFP had a significance level of .149.

Hypothesis 4

H_4: *A positive pilot commitment to the organization (PC) has a positive influence on safety performance (NFP).*

This hypothesis could no longer be tested due to the elimination of the PC factor during the EFA.

Hypothesis 5

H_5: *A positive ethical leadership (ELN) has a negative influence on safety performance (NFP).*

As shown in Table 15, this hypothesis is not supported. The results of the SEM analysis confirmed ELN had a non-significant (p = -.184) and negative relationship to NFP. This result was unexpected based on a review of the literature.

Hypothesis 6

H_6: *A positive* ethical *leadership (ELN) has a positive influence on pilot commitment to the organization (PC).*

This hypothesis can no longer be tested due to the elimination of the PC factor during the EFA.

CHAPTER V

DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

This study analyzed the relationship between safety culture (SC), ethical leadership (EL), pilot commitment to the AMC (PC), and safety performance (SP) for U.S. based Fractional jet pilots. The proposed factor model structure derived from the literature could not attain an adequate model fit during the initial CFA; therefore, an EFA was conducted. After the EFA, a second CFA was conducted on M2 followed by the development and testing of a SEM. The SEM developed allowed for hypothesis testing based on the new factor structure.

The objective of this chapter is to discuss the results of the study and how these results compare with the findings in the available literature. Additionally, this chapter will interpret these results, discuss how these results may impact general aviation in the future, and discuss recommendations for future research.

Discussion

Hypotheses. There were six hypotheses planned for this research study. After the EFA, three (H_1, H_4, H_6) of the six hypotheses could no longer be tested due to the removal of the PC factor.

(H_1) A positive safety culture has a positive influence on pilot commitment to the organization. This hypothesis (H_1) could not be tested because of the low and cross loading of the PC items as a stand-alone factor.

(H_2) A positive safety culture (SCN) has a positive influence on ethical leadership (ELN). This hypothesis was tested and supported. The results showed H_2 had both a significant (p =.001) and strong (estimate = .824) relationship. These results confirm Schein's (2004) assertion that corporate culture is intertwined with organizational leadership. The high correlation and the inability to confirm one of the two discriminant validity tests performed between the SCN and ELN constructs suggest a deep relationship between ELN and SCN. One of the important revelations in this study is that in Fractional pilots there exists a strong correlation between ELN and SCN. There is a need for discrimination between these two constructs to better understand how to measure, monitor, and improve them respectively, if needed. Many studies have concluded that both EL (Freiwald, 2013) and SC (Alsowayigh, 2014) influence the safety of an organization, though the current study did not confirm those conclusions.

As noted above, the current study results do not match Freiwald's (2013) findings that ethical leadership (EL) did not have a significant relationship with proactive safety climate. Freiwald's (2013) reasoning suggested that EL is merely a subset of the larger construct of leadership, and Freiwald stated that the narrowness of the EL construct might explain the lack of a relationship in the 2013 study (Freiwald, 2013). Additionally, the Freiwald study included EL as the exogenous variable and safety climate as the endogenous variable, whereas the present study reverses the direction of that relationship.

(H_3) A positive safety culture (SCN) has a negative influence on safety performance (NFP). The SEM analysis showed that H_3 is not supported, and SCN does not have a significant influence on NFP. This result was unexpected due to the support in previous studies (Alsowayigh, 2014; Fogarty, 2004) showing a significant relationship between safety culture or safety climate and self-reported safety performance. Due to the infrequency of aviation accidents or incidents potentially leading to invalid conclusions

(O’Connor et al., 2011), the current study relied on self-reported safety behavior as did Alsowayigh (2014) and Fogarty (2004). In contrast, research by Zohar (2000) relied on quantitative outcome variables, such as employee micro-accidents. This micro-accident research also concluded there was a significant relationship between safety climate and safety performance. Zohar hypothesized that micro-accidents were a leading indicator to a decline in safety climate that could lead to larger accidents. General aviation needs to develop a methodology that includes identifying and monitoring quantifiable data that is considered a leading indicator of a decline in safety to augment self-reported data.

Future research should continue to test the relationship between SCN and NFP because the results are likely to be more consistent with past research from Alsowayigh (2014), Fogarty (2004), and Zohar (2000). Freiwald (2013) suggested that the narrowness of the EL construct in the 2013 study was a potential cause for the unexpected lack of support for the relationship between EL and employee injuries. In the current study, the major reduction in the SP items from 13 original items to 4 items could have also narrowed the NFP construct in a similar manner, thereby altering the significance of the relationship.

(H_4) A positive pilot commitment to the organization (PC) has a positive influence on safety performance (NFP). Alsowayigh (2014) found that PC did not mediate the relationship between ER and AT. Alsowayigh (2014) also determined that PC did not influence a professional pilot’s behavior in the cockpit. The inability of the PC items to maintain integrity as a factor combined with the results of previous research suggests that PC is not essential for future research attempting to predict pilot safety behavior.

(H_5) A positive ethical leadership (ELN) has a negative influence on safety performance (NFP). The SEM results did not support that positive ELN reduces the likelihood of pilots not following procedures (NFP). In 1998, Craig and Gustafson (1998) warned managers that ethical leadership should be a priority. The study by Kapp and Parboteeah (2008) concluded that ethical climate had a strong influence over safety behavior. Freiwald (2013) concluded that ethical leadership led to fewer occupational accidents. The present study did not match these other studies and did not support the construct that ethical leadership plays a significant role in safety behavior and outcomes. There is ample evidence in the literature suggesting that future studies continue to test the relationship between ELN and safety behaviors. The positioning of ELN as the exogenous variable in future studies is likely to influence the level of significance between ELN and safety behaviors.

(H_6) A positive Ethical leadership (ELN) has a positive influence on pilot commitment to the organization (PC). This hypothesis (H_6) could not be tested because of the low, cross, and sporadic loading of the PC items during the EFA.

Conclusions

This study analyzed the relationship between safety culture (SCN), ethical leadership (ELN), and safety performance (NFP). Schein (2004) stated that corporate culture was the personality of the organization and that corporate culture was strongly connected with leadership and employee behavior (Schein, 2004). James Reason (1997) wrote that when employees of an organization hold similar beliefs, those beliefs will govern behavior. In 1979, Butler warned that leaders who distanced themselves from tasks may contribute to accidents.

The present study tested the nature of this relationship between safety culture and ethical leadership. It was concluded that SCN and ELN had a strong and significant relationship. In addition to this strong and significant relationship, these two factors were also highly correlated. The constructs of SCN and ELN also had discriminant validity concerns based on one conservative test of discriminant validity (Hair et al., 2010). The cross-loading of many of the items between the SC and EL factors also suggested a strong relationship between the constructs.

In the perceptions of the Fractional pilots, the constructs of SC and EL are closely related. Stolzer et al. (2015) confirmed this by suggesting the need for safety mandates to have the complete support of the company leadership. Though these findings re-confirm the conclusions by other studies and subject matter experts, there exists a new concern about the ability to discriminate between the two constructs in future research. If SC and EL are so closely perceived by Fractional pilots, the construct of SC may be too wide and the CASS too broad in scope. The CASS did not retain the expected factor structure and lost 69% of the original items during the study of Fractional pilots. In contrast to the CASS, the ELS (Brown et al., 2005) was concise, and 80% the items remained together throughout the EFA and multiple CFA processes.

The unexpected result from this study was the non-significant relationship between SCN and NFP. Research from Alsowayigh (2014), Fogarty (2004), and Zohar (2000) supported that safety culture or safety climate has a significant effect on safety performance. The number of items in the second order factor SP in the proposed model was reduced from 13 items to 4 (NFP) in the final model. It is plausible that this narrowing of the items may have affected this relationship. Future research is recommended, as it is likely to re-confirm the research from Alsowayigh (2014), Fogarty (2004), and Zohar (2000) that safety culture or safety climate influences safety performance or safety behavior.

The positioning of the ELN factor as the exogenous variable in the recommended future model shown in Figure 11 is likely to influence the significance of these relationships. The shifting of the ELN scale to the exogenous position is also consistent with the SEM model presented in the Freiwald (2013) research.

Contributions to the Literature

This study contributed to the literature by re-confirming several previous studies and opening the discussion to re-examine the validity and reliability of four survey instruments in the literature.

This research supports the O'Connor et al. study (2011) which concluded that, in aviation, there are too many different instruments attempting to measure similar constructs, and called for future studies to begin confirming the reliability and discriminant validity of the existing instruments rather than testing new instruments. The O'Connor et al. (2011) study stated that studies are needed that re-confirm both the predictive ability of the instruments and their discriminant validity from other constructs.

In the current study with Fractional pilot data, the factor structure of most of the instruments used did not maintain their proposed factor structure during the EFA. This lack of factor structure integrity causes a concern that these instruments will not maintain their integrity when tested on various aviation groups in future research. As suggested by O'Connor et al. (2011), confirming predictive capability from unreliable instruments will not be possible. Additionally, if the constructs cannot maintain their discriminant validity from other constructs when measured together, the results will be difficult to interpret, easily challenged, and have little practical benefit.

The CASS (Gibbons et al., 2006) was a very broad instrument and the proposed factor structure did not hold up to the Fractional pilot survey data. The CASS had four first order factors with one second order factor for SC. The post EFA structure was reduced to one first order factor (SCN). It may be argued the CASS was originally designed for commercial airline pilots; therefore, the questions were developed for a different pilot group. During this research, there were only minor adaptations needed for the CASS to be applicable to Fractional pilots. The survey was tested with multiple experienced pilots before deployment. Fractional companies and airlines in the U.S. both operate very large fleets and face many of the same challenges. Both pilot groups are mostly unionized; therefore, the CASS should be adaptable to the Fractional pilot group.

The CASS, in the form used for this study, was arguably overly complex and too large in scope for this research. The items in the CASS overlapped with other instruments in the study; however, the main concern was the factor structure was not maintained with the data from the Fractional pilots. The result of the first EFA showed 16 components with eigenvalues over 1.0 that explained 68% of the variance in the model. The subsequent EFA was constrained to seven factors that explained 67.959% of the variation in that model. The final three components from the EFA model constrained to seven components, made up just 7% of the remaining variance; therefore, those items would have added minimal value to the study had they been retained.

Of the original 55 items in the CASS, only 17 items were retained in the final model due to low, cross, and sporadic loading. This major reduction in the CASS items due to cross-loading combined with the high correlation with the ELN construct suggests the CASS is a comprehensive survey instrument and is likely broader in scope than the construct of safety culture. In Appendix E, the 17 remaining CASS items are presented for consideration for the measurement of SCN for future research on pilot groups similar to Fractional pilots. The aviation industry needs to agree on a standard set of instruments that measures the intended construct and maintains both reliability and discriminant validity. This set of instruments must also possess the ability to predict declines in safety behavior or the instruments will be of minimal value.

The prediction of safety performance should be forecasted from a combination of qualitative and quantitative data. Survey data may reveal the perception of a decline in safety culture which could be the antecedent to a decline in safety performance. The weakness in qualitative data is that self-reported survey data have the potential to be biased by the respondent. Conversely, accurately compiled quantitative data can provide unbiased data that can forecast a decline in safety performance. The weakness in quantitative data can be the inability to accurately measure or interpret the data. The weaknesses in both qualitative and quantitative measurements should compel safety practitioners to rely on a combination of both qualitative and quantitative data to forecast declines in safety performance.

Study Limitations

The data collected in the study was collected through the voluntary participation of Fractional jet pilots in the U.S. The responses by the participants were based on their perception of ELN, SCN, and NFP. The perceptions of the Fractional pilots may have been affected by the challenges between the unions and management during the data collection process. NJASAP completed their negotiation of a new collective bargaining agreement (CBA) after years of negotiations in December 2015. Flight Options pilots had been unionized for many years while Flexjet pilots were non-union. After the merger of Flight Options and Flexjet, there was a vote to continue a company-wide union or disband the union. The union passed by a narrow margin. The total affirmative votes were less than the number of existing Flight Options union members; therefore, many union members did not vote for the union. The results were so close they were challenged by Flight Options / Flexjet management.

Each of the aforementioned issues had the potential to influence the responses provided by the Fractional pilots. Additionally, these situations could have influenced which pilots were motivated to participate in the survey. Nearly all of the Fractional pilots in this study were protected by their respective unions; therefore, they would have been able to answer the questions in this study without fear of repercussions.

One limitation included the inability to confirm the discriminant validity between ELN and SCN in one of two tests of discriminant validity conducted. According to the more conservative method from Hair et al. (2010), the AVE for each factor should be higher than the squared correlation between factors. The AVE of SCN was .599; however, the squared correlation between SCN and ELN was .677. In an alternative method for confirming discriminant validity, the correlation coefficient between SCN and ELN did pass the standard set by Kline (2005) of <.85 with a correlation of .824. Based on the extensive existing literature demonstrating the factors as distinct and achieving Kline's (2010) <.85, both SCN and ELN were retained. The relatively high correlation and inability to confirm discriminant validity by one methodology may have been due to the broad scope of questions in the CASS and the question content being similar between these factors. Several of the original CASS items loaded better on the ELPC variable than the SCN during the CFA.

In the final revisions of the CFA and the SEM, there was a negative variance discovered in the model. This issue was determined to be a Heywood case and may have been caused by the M2 not meeting the suggested minimum of three items loading on ATN and three items loading on ERN (Hair et al., 2006). The solution suggested by Hair et al. (2006) was to equalize the regression weights in the model for the ATN and ERN items. The ATN items were both set to 1.0 and the ERN items were both set to .005, and the issue was resolved. The model fit worsened from revision 8 to revision 9 by a minimal amount as shown in Table 12.

Practical Implications

The practical implication of this research may be far reaching for general aviation and for AMCs. New and inexpensive survey programs can be implemented and monitored that could improve the understanding of the relationship between the AMC and their pilots. Additionally, these monitoring programs may prove to have the ability to predict a decline in safety behavior.

The conclusion that SCN predicts ELN should encourage AMCs to monitor these factors within their organizations. The implementation of a survey-based measurement program is inexpensive and easy to both implement and interpret. A survey-based measurement program may also be considered part of the requirement for their AMC's SMS to continually improve safety (Stolzer & Goglia., 2015). The AMC would be able to identify and react to any declines in the SCN and or ELN. This identification and reaction has the potential to improve the organization's culture and relationship with their pilots. A positive safety culture and a positive perception of leadership have been demonstrated in other studies to reduce accidents and improve safety behavior.

The other important implication of this research is that AMC owners and organizational leaders may realize their leadership is an important aspect for both the financial success and the safety of their organization. Brown et al. (2005) stated that if leaders are attractive, credible, and legitimate, they will govern employee's behavior. Schein (2004) stated that a strong positive culture leads to better financial performance. This research study concluded that SCN and ELN are highly correlated and, therefore, both are of critical importance to the success of the organization. The leaders of AMCs must be ethical and strong leaders who create a just and blame free organization that encourages open communication. AMC leaders must be committed to safety initiatives to realize any long-lasting effects of their efforts (Helmreich et al., 1997). Strong and ethical AMC leaders may enjoy a financially sound and safe operation.

Future Research

O'Connor et al. (2011) called for the repeated use of common survey instruments that could withstand rigorous discriminant validity and predict reliable results. This study re-confirmed the need for survey instruments that can be applied across different groups and maintain both construct integrity and discriminant validity. In aviation, there needs to be a reliable instrument or small set of instruments that are open for use across diverse groups. This common group of survey instruments needs to have the ability to detect a decline in safety behavior or their antecedents early enough to implement solutions before these declines become safety issues.

The IS, PC, and AT items used from the literature did not load strongly on their hypothesized factors and, therefore, may not be reliable instruments for future research with Fractional pilots or similar groups, or the questions would need to be revised. Future instruments need to be concise and measure the intended construct efficiently. The IS, PC, and AT factors may not provide enough benefit for future studies on similar pilot groups.

Future research may include the following alternative SEM model based on the existing literature from Brown et al. (2005) and Freiwald (2013). The Brown, Treviño, & Harrison (2005) and Freiwald (2013) studies suggested ethical leadership has an influence on safety behavior and outcomes. These studies suggest that future research may be conducted with ethical leadership or the wider construct of leadership as the exogenous or predictor variable in a causal model with safety culture and safety performance as the endogenous variables. The following model for future SEM research has the potential for strong and significant relationships of both hypotheses (see Figure 11).

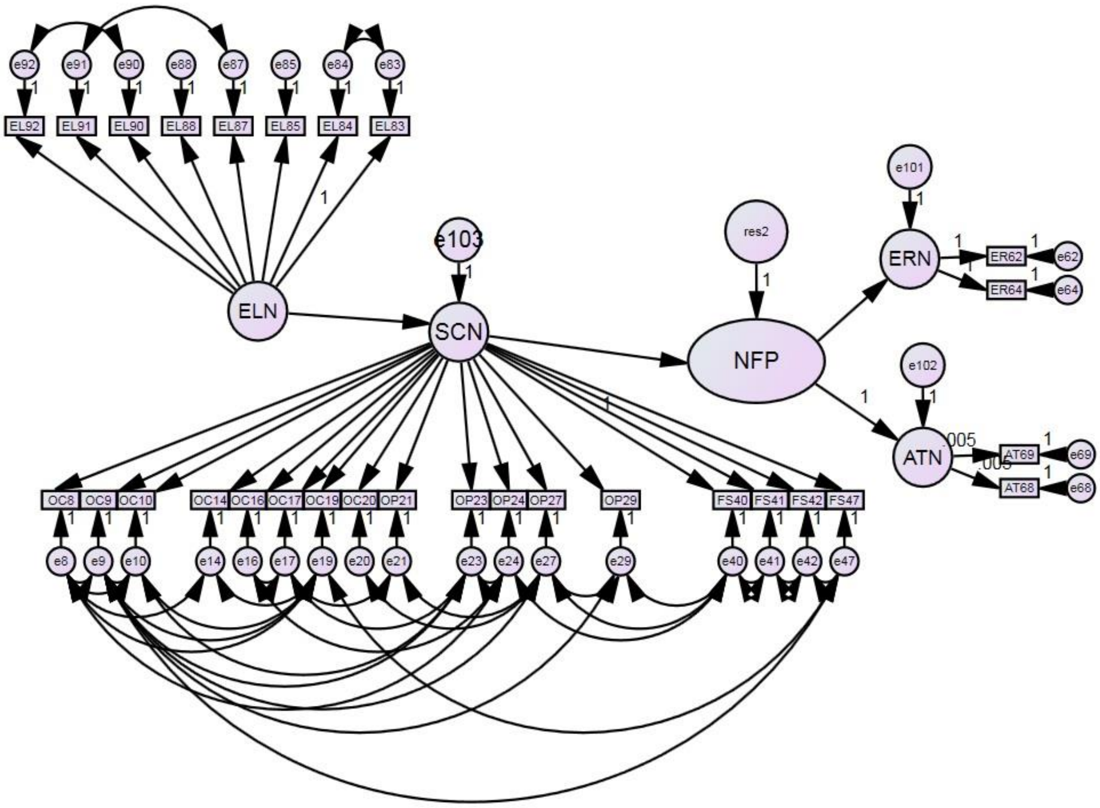


Figure 11. Proposed Future SEM Model.

Conducting the revised study on similar pilot groups with varying historical safety records may yield actionable group differences. The Fractional companies have achieved a superior safety record when compared with Charter operators; therefore, conducting the same study for random Charter pilots in the U.S. has the potential to both test the revised model and identify group differences. If significant, these group differences may lead to strategies to improve general aviation safety.

Future studies should include a reliable and quantifiable data source to augment the self-reporting data. Zohar's study (2000) used quantifiable data as the endogenous variable from which to draw conclusions. Zohar has advocated the use of quantifiable data such as micro-accidents as the endogenous variable in a safety climate research. In general aviation, the accident and incident rates are so low that drawing valid conclusions about antecedents to accidents and incidents may not be valid (O'Connor, 2011). In an unpublished study using quantifiable data in commercial aviation, Cistone et al. (2011) encountered issues with the reliability and validity of the accelerometer measurements for hard landings at one Middle Eastern airline. The accelerometers had both measurement errors and instrument calibration issues across the fleet that made drawing conclusions from the data difficult.

Self-reported data will remain an important part of aviation safety due to infrequency of accidents and or incidents; however, augmenting survey data with reliable and quantifiable data would be recommended to create a more comprehensive methodology to predict declines in aviation safety. In 2000, Zohar used micro-accidents to illuminate declines in safety before more serious accidents could occur. The Quick Access Recorder (QAR) installed in many aircraft, records operational data, such as pilot inputs. This QAR data can be analyzed and used as an indication that safety is declining. For example, in May 2014, a G-IV crashed while departing Bedford, MA (KBED). In its report, the NTSB reviewed the QAR data and determined the crew had not performed a proper check of the flight controls on 89.8% of the previous 176 flights (NTSB AAR-15/03, 2015). If the QAR data had been monitored, it would have demonstrated this crew’s disregard for standard pre-flight checks, and corrective actions could have been implemented that would have likely prevented this accident.

Finally, the instruments used in aviation need to be more reliable, freely available for use in other studies, and must maintain discriminant validity when used with other instruments. These instruments need to be concise and measure the intended construct. Without the open and repeated use of a distinct and reliable instrument or a small set of instruments, aviation is unlikely to realize the potential benefits of forecasting a decline in safety behavior. Reliable forecasting of declines in safety behavior has the potential to prevent catastrophic aviation accidents.

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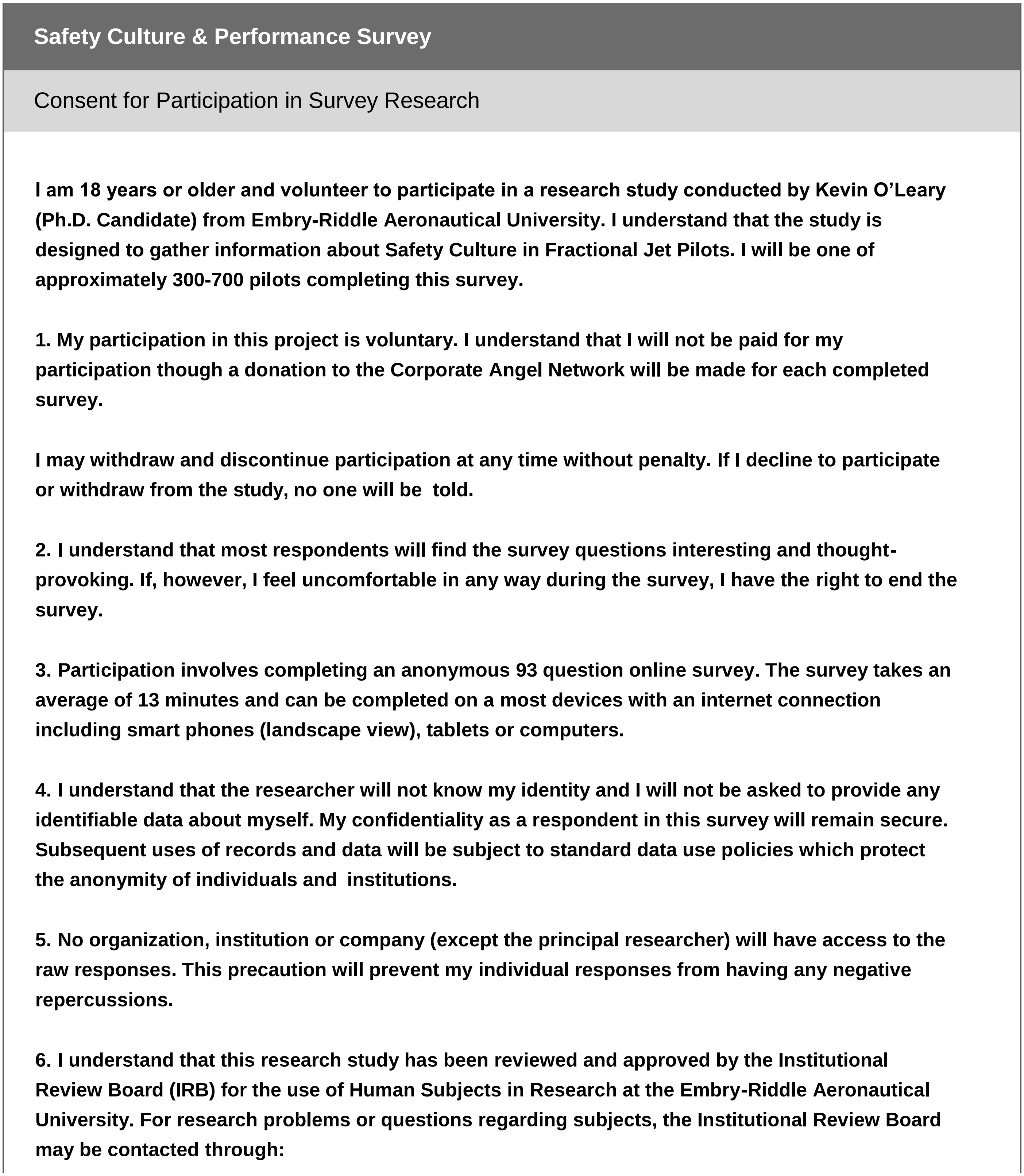
APPENDIX A

Permission to Conduct Research



Safety Culture & Performance Survey

Consent for Participation in Survey Research

I am 18 years or older and volunteer to participate in a research study conducted by Kevin O'Leary (Ph.D. Candidate) from Embry-Riddle Aeronautical University. I understand that the study is designed to gather information about Safety Culture in Fractional Jet Pilots. I will be one of approximately 300-700 pilots completing this survey.

1. My participation in this project is voluntary. I understand that I will not be paid for my participation though a donation to the Corporate Angel Network will be made for each completed survey.

I may withdraw and discontinue participation at any time without penalty. If I decline to participate or withdraw from the study, no one will be told.

2. I understand that most respondents will find the survey questions interesting and thought-provoking. If, however, I feel uncomfortable in any way during the survey, I have the right to end the survey.

3. Participation involves completing an anonymous 93 question online survey. The survey takes an average of 13 minutes and can be completed on a most devices with an internet connection including smart phones (landscape view), tablets or computers.

4. I understand that the researcher will not know my identity and I will not be asked to provide any identifiable data about myself. My confidentiality as a respondent in this survey will remain secure. Subsequent uses of records and data will be subject to standard data use policies which protect the anonymity of individuals and institutions.

5. No organization, institution or company (except the principal researcher) will have access to the raw responses. This precaution will prevent my individual responses from having any negative repercussions.

6. I understand that this research study has been reviewed and approved by the Institutional Review Board (IRB) for the use of Human Subjects in Research at the Embry-Riddle Aeronautical University. For research problems or questions regarding subjects, the Institutional Review Board may be contacted through:

David C. Ison, Ph.D. Research Chair
Assistant Professor of Aeronautics College of Aeronautics
Embry-Riddle Aeronautical University, Worldwide
Editor, International Journal of Aviation, Aeronautics, and Aerospace Office
(Cell): (503) 507-5697
email: isond46@erau.edu Skype: david.ison73
Website: http://worldwide.erau.edu

7. If requested, I will be given a copy of this consent form.

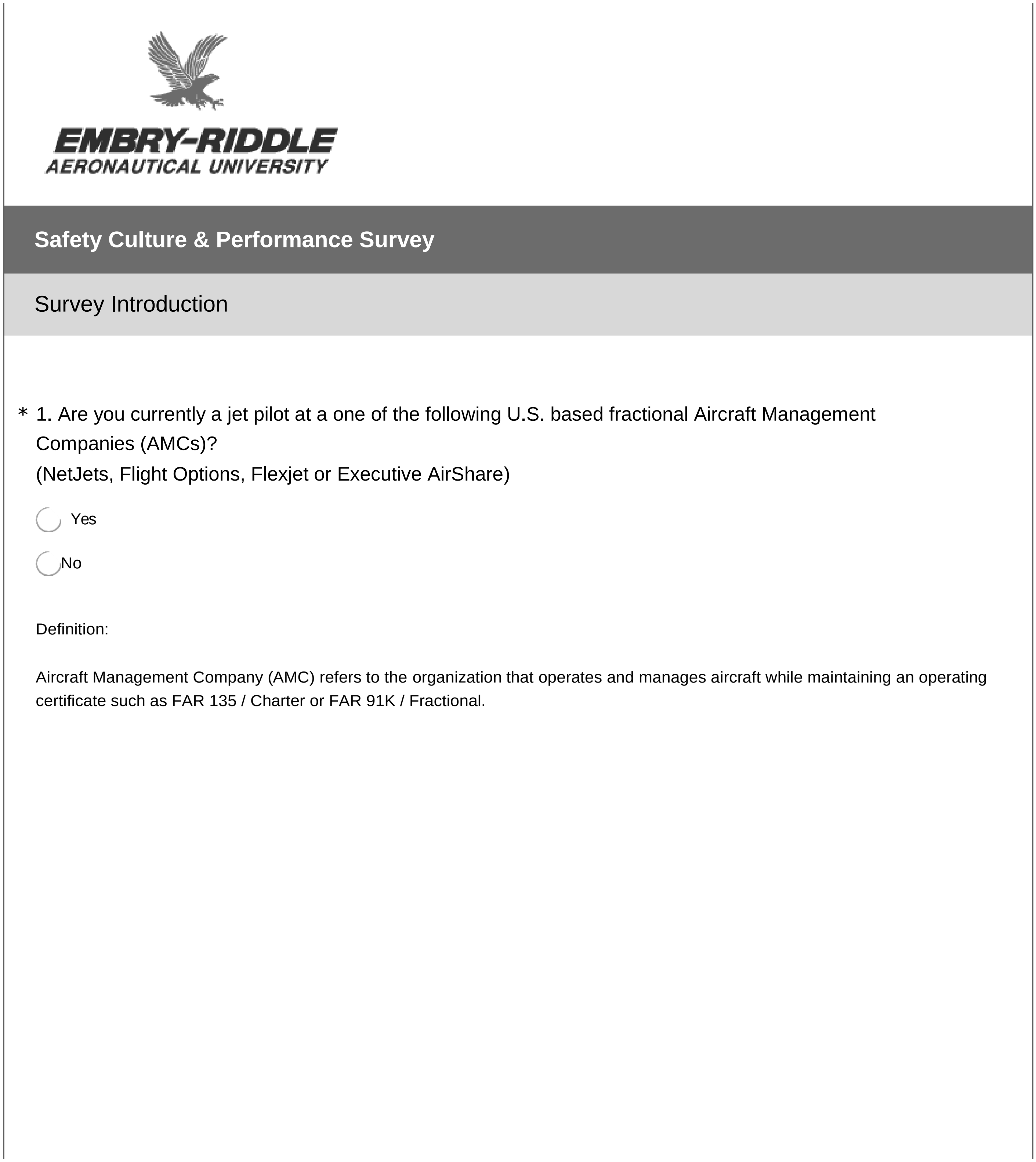
8. I have read and understand the explanation provided to me. I have had all my questions answered to my satisfaction, and I voluntarily agree to participate in this study. My continuation with this survey will serve as confirmation of my consent to participate in this study.

Thank you very much for your participation in this important study. Principal

Investigator
Kevin O'Leary Ph.D. Candidate
Embry-Riddle Aeronautical University olearyk1@my.erau.edu
617-600-6868

APPENDIX B

Data Collection Device



EMBRY-RIDDLE
AERONAUTICAL UNIVERSITY

Safety Culture & Performance Survey

Survey Introduction

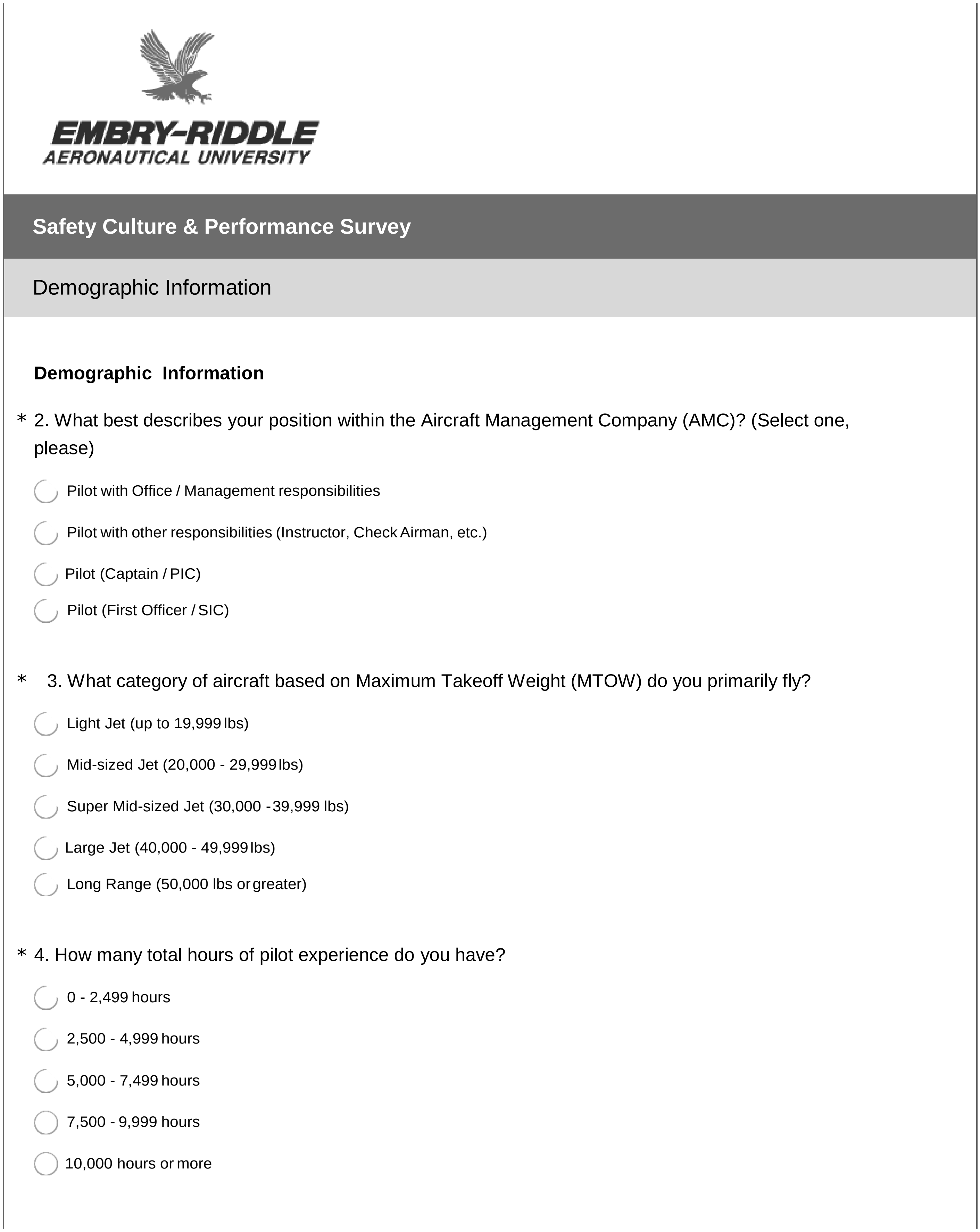
* 1. Are you currently a jet pilot at a one of the following U.S. based fractional Aircraft Management Companies (AMCs)?
(NetJets, Flight Options, Flexjet or Executive AirShare)

○ Yes

○ No

Definition:

Aircraft Management Company (AMC) refers to the organization that operates and manages aircraft while maintaining an operating certificate such as FAR 135 / Charter or FAR 91K / Fractional.



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Safety Culture & Performance Survey

Demographic Information

Demographic Information

* 2. What best describes your position within the Aircraft Management Company (AMC)? (Select one, please)

○ Pilot with Office / Management responsibilities

○ Pilot with other responsibilities (Instructor, Check Airman, etc.)

○ Pilot (Captain / PIC)

○ Pilot (First Officer / SIC)

* 3. What category of aircraft based on Maximum Takeoff Weight (MTOW) do you primarily fly?

○ Light Jet (up to 19,999 lbs)

○ Mid-sized Jet (20,000 - 29,999 lbs)

○ Super Mid-sized Jet (30,000 -39,999 lbs)

○ Large Jet (40,000 - 49,999 lbs)

○ Long Range (50,000 lbs or greater)

* 4. How many total hours of pilot experience do you have?

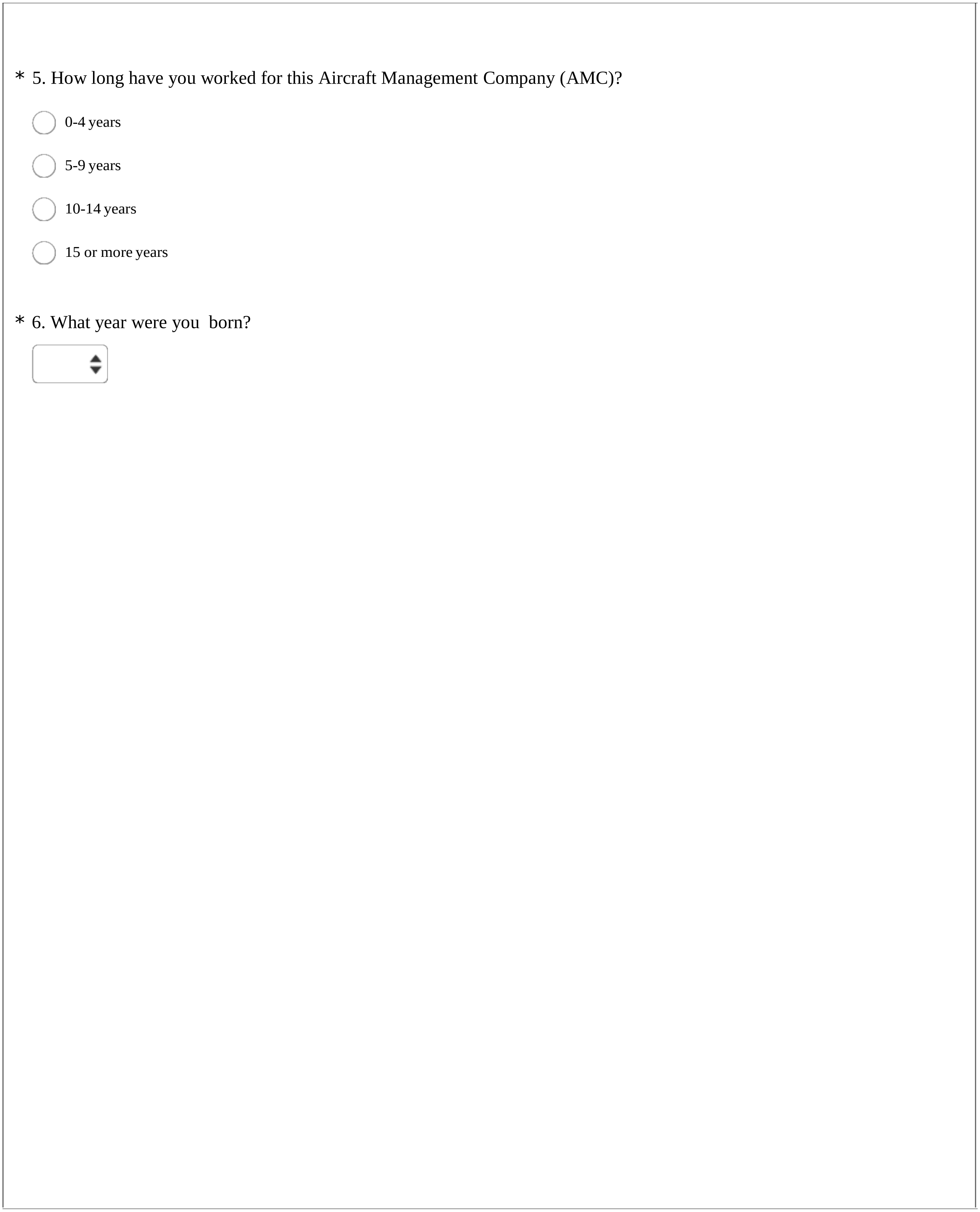
○ 0 - 2,499 hours

○ 2,500 - 4,999 hours

○ 5,000 - 7,499 hours

○ 7,500 - 9,999 hours

○ 10,000 hours or more



* 5. How long have you worked for this Aircraft Management Company (AMC)?

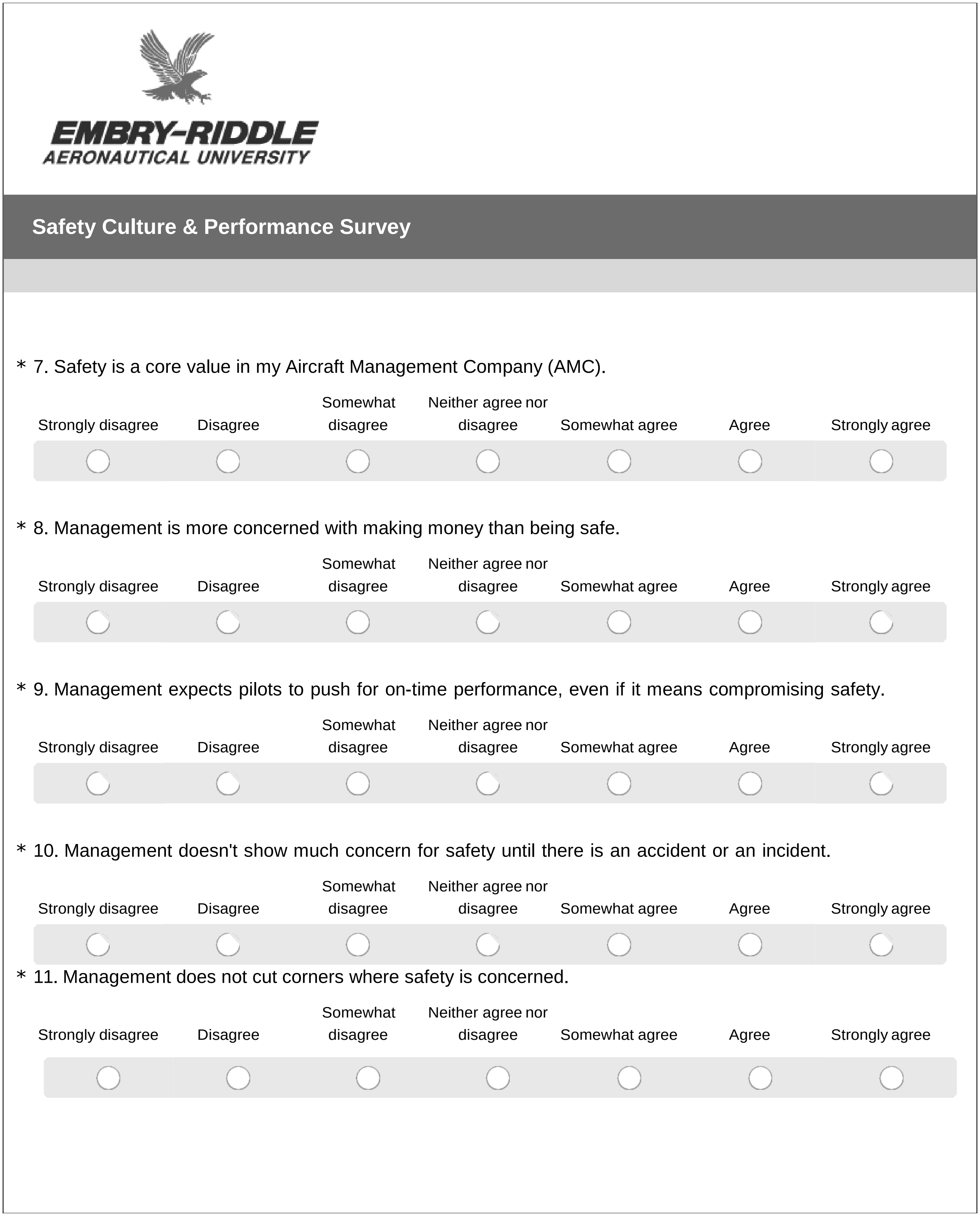
○ 0-4 years

○ 5-9 years

○ 10-14 years

○ 15 or more years

* 6. What year were you born?



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Safety Culture & Performance Survey

* 7. Safety is a core value in my Aircraft Management Company (AMC).

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 8. Management is more concerned with making money than being safe.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 9. Management expects pilots to push for on-time performance, even if it means compromising safety.

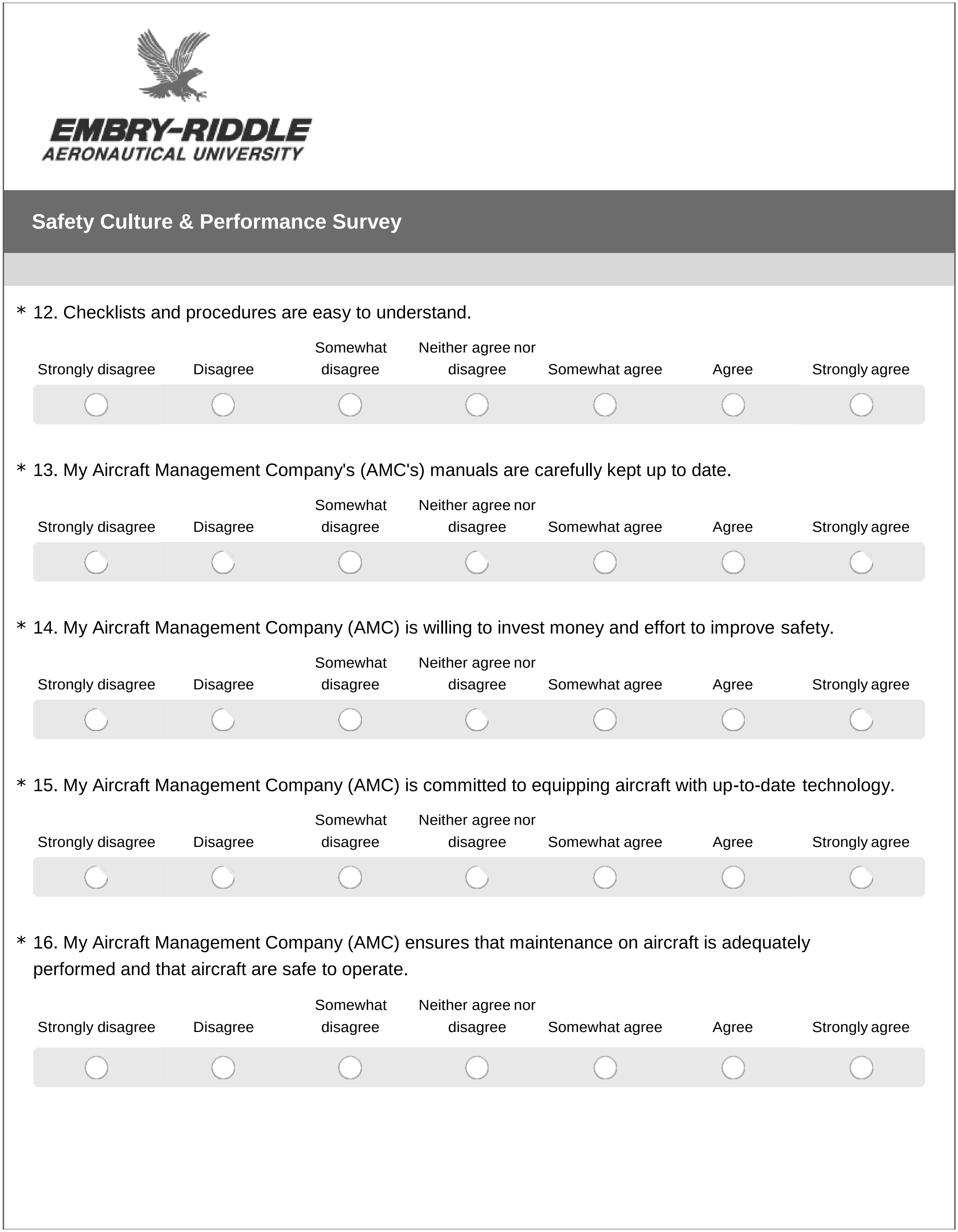
Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 10. Management doesn't show much concern for safety until there is an accident or an incident.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 11. Management does not cut corners where safety is concerned.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○



EMBRY-RIDDLE
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Safety Culture & Performance Survey

* 12. Checklists and procedures are easy to understand.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 13. My Aircraft Management Company's (AMC's) manuals are carefully kept up to date.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 14. My Aircraft Management Company (AMC) is willing to invest money and effort to improve safety.

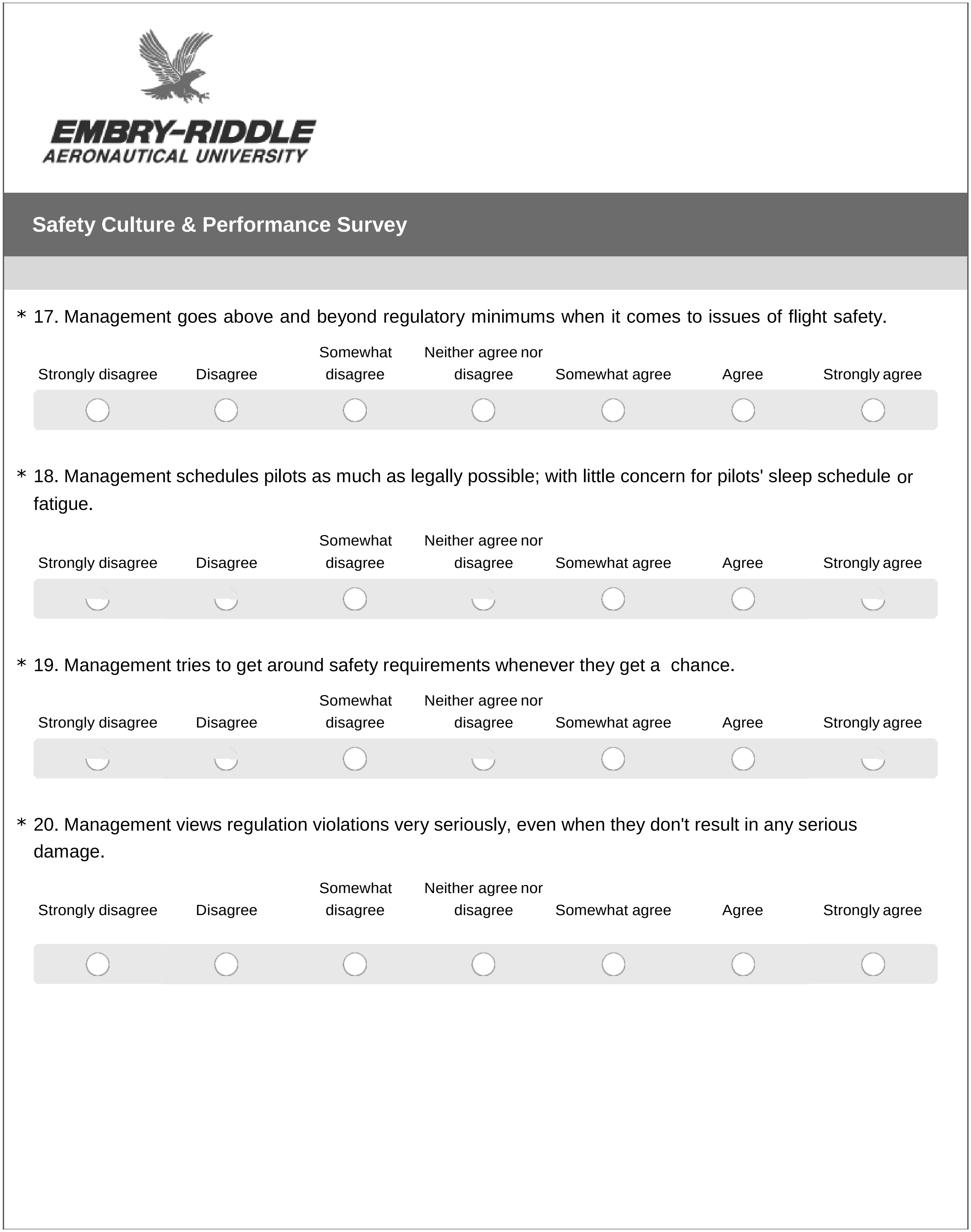
Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 15. My Aircraft Management Company (AMC) is committed to equipping aircraft with up-to-date technology.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 16. My Aircraft Management Company (AMC) ensures that maintenance on aircraft is adequately performed and that aircraft are safe to operate.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○



EMBRY-RIDDLE AERONAUTICAL UNIVERSITY

Safety Culture & Performance Survey

* 17. Management goes above and beyond regulatory minimums when it comes to issues of flight safety.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 18. Management schedules pilots as much as legally possible; with little concern for pilots' sleep schedule or fatigue.

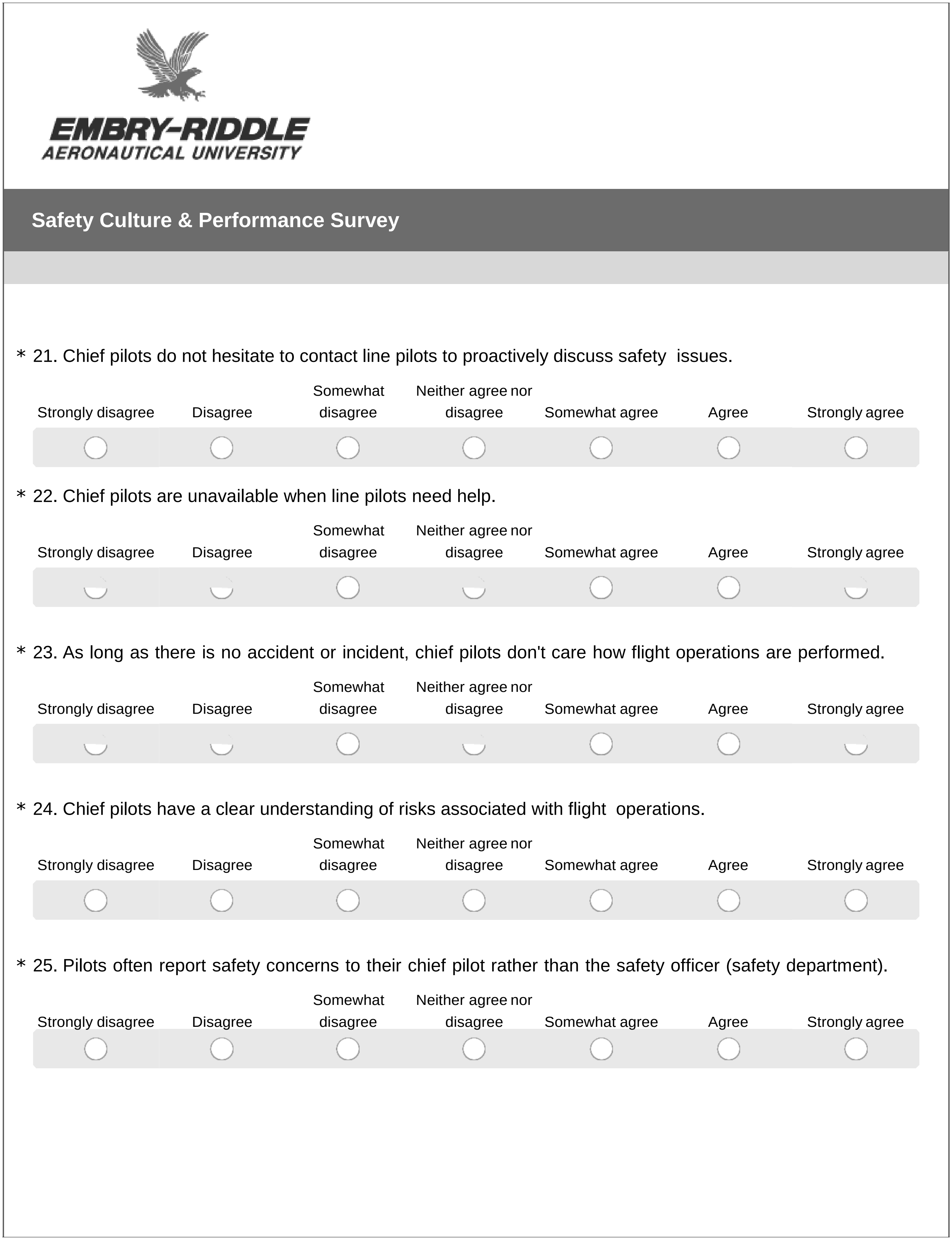
Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 19. Management tries to get around safety requirements whenever they get a chance.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 20. Management views regulation violations very seriously, even when they don't result in any serious damage.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○



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Safety Culture & Performance Survey

* 21. Chief pilots do not hesitate to contact line pilots to proactively discuss safety issues.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 22. Chief pilots are unavailable when line pilots need help.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 23. As long as there is no accident or incident, chief pilots don't care how flight operations are performed.

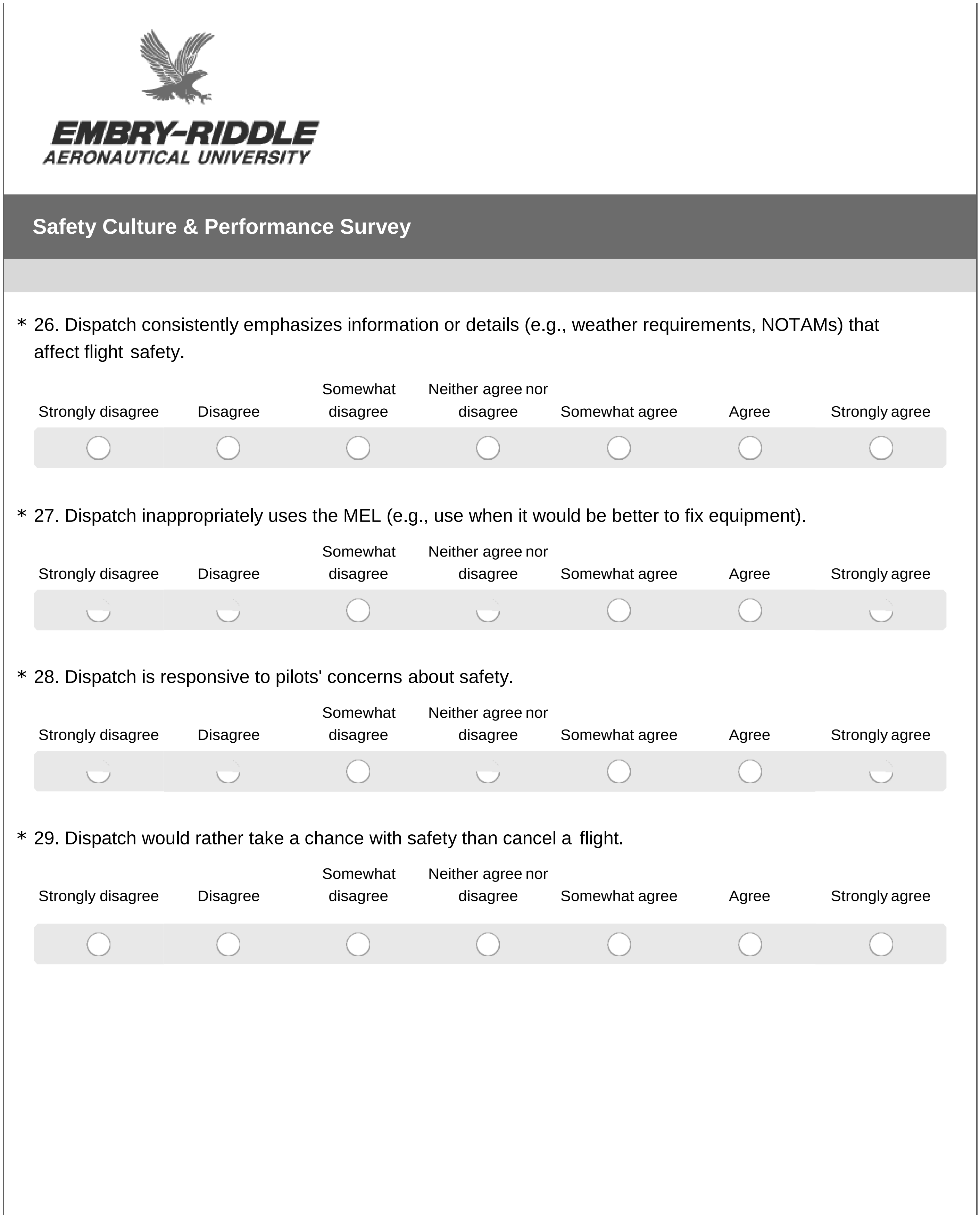
Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 24. Chief pilots have a clear understanding of risks associated with flight operations.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 25. Pilots often report safety concerns to their chief pilot rather than the safety officer (safety department).

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○



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Safety Culture & Performance Survey

* 26. Dispatch consistently emphasizes information or details (e.g., weather requirements, NOTAMs) that affect flight safety.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 27. Dispatch inappropriately uses the MEL (e.g., use when it would be better to fix equipment).

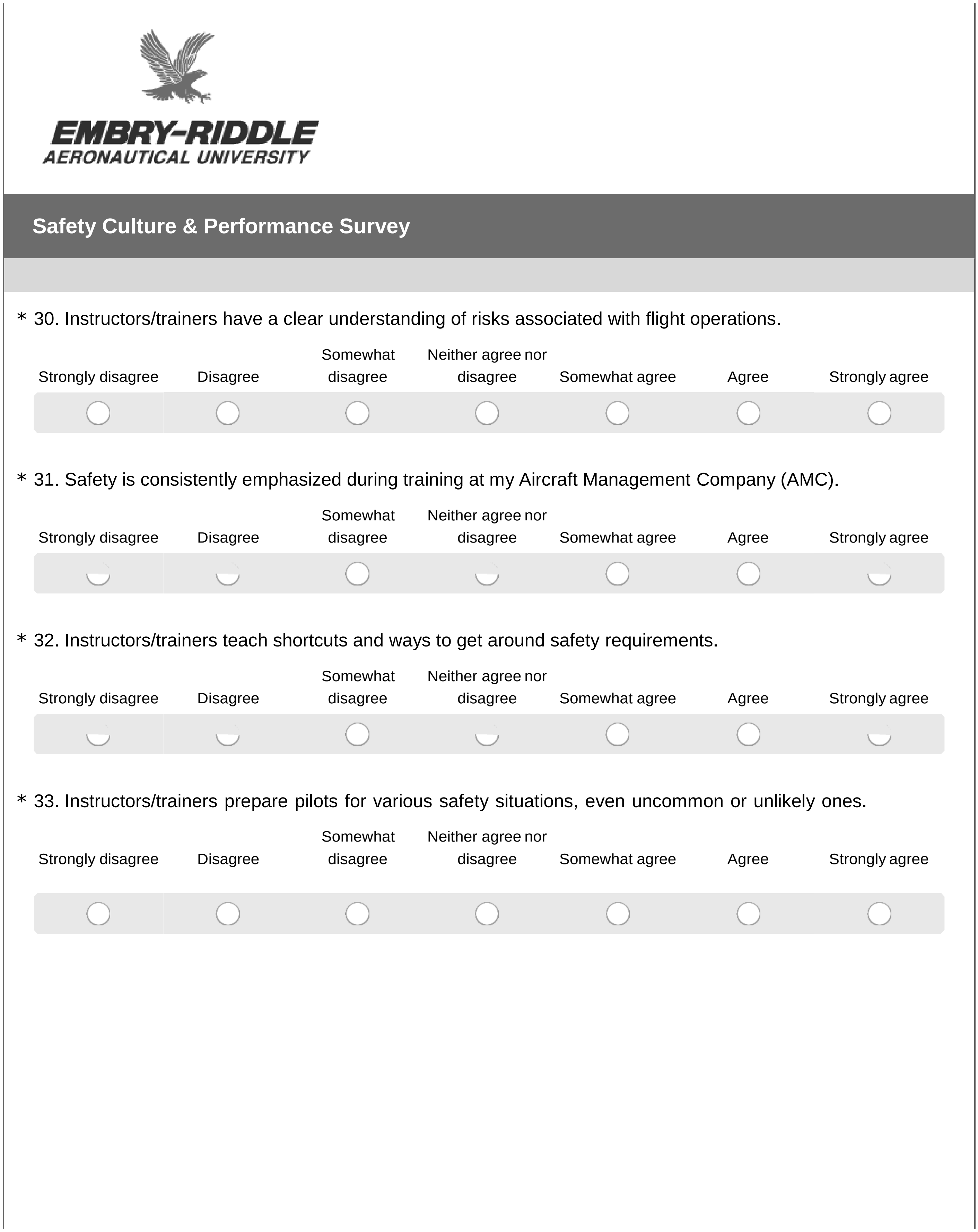
Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 28. Dispatch is responsive to pilots' concerns about safety.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 29. Dispatch would rather take a chance with safety than cancel a flight.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○



Safety Culture & Performance Survey

* 30. Instructors/trainers have a clear understanding of risks associated with flight operations.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 31. Safety is consistently emphasized during training at my Aircraft Management Company (AMC).

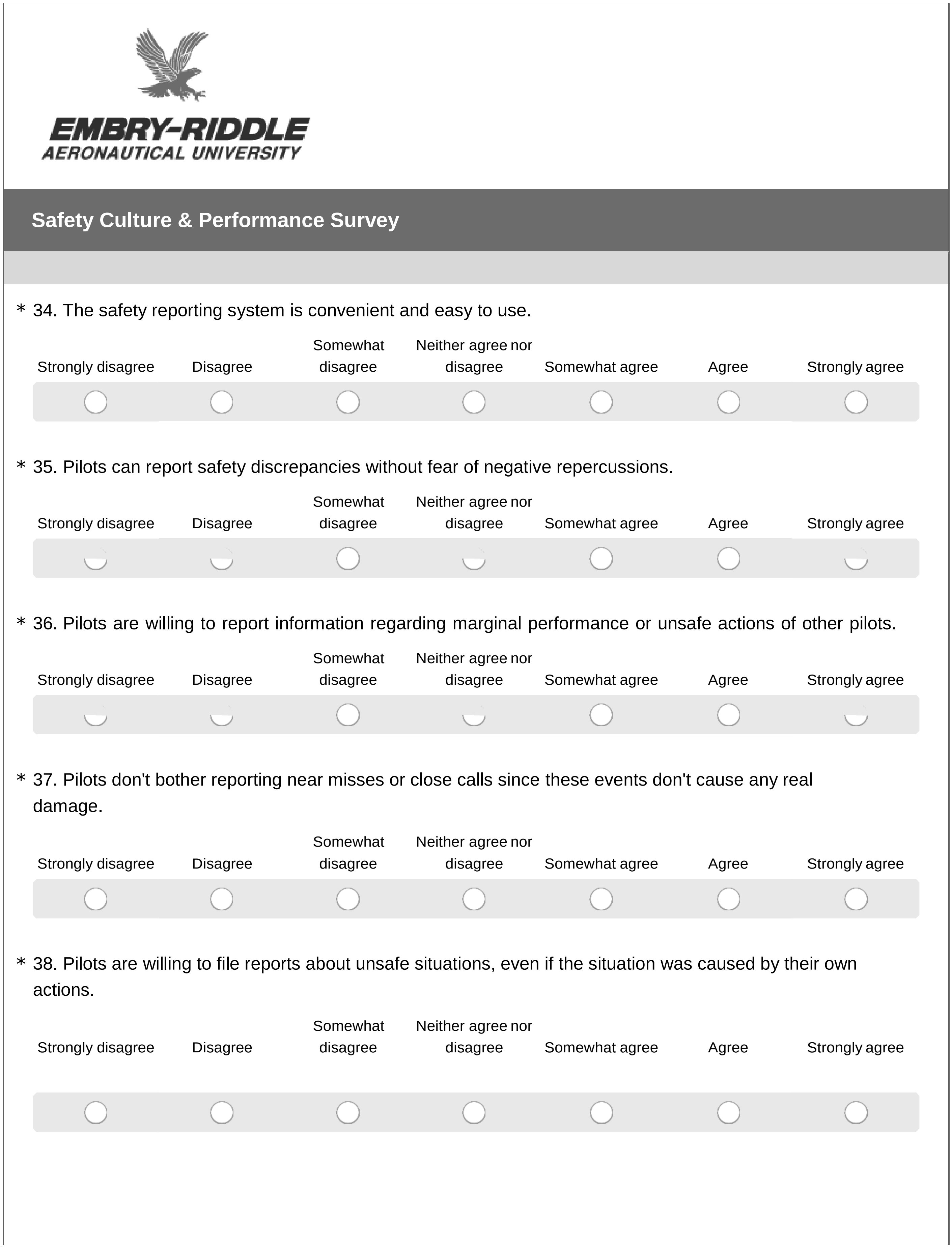
Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 32. Instructors/trainers teach shortcuts and ways to get around safety requirements.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 33. Instructors/trainers prepare pilots for various safety situations, even uncommon or unlikely ones.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○



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Safety Culture & Performance Survey

* 34. The safety reporting system is convenient and easy to use.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 35. Pilots can report safety discrepancies without fear of negative repercussions.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 36. Pilots are willing to report information regarding marginal performance or unsafe actions of other pilots.

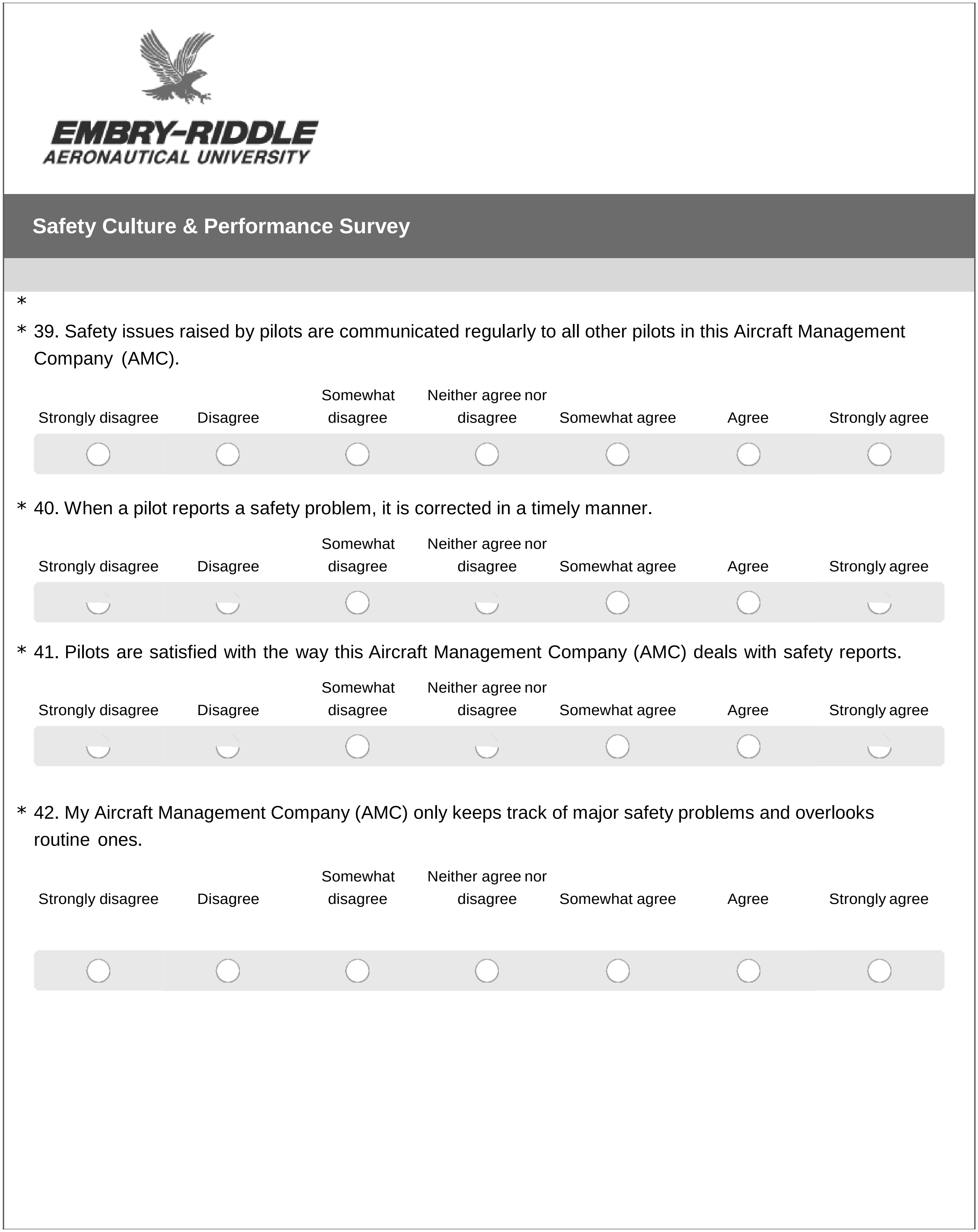
Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 37. Pilots don't bother reporting near misses or close calls since these events don't cause any real damage.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 38. Pilots are willing to file reports about unsafe situations, even if the situation was caused by their own actions.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○



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Safety Culture & Performance Survey

*

* 39. Safety issues raised by pilots are communicated regularly to all other pilots in this Aircraft Management Company (AMC).

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 40. When a pilot reports a safety problem, it is corrected in a timely manner.

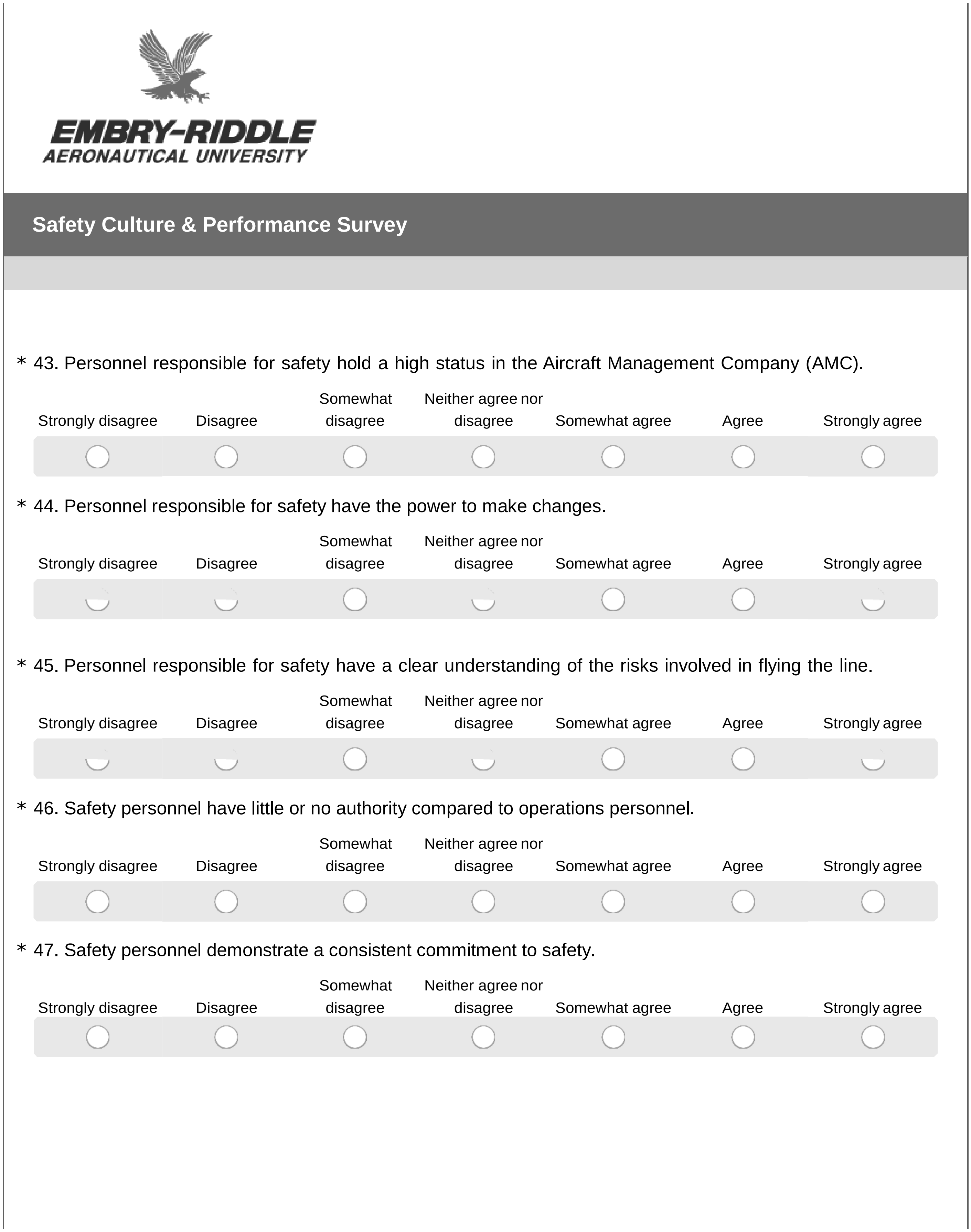
Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 41. Pilots are satisfied with the way this Aircraft Management Company (AMC) deals with safety reports.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 42. My Aircraft Management Company (AMC) only keeps track of major safety problems and overlooks routine ones.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○



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Safety Culture & Performance Survey

* 43. Personnel responsible for safety hold a high status in the Aircraft Management Company (AMC).

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 44. Personnel responsible for safety have the power to make changes.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 45. Personnel responsible for safety have a clear understanding of the risks involved in flying the line.

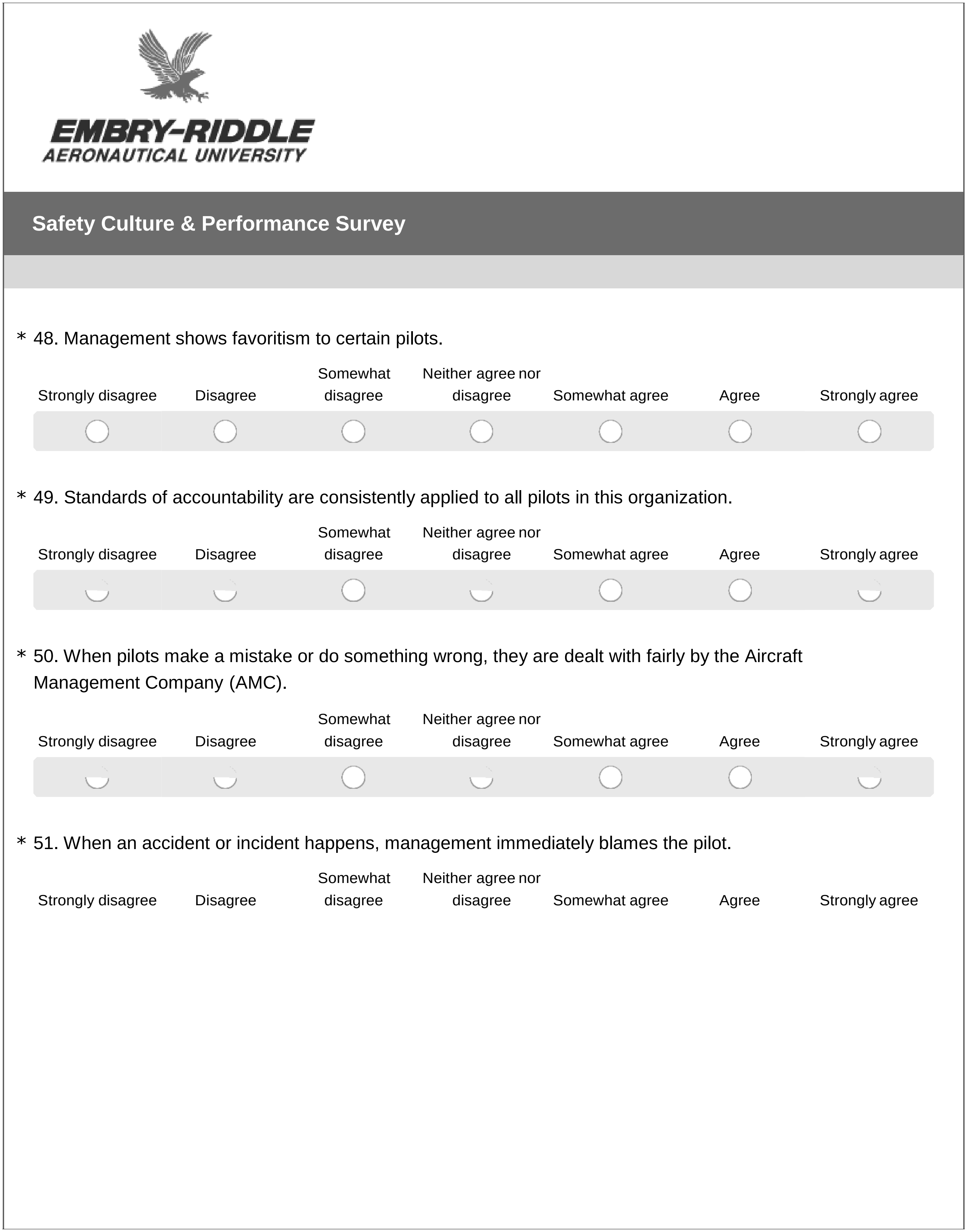
Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 46. Safety personnel have little or no authority compared to operations personnel.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 47. Safety personnel demonstrate a consistent commitment to safety.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○



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Safety Culture & Performance Survey

* 48. Management shows favoritism to certain pilots.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 49. Standards of accountability are consistently applied to all pilots in this organization.

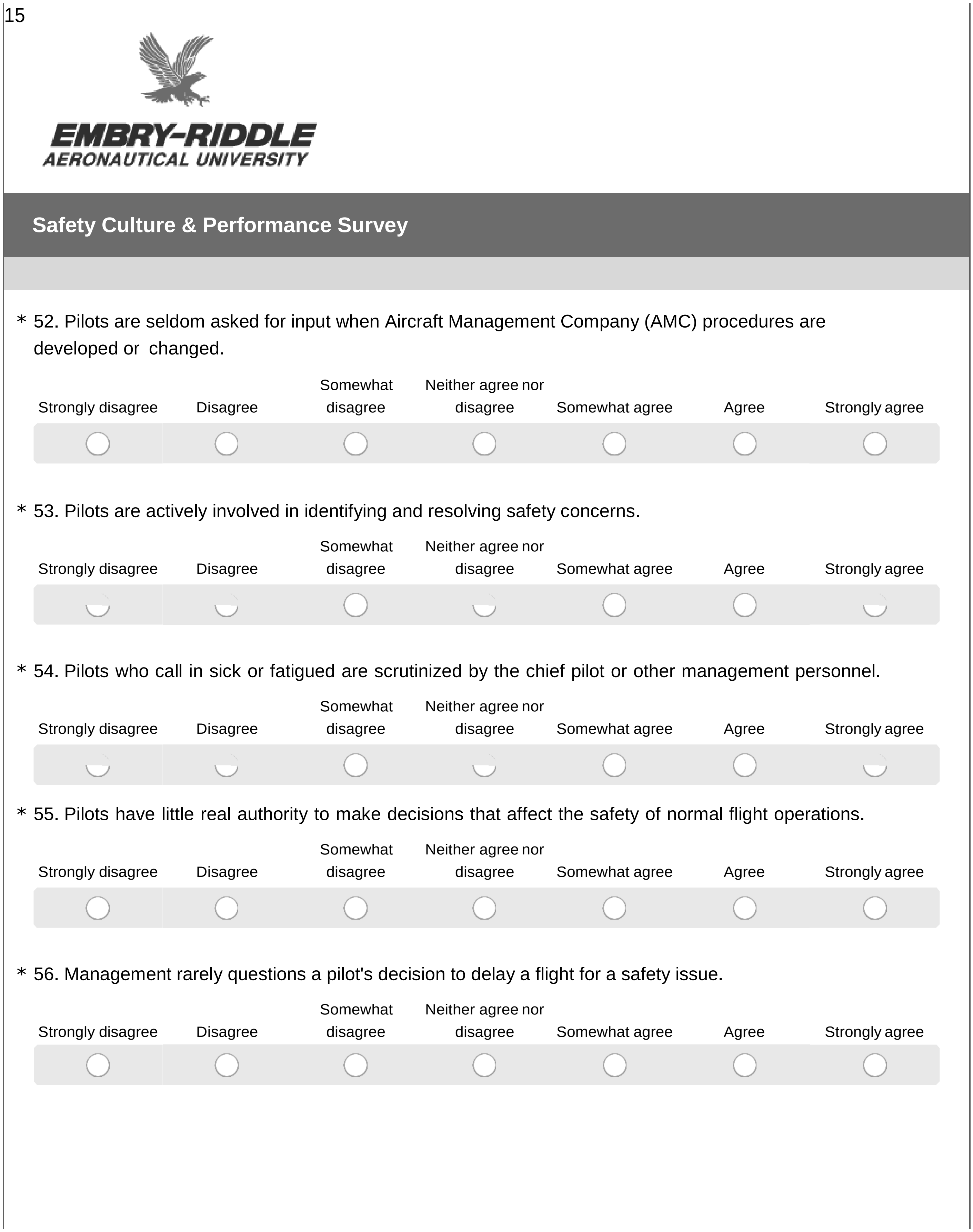
Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 50. When pilots make a mistake or do something wrong, they are dealt with fairly by the Aircraft Management Company (AMC).

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 51. When an accident or incident happens, management immediately blames the pilot.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree



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Safety Culture & Performance Survey

* 52. Pilots are seldom asked for input when Aircraft Management Company (AMC) procedures are developed or changed.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 53. Pilots are actively involved in identifying and resolving safety concerns.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 54. Pilots who call in sick or fatigued are scrutinized by the chief pilot or other management personnel.

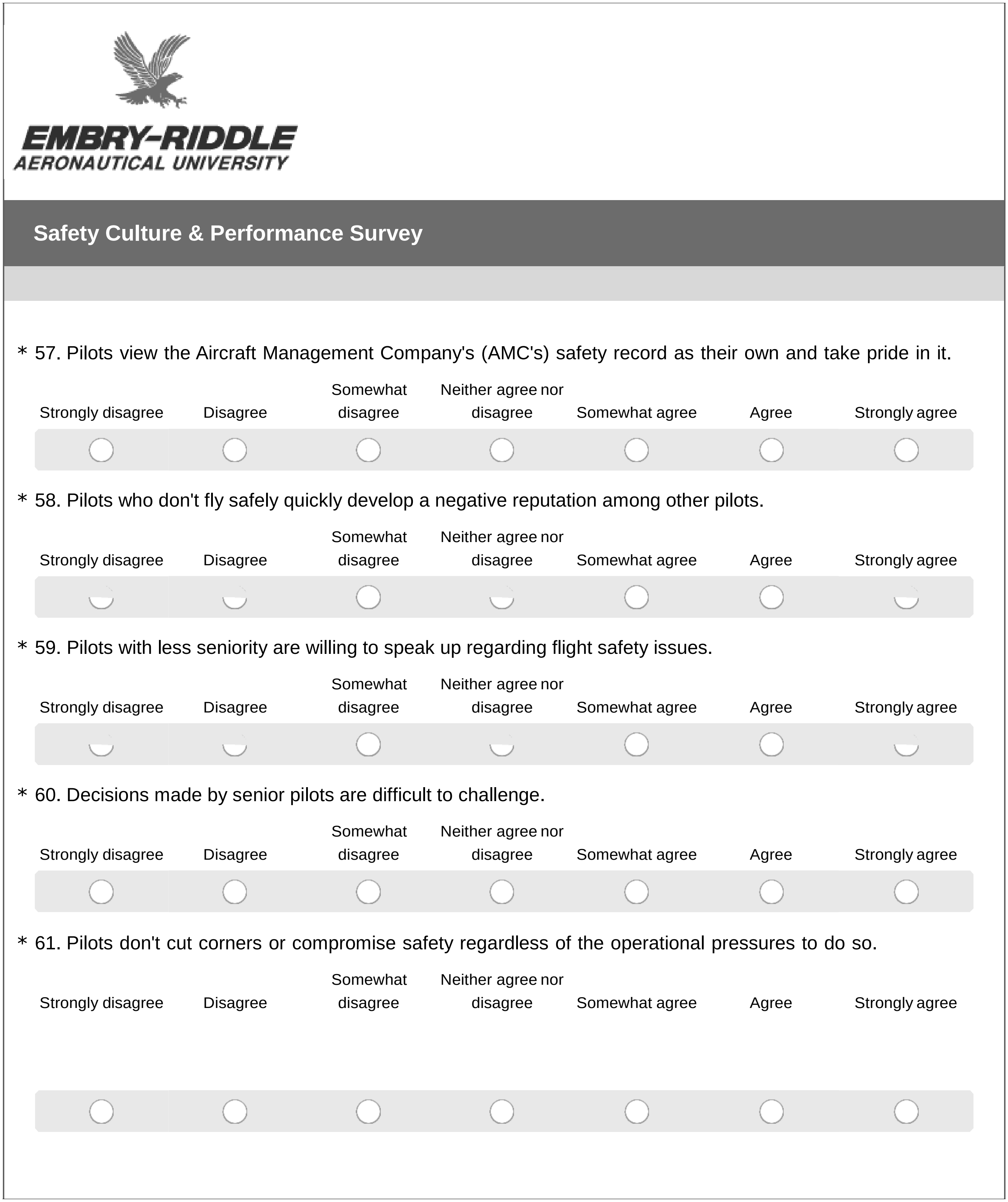
Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 55. Pilots have little real authority to make decisions that affect the safety of normal flight operations.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 56. Management rarely questions a pilot's decision to delay a flight for a safety issue.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○



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Safety Culture & Performance Survey

* 57. Pilots view the Aircraft Management Company's (AMC's) safety record as their own and take pride in it.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 58. Pilots who don't fly safely quickly develop a negative reputation among other pilots.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 59. Pilots with less seniority are willing to speak up regarding flight safety issues.

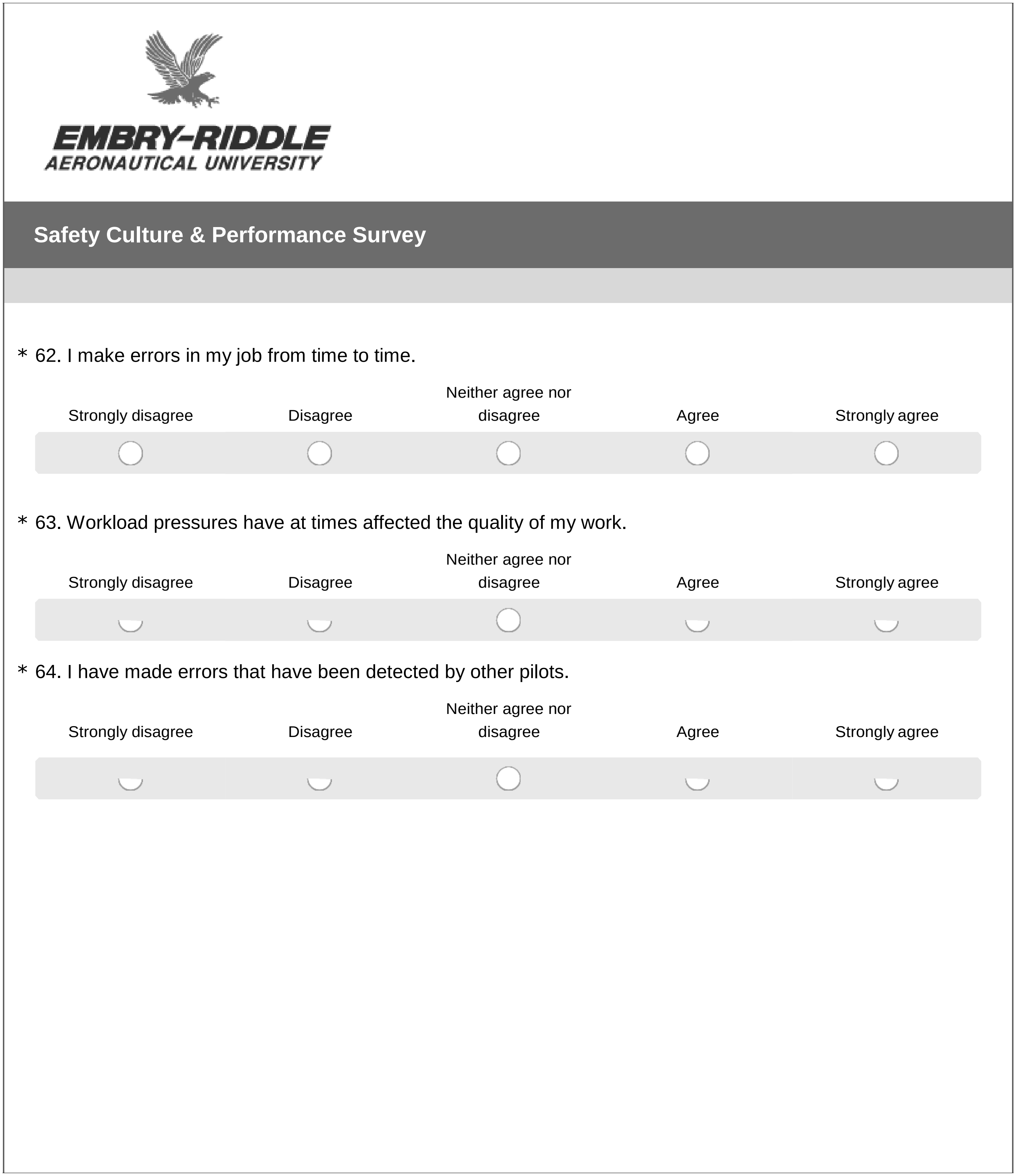
Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 60. Decisions made by senior pilots are difficult to challenge.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 61. Pilots don't cut corners or compromise safety regardless of the operational pressures to do so.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○



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Safety Culture & Performance Survey

* 62. I make errors in my job from time to time.

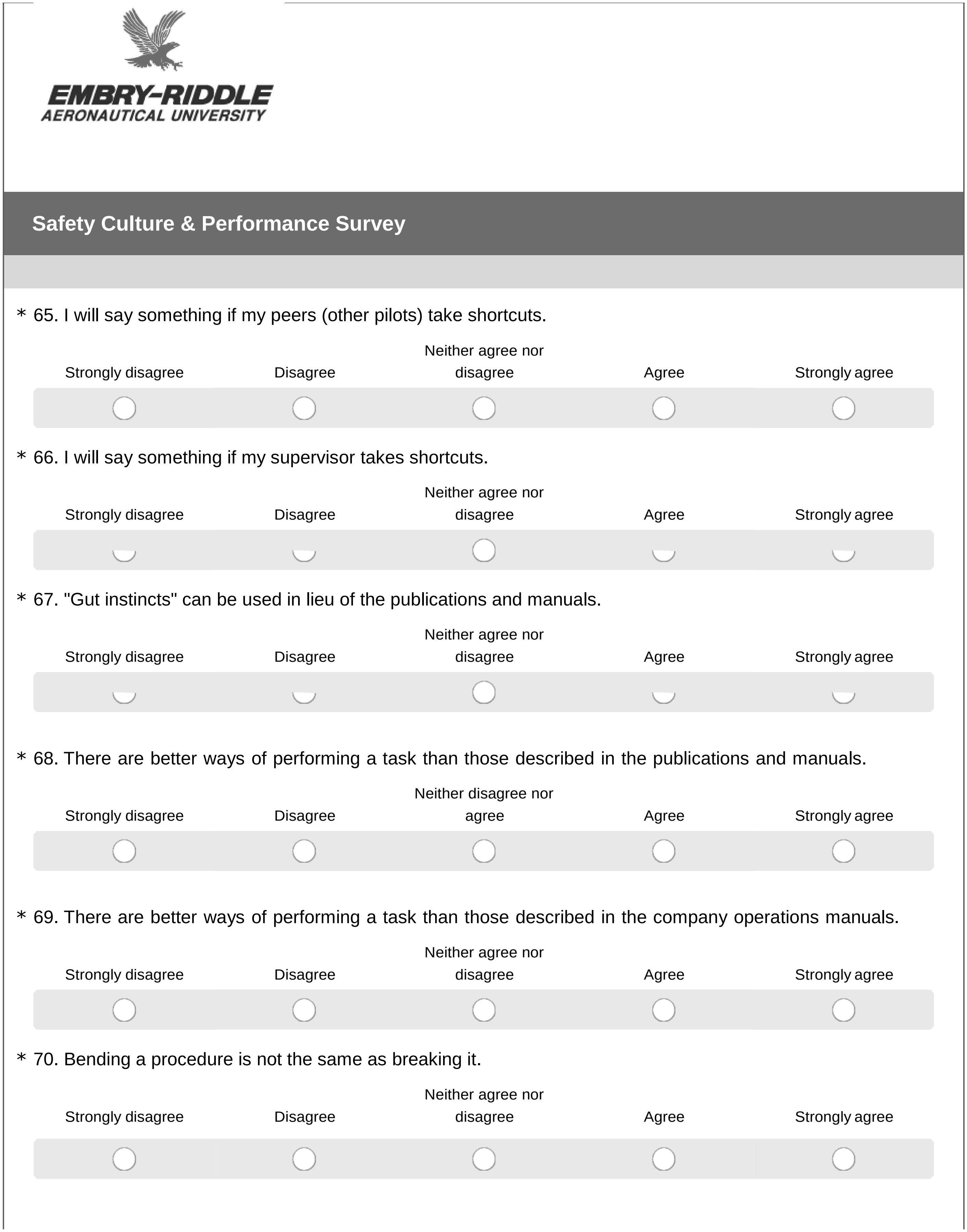
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
○	○	○	○	○

* 63. Workload pressures have at times affected the quality of my work.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
○	○	○	○	○

* 64. I have made errors that have been detected by other pilots.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
○	○	○	○	○



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Safety Culture & Performance Survey

* 65. I will say something if my peers (other pilots) take shortcuts.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
○	○	○	○	○

* 66. I will say something if my supervisor takes shortcuts.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
○	○	○	○	○

* 67. "Gut instincts" can be used in lieu of the publications and manuals.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
○	○	○	○	○

* 68. There are better ways of performing a task than those described in the publications and manuals.

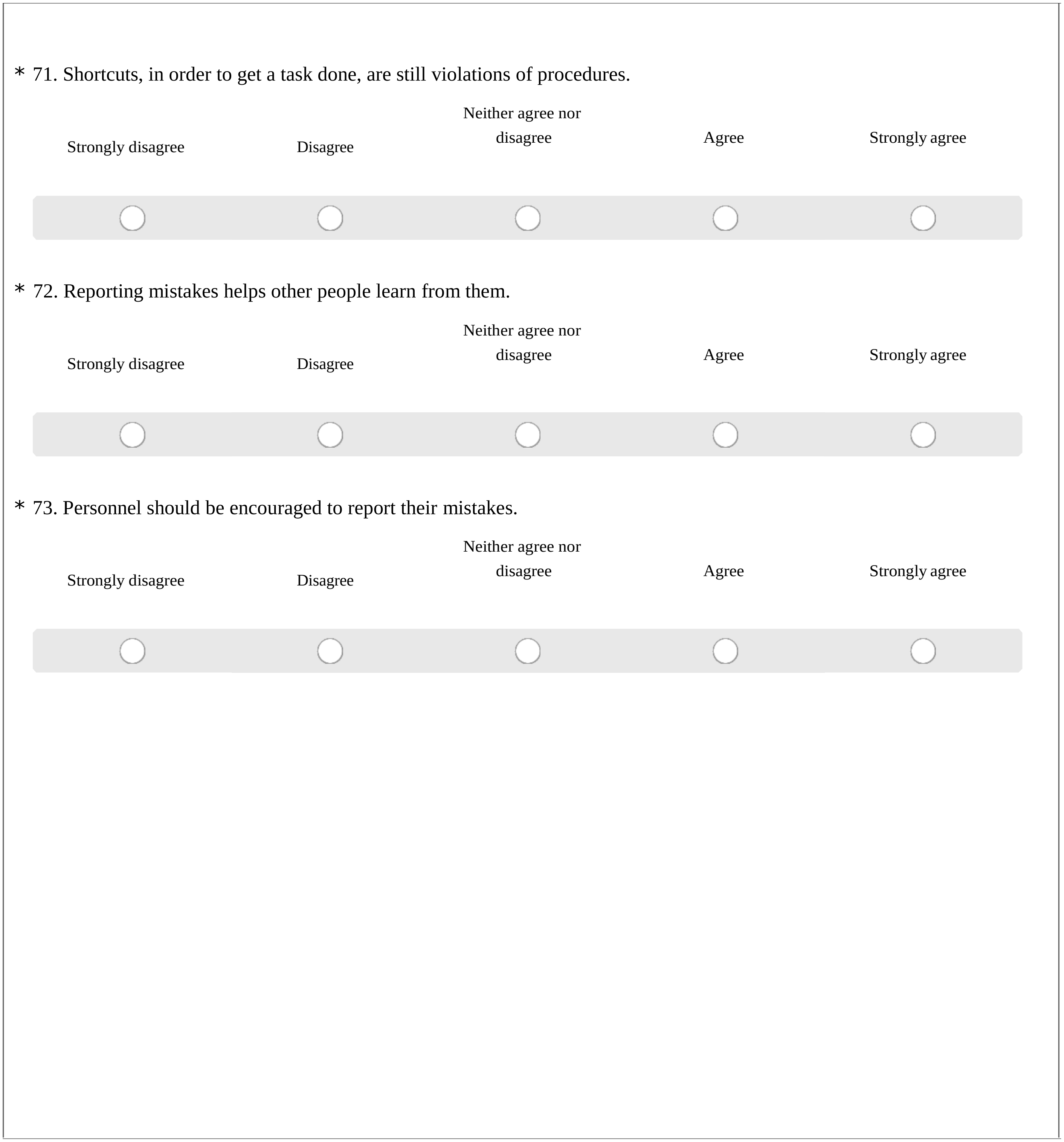
Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
○	○	○	○	○

* 69. There are better ways of performing a task than those described in the company operations manuals.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
○	○	○	○	○

* 70. Bending a procedure is not the same as breaking it.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
○	○	○	○	○



* 71. Shortcuts, in order to get a task done, are still violations of procedures.

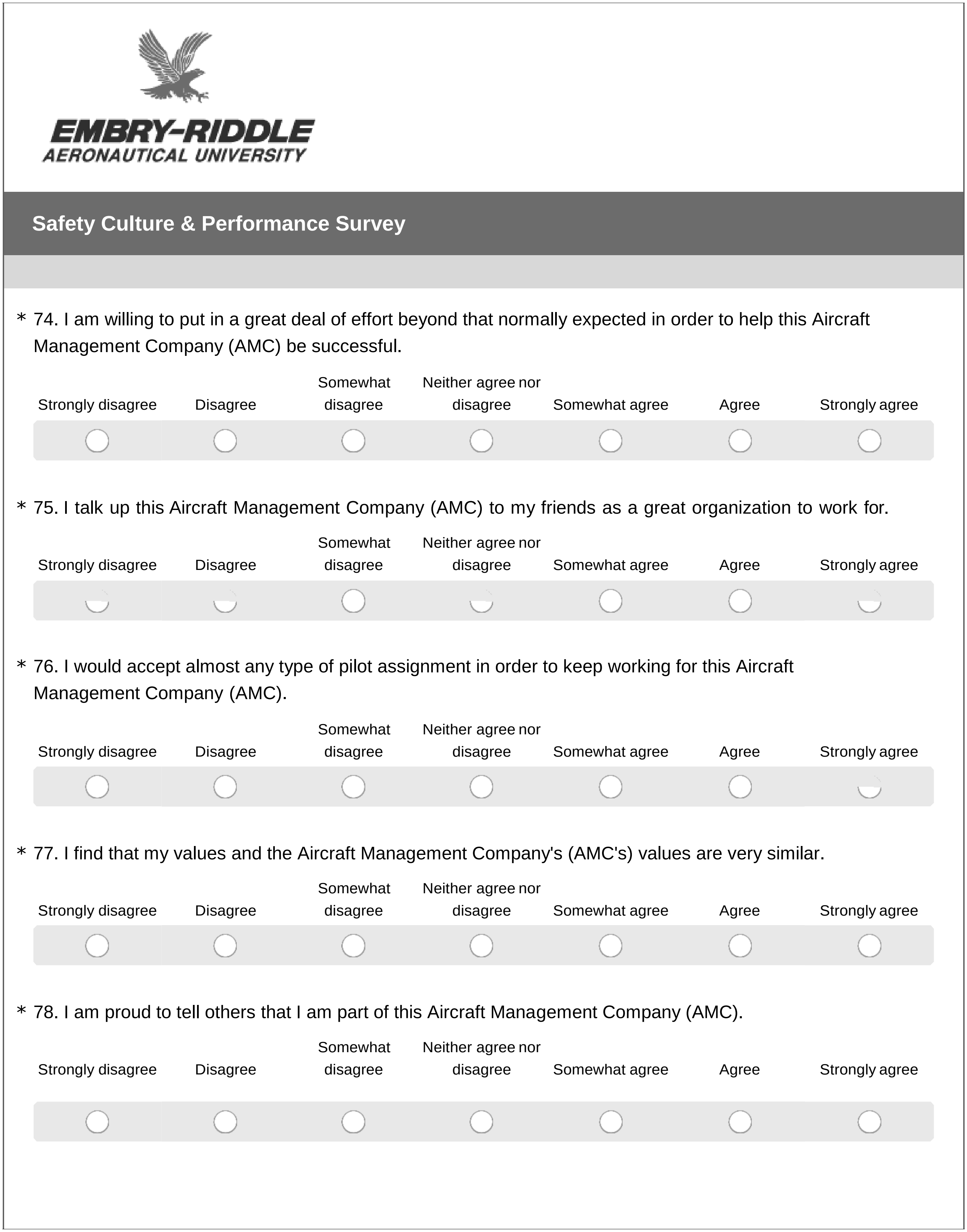
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
○	○	○	○	○

* 72. Reporting mistakes helps other people learn from them.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
○	○	○	○	○

* 73. Personnel should be encouraged to report their mistakes.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
○	○	○	○	○



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Safety Culture & Performance Survey

* 74. I am willing to put in a great deal of effort beyond that normally expected in order to help this Aircraft Management Company (AMC) be successful.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 75. I talk up this Aircraft Management Company (AMC) to my friends as a great organization to work for.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 76. I would accept almost any type of pilot assignment in order to keep working for this Aircraft Management Company (AMC).

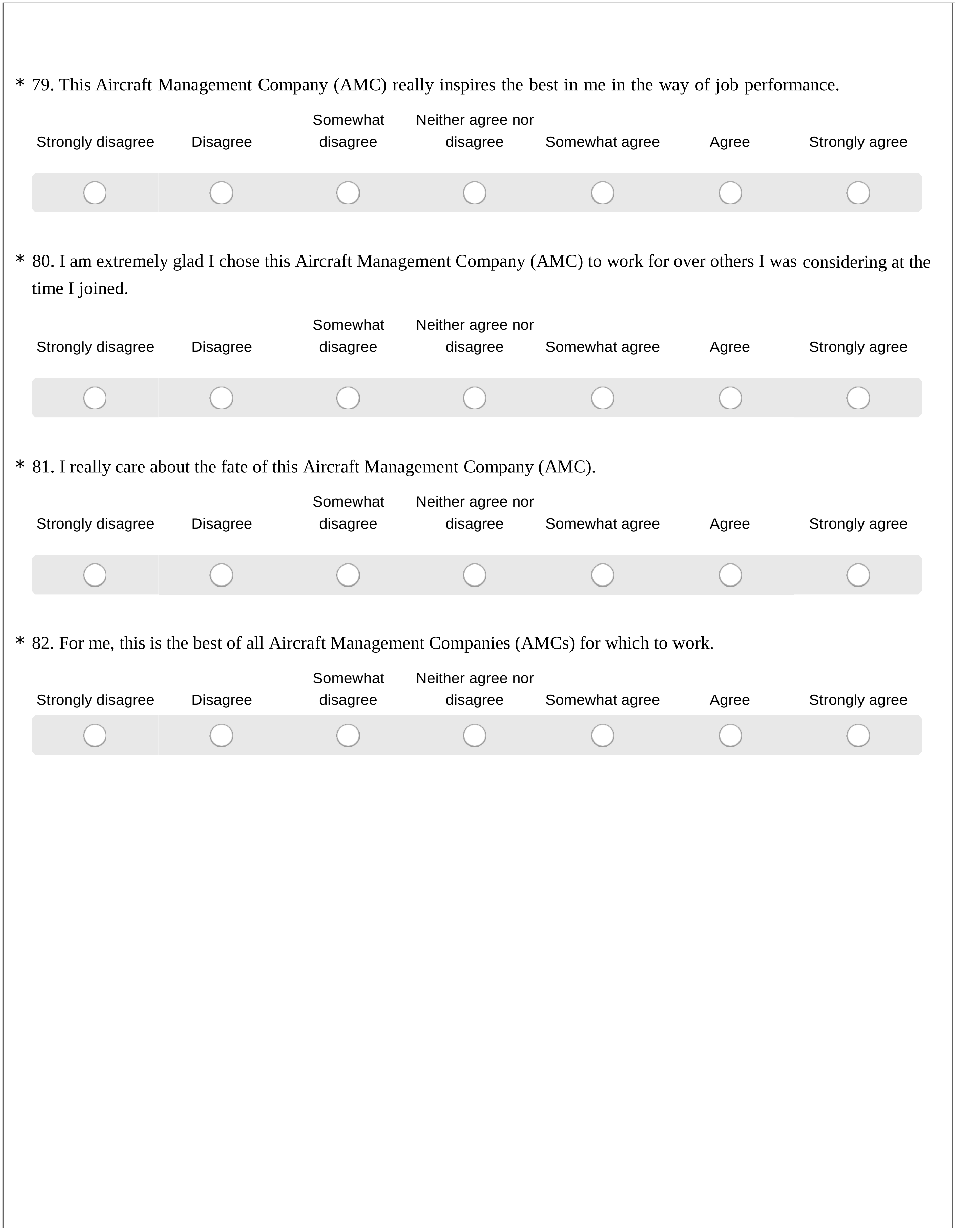
Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 77. I find that my values and the Aircraft Management Company's (AMC's) values are very similar.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 78. I am proud to tell others that I am part of this Aircraft Management Company (AMC).

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○



* 79. This Aircraft Management Company (AMC) really inspires the best in me in the way of job performance.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 80. I am extremely glad I chose this Aircraft Management Company (AMC) to work for over others I was considering at the time I joined.

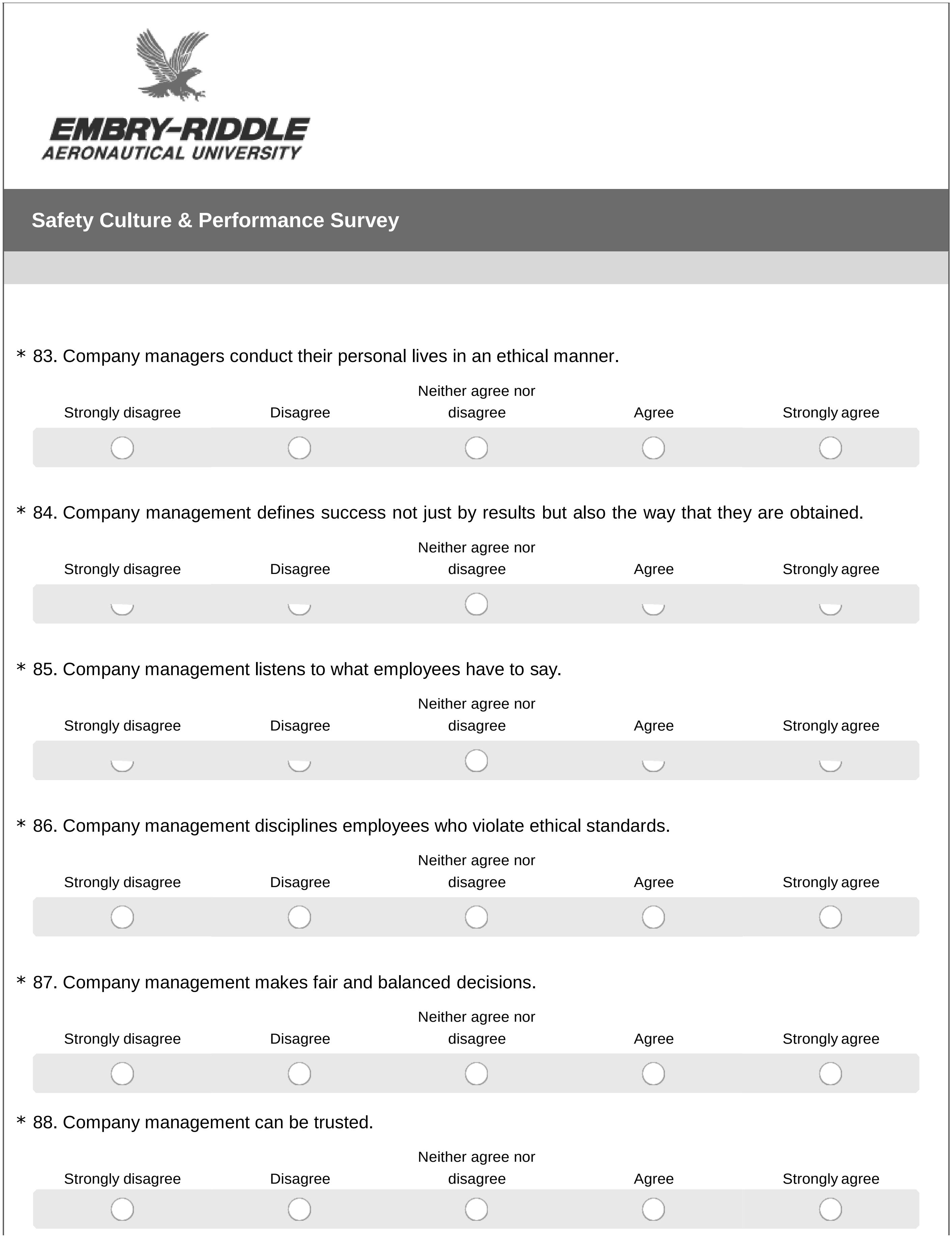
Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 81. I really care about the fate of this Aircraft Management Company (AMC).

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

* 82. For me, this is the best of all Aircraft Management Companies (AMCs) for which to work.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○



Safety Culture & Performance Survey

* 83. Company managers conduct their personal lives in an ethical manner.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
○	○	○	○	○

* 84. Company management defines success not just by results but also the way that they are obtained.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
○	○	○	○	○

* 85. Company management listens to what employees have to say.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
○	○	○	○	○

* 86. Company management disciplines employees who violate ethical standards.

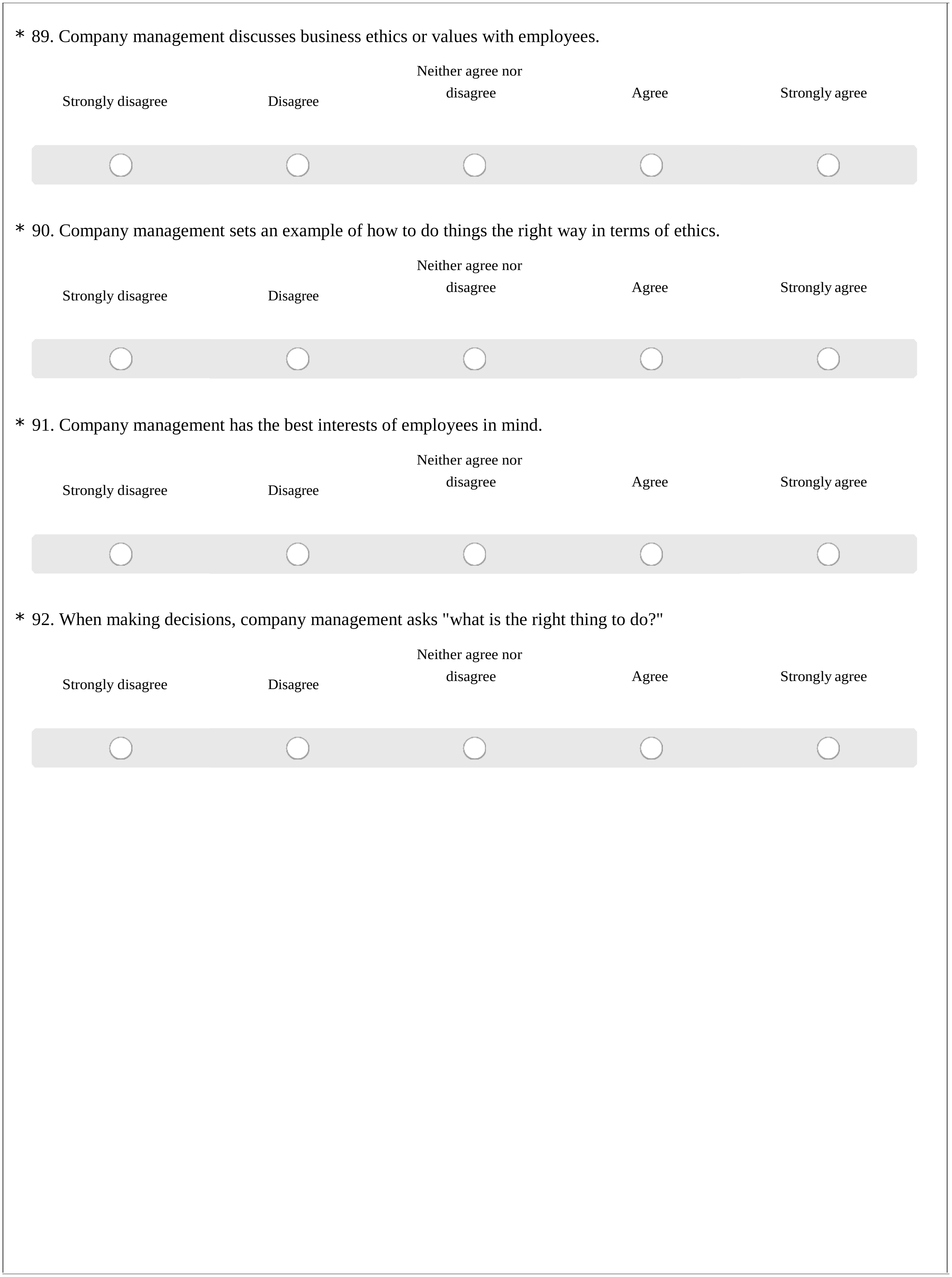
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
○	○	○	○	○

* 87. Company management makes fair and balanced decisions.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
○	○	○	○	○

* 88. Company management can be trusted.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
○	○	○	○	○



* 89. Company management discusses business ethics or values with employees.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
○	○	○	○	○

* 90. Company management sets an example of how to do things the right way in terms of ethics.

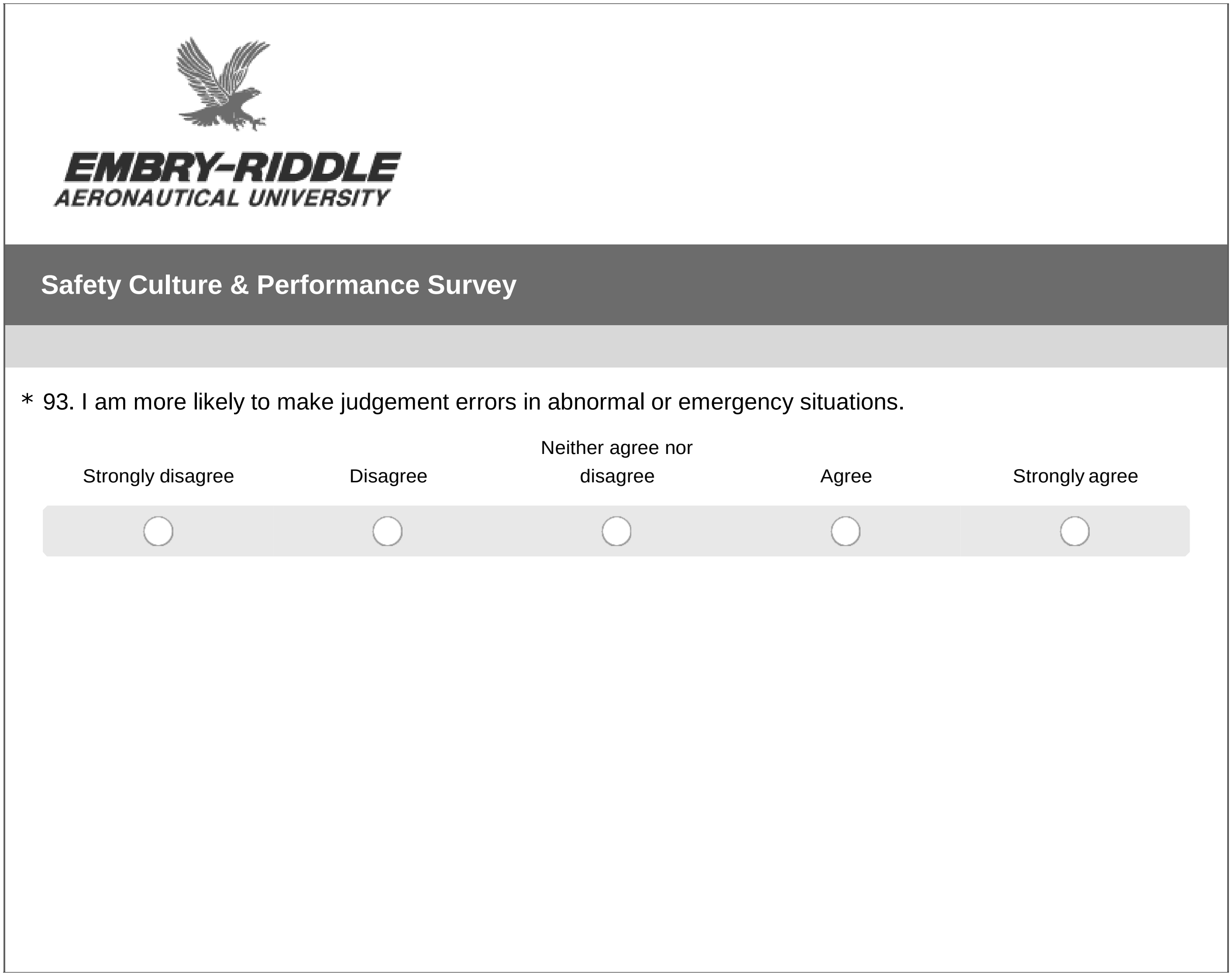
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
○	○	○	○	○

* 91. Company management has the best interests of employees in mind.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
○	○	○	○	○

* 92. When making decisions, company management asks "what is the right thing to do?"

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
○	○	○	○	○



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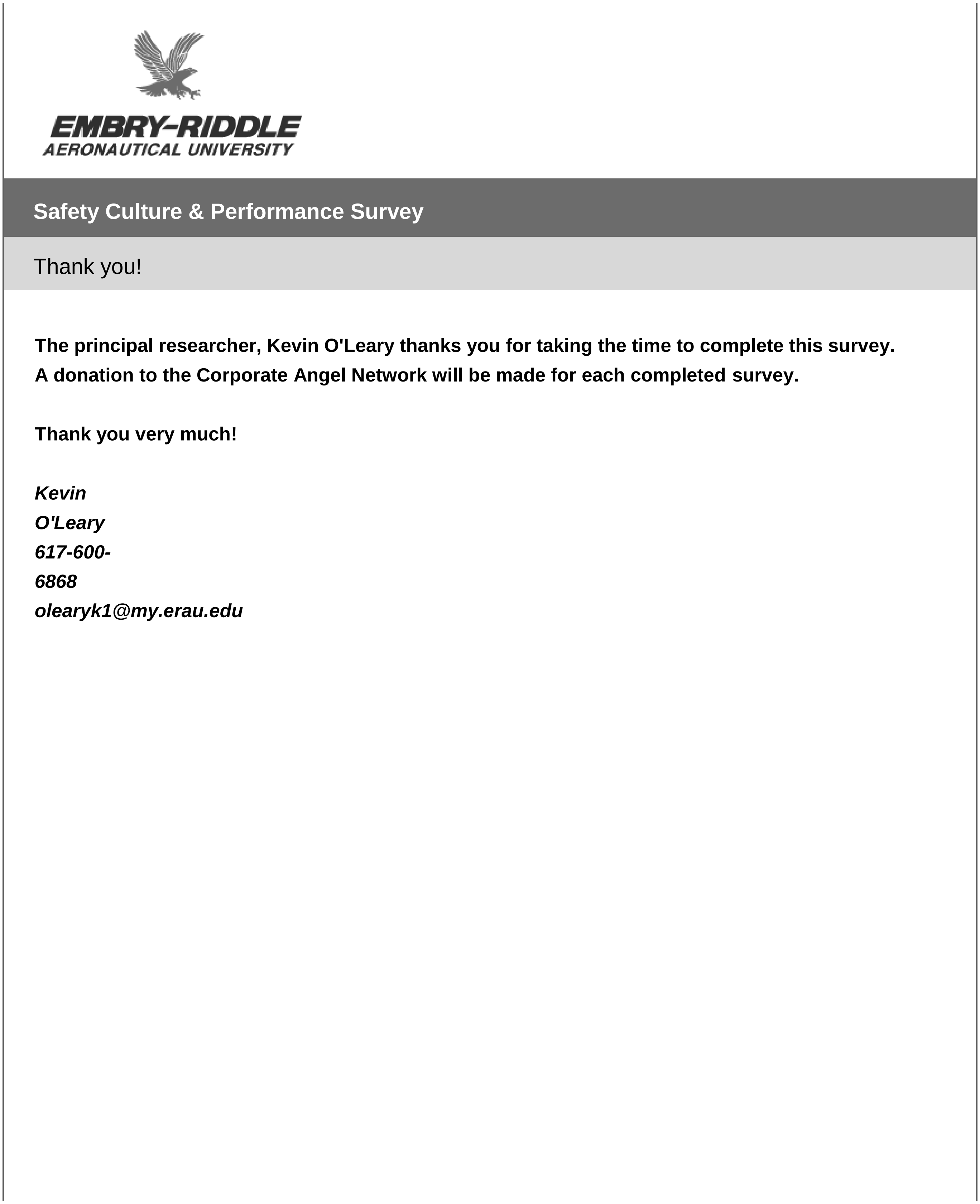
Safety Culture & Performance Survey

* 93. I am more likely to make judgement errors in abnormal or emergency situations.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
○	○	○	○	○



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Safety Culture & Performance Survey

Thank you!

The principal researcher, Kevin O'Leary thanks you for taking the time to complete this survey. A donation to the Corporate Angel Network will be made for each completed survey.

Thank you very much!

Kevin
O'Leary
617-600-
6868
olearyk1@my.erau.edu

APPENDIX C

Tables

Table C1

Descriptive Statistics

						Skewness		Kurtosis	
Item	N	Min	Max	Std. Dev	Var.	Statistic	Std. Error	Statistic	Std. Error
OC7. Safety is a core value in my Aircraft Management Company (AMC).	305	1	7	1.58	2.50	-1.59	0.14	2.04	0.28
OC8. Management is more concerned with making money than being safe.	305	1	7	1.94	3.75	0.36	0.14	-1.21	0.28
OC9. Management expects pilots to push for on-time performance, even if it means compromising safety.	305	1	7	1.84	3.37	0.80	0.14	-0.61	0.28
OC10. Management doesn't show much concern for safety until there is an accident or an incident.	305	1	7	1.79	3.21	0.87	0.14	-0.45	0.28
OC11. Management does not cut corners where safety is concerned.	305	1	7	1.88	3.52	-0.14	0.14	-1.33	0.28
OC12. Checklists and procedures are easy to understand.	305	1	7	1.31	1.72	-1.34	0.14	1.32	0.28

OC13. My Aircraft Management Company's (AMC's) manuals are carefully kept up to date.	305	2	7	1.02	1.04	-1.68	0.14	3.75	0.28
OC14. My Aircraft Management Company (AMC) is willing to invest money and effort to improve safety.	305	1	7	1.31	1.71	-1.08	0.14	1.42	0.28
OC15. My Aircraft Management Company (AMC) is committed to equipping aircraft with up-to-date technology.	305	1	7	1.51	2.27	-0.89	0.14	0.32	0.28
OC16. My Aircraft Management Company (AMC) ensures that maintenance on aircraft is adequately performed and that aircraft are safe to operate.	305	1	7	1.59	2.52	-0.88	0.14	-0.10	0.28
OC17. Management goes above and beyond regulatory minimums when it comes to issues of flight safety.	305	1	7	1.53	2.35	-0.65	0.14	-0.38	0.28

OC18. Management schedules pilots as much as legally possible; with little concern for pilots' sleep schedule or fatigue.	305	1	7	1.80	3.23	-0.66	0.14	-0.74	0.28
OC19. Management tries to get around safety requirements whenever they get a chance.	305	1	7	1.76	3.11	0.64	0.14	-0.65	0.28
OC20. Management views regulation violations very seriously, even when they don't result in any serious damage.	305	1	7	1.33	1.76	-0.94	0.14	0.56	0.28
OP21. Chief pilots do not hesitate to contact line pilots to proactively discuss safety issues.	305	1	7	1.72	2.97	-0.50	0.14	-0.75	0.28
OP22. Chief pilots are unavailable when line pilots need help.	305	1	7	1.54	2.36	1.03	0.14	0.28	0.28
OP23. As long as there is no accident or incident, chief pilots don't care how flight	305	1	7	1.74	3.02	1.00	0.14	-0.14	0.28

operations are performed.								
OP24. Chief pilots have a clear understanding of risks associated with flight operations.	305	1	7	1.43	2.06	-1.15	0.14	0.85	0.28
OP25. Pilots often report safety concerns to their chief pilot rather than the safety officer (safety department).	305	1	7	1.65	2.71	-0.12	0.14	-0.95	0.28
OP26. Dispatch consistently emphasizes information or details (e.g., weather requirements, NOTAMs) that affect flight safety.	305	1	7	1.83	3.34	-0.27	0.14	-1.11	0.28
OP27. Dispatch inappropriately uses the MEL (e.g., use when it would be better to fix equipment).	305	1	7	1.84	3.38	0.07	0.14	-1.23	0.28
OP28. Dispatch is responsive to pilots' concerns about safety.	305	1	7	1.47	2.16	-1.01	0.14	0.43	0.28
OP29. Dispatch would rather take a chance with safety than cancel a flight.	305	1	7	1.73	2.99	0.69	0.14	-0.64	0.28

OP30. Instructors/trainers have a clear understanding of risks associated with flight operations.	305	2	7	1.15	1.33	-1.24	0.14	1.51	0.28
OP31. Safety is consistently emphasized during training at my Aircraft Management Company (AMC).	305	2	7	1.14	1.30	-1.31	0.14	1.78	0.28
OP32. Instructors/trainers teach shortcuts and ways to get around safety requirements.	305	1	7	1.01	1.02	1.95	0.14	5.60	0.28
OP33. Instructors/trainers prepare pilots for various safety situations, even uncommon or unlikely ones.	305	1	7	1.29	1.67	-1.20	0.14	1.30	0.28
FS34. The safety reporting system is convenient and easy to use.	305	1	7	1.37	1.88	-1.25	0.14	1.20	0.28
FS35. Pilots can report safety discrepancies without fear of negative repercussions.	305	1	7	1.38	1.90	-1.66	0.14	2.68	0.28

FS36. Pilots are willing to report information regarding marginal performance or unsafe actions of other pilots.	305	1	7	1.58	2.51	-0.20	0.14	-0.96	0.28
FS37. Pilots don't bother reporting near misses or close calls since these events don't cause any real damage.	305	1	7	1.49	2.21	0.57	0.14	-0.61	0.28
FS38. Pilots are willing to file reports about unsafe situations, even if the situation was caused by their own actions.	305	1	7	1.16	1.35	-1.09	0.14	1.29	0.28
FS39. Safety issues raised by pilots are communicated regularly to all other pilots in this Aircraft Management Company (AMC).	305	1	7	1.80	3.25	-0.64	0.14	-0.76	0.28
FS40. When a pilot reports a safety problem, it is corrected in a timely manner.	305	1	7	1.53	2.36	-0.36	0.14	-0.60	0.28

FS41. Pilots are satisfied with the way this Aircraft Management Company (AMC) deals with safety reports.	305	1	7	1.67	2.78	-0.36	0.14	-0.86	0.28
FS42. My Aircraft Management Company (AMC) only keeps track of major safety problems and overlooks routine ones.	305	1	7	1.52	2.32	0.65	0.14	-0.38	0.28
FS43. Personnel responsible for safety hold a high status in the Aircraft Management Company (AMC).	305	1	7	1.49	2.21	-0.59	0.14	-0.19	0.28
FS44. Personnel responsible for safety have the power to make changes.	305	1	7	1.57	2.47	-0.42	0.14	-0.70	0.28
FS45. Personnel responsible for safety have a clear understanding of the risks involved in flying the line.	305	1	7	1.62	2.63	-0.83	0.14	-0.11	0.28
FS46. Safety personnel have little or no authority compared to operations personnel.	305	1	7	1.67	2.79	0.10	0.14	-0.94	0.28

FS47. Safety personnel demonstrate a consistent commitment to safety.	305	1	7	1.41	1.99	-0.92	0.14	0.47	0.28
IS48. Management shows favoritism to certain pilots.	305	1	7	1.69	2.84	-1.00	0.14	0.10	0.28
IS49. Standards of accountability are consistently applied to all pilots in this organization.	305	1	7	1.96	3.84	-0.10	0.14	-1.35	0.28
IS50. When pilots make a mistake or do something wrong, they are dealt with fairly by the Aircraft Management Company (AMC).	305	1	7	1.71	2.91	-0.48	0.14	-0.77	0.28
IS51. When an accident or incident happens, management immediately blames the pilot.	305	1	7	1.70	2.89	0.12	0.14	-0.84	0.28
IS52. Pilots are seldom asked for input when Aircraft Management Company (AMC) procedures are developed or changed.	305	1	7	1.82	3.31	-0.31	0.14	-1.15	0.28

IS53. Pilots are actively involved in identifying and resolving safety concerns.	305	1	7	1.70	2.90	-0.39	0.14	-0.97	0.28
IS54. Pilots who call in sick or fatigued are scrutinized by the chief pilot or other management personnel.	305	1	7	2.02	4.07	0.32	0.14	-1.26	0.28
IS55. Pilots have little real authority to make decisions that affect the safety of normal flight operations.	305	1	7	1.73	3.01	1.31	0.14	0.55	0.28
IS56. Management rarely questions a pilot's decision to delay a flight for a safety issue.	305	1	7	1.93	3.73	-0.51	0.14	-1.09	0.28
IS57. Pilots view the Aircraft Management Company's (AMC's) safety record as their own and take pride in it.	305	1	7	1.40	1.95	-1.01	0.14	0.45	0.28
IS58. Pilots who don't fly safely quickly develop a negative reputation among other pilots	305	2	7	1.15	1.33	-1.04	0.14	1.20	0.28

IS59. Pilots with less seniority are willing to speak up regarding flight safety issues.	305	1	7	1.42	2.02	-0.98	0.14	0.29	0.28
IS60. Decisions made by senior pilots are difficult to challenge.	305	1	7	1.46	2.13	0.91	0.14	-0.05	0.28
IS61. Pilots don't cut corners or compromise safety regardless of the operational pressures to do so.	305	1	7	1.59	2.53	-0.52	0.14	-0.80	0.28
ER62. I make errors in my job from time to time.	305	1	5	0.55	0.30	-0.53	0.14	3.84	0.28
ER63. Workload pressures have at times affected the quality of my work.	305	1	5	0.87	0.76	-1.34	0.14	2.26	0.28
ER64. I have made errors that have been detected by other pilots.	305	1	5	0.56	0.31	-0.77	0.14	4.55	0.28
AT65. I will say something if my peers (other pilots) take short cuts.	305	2	5	0.57	0.33	-0.47	0.14	1.86	0.28
AT66. I will say something if my supervisor takes shortcuts.	305	1	5	0.71	0.51	-0.81	0.14	1.57	0.28

AT67. Gut instincts can be used in lieu of the publications and manuals.	305	1	5	0.97	0.94	0.40	0.14	-0.52	0.28
AT68. There are better ways of performing a task than those described in the publications and manuals.	305	1	5	0.94	0.88	-0.19	0.14	-0.29	0.28
AT69. There are better ways of performing a task than those described in the company operations manuals.	305	1	5	0.98	0.97	-0.19	0.14	-0.49	0.28
AT70. Bending a procedure is not the same as breaking it.	305	1	5	0.88	0.78	0.38	0.14	-0.45	0.28
AT71. Shortcuts, in order to get a task done, are still violations * of procedures.	305	1	5	0.81	0.66	-0.87	0.14	1.17	0.28
AT72. Reporting mistakes helps other people learn from them.	305	2	5	0.59	0.35	-0.62	0.14	0.49	0.28
AT73. Personnel should be encouraged to report their mistakes.	305	2	5	0.57	0.33	-0.64	0.14	0.04	0.28

PC74. I am willing to put in a great deal of effort beyond that normally expected in order to help this Aircraft Management Company (AMC) be successful.	305	1	7	1.24	1.55	-1.33	0.14	2.05	0.28
PC75. I talk up this Aircraft Management Company (AMC) to my friends as a great organization to work for.	305	1	7	1.72	2.96	-0.64	0.14	-0.50	0.28
PC76. I would accept almost any type of pilot assignment in order to keep working for this Aircraft Management Company (AMC).	305	1	7	1.85	3.43	0.08	0.14	-1.20	0.28
PC77. I find that my values and the Aircraft Management Company's (AMC's) values are very similar.	305	1	7	1.77	3.14	-0.47	0.14	-0.84	0.28
PC78. I am proud to tell others that I am part of this Aircraft Management Company (AMC).	305	1	7	1.67	2.78	-0.91	0.14	-0.06	0.28

PC79. This Aircraft Management Company (AMC) really inspires the best in me in the way of job performance.	305	1	7	1.71	2.91	-0.44	0.14	-0.69	0.28
PC80. I am extremely glad I chose this Aircraft Management Company (AMC) to work for over others I was considering at the time I joined.	305	1	7	1.84	3.40	-0.85	0.14	-0.41	0.28
PC81. I really care about the fate of this Aircraft Management Company (AMC).	305	1	7	1.38	1.91	-1.96	0.14	3.72	0.28
PC82. For me, this is the best of all Aircraft Management Companies (AMCs) for which to work.	305	1	7	1.78	3.18	-1.16	0.14	0.12	0.28
EL83. Company managers conduct their personal lives in an ethical manner.	305	1	5	0.93	0.86	-0.34	0.14	0.47	0.28
EL84. Company management defines success not just by results but also the way that they are obtained.	305	1	5	0.99	0.98	-0.29	0.14	-0.41	0.28

EL85. Company management listens to what employees have to say.	305	1	5	1.11	1.24	-0.22	0.14	-0.85	0.28
EL86. Company management disciplines employees who violate ethical standards.	305	1	5	0.90	0.81	-0.97	0.14	0.68	0.28
EL87. Company management makes fair and balanced decisions.	305	1	5	1.07	1.15	-0.15	0.14	-0.77	0.28
EL88. Company management can be trusted.	305	1	5	1.18	1.40	0.13	0.14	-0.91	0.28
EL89. Company management discusses business ethics or values with employees.	305	1	5	1.01	1.03	-0.91	0.14	0.41	0.28
EL90. Company management sets an example of how to do things the right way in terms of ethics.	305	1	5	1.23	1.50	0.02	0.14	-1.12	0.28
EL91. Company management has the best interests of employees in mind.	305	1	5	1.12	1.25	0.23	0.14	-0.76	0.28
EL92. When making decisions, company management asks "what is the right thing to do?"	305	1	5	1.09	1.20	0.05	0.14	-0.77	0.28

A93. I am more likely to make judgement errors in abnormal or emergency situations.	305	1	5	1.01	1.03	0.24	0.14	-0.94	0.28

APPENDIX D

Tables

Table D1

Total Variance Explained for EFA

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Comp	Total	% of Var.	*Cumul %	Total	% of Var	*Cumul %	Total	% of Var	*Cumul %
1	18.886	46.064	46.064	18.886	46.064	46.064	9.320	22.733	22.733
2	2.227	5.431	51.495	2.227	5.431	51.495	8.514	20.766	43.499
3	1.792	4.370	55.865	1.792	4.370	55.865	2.630	6.414	49.913
4	1.585	3.865	59.730	1.585	3.865	59.730	2.260	5.511	55.424
5	1.245	3.036	62.766	1.245	3.036	62.766	2.196	5.355	60.780
6	1.096	2.674	65.440	1.096	2.674	65.440	1.764	4.301	65.081
7	1.033	2.519	67.959	1.033	2.519	67.959	1.180	2.878	67.959

*Cumul % is the Cumulative Percentage

Table D2

Rotated Correlation Matrix for EFA

	Components						
	1	2	3	4	5	6	7
OC8.	-.680	-.460					
OC9.	-.793	-.382					
OC10.	-.777	-.383					
OC11.	.481	.441					
OC14.	.529	.382	.387				
OC16.	.643	.379	.376				
OC17.	.618	.423	.331				
OC19.	-.709	-.428					
OC20.	.527	.309	.483				
OP21.	.449	.404					
OP22.	-.639						
OP23.	-.661	-.343					
OP24.	.623		.391				
OP27.	-.627	-.347					
OP28.	.708						
OP29.	-.768						
OP31.	.475		.482				
FS36.				.753			
FS38.				.716			
FS40.	.452	.462	.420	.330			
FS41.	.497	.421	.365	.339			
FS42.	-.531	-.343					
FS47.	.440	.383	.447				
IS48.	-.403	-.601					
IS49.	.380	.596					
IS53.	.361	.447		.457			
ER62.						.889	
ER64.						.897	
AT66.							.801
AT68.					.917		
AT69.					.891		
AT70.					.524		-.346
PC74.			.687				.396
EL83.	.308	.650					
EL84.		.638					
EL85.	.409	.718					
EL87.	.350	.809					

EL88.	.344	.821
EL90.	.333	.831
EL91.	.331	.806
EL92.		.807

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 13 iterations.

APPENDIX E

Suggested Future CASS Survey Questions

OC8. Management is more concerned with making money than being safe.

OC9. Management expects pilots to push for on-time performance, even if it means compromising safety.

OC10. Management doesn't show much concern for safety until there is an accident or an incident.

OC14. My Aircraft Management Company (AMC) is willing to invest money and effort to improve safety.

OC16. My Aircraft Management Company (AMC) ensures that maintenance on aircraft is adequately performed and that aircraft are safe to operate.

OC17. Management goes above and beyond regulatory minimums when it comes to issues of flight safety.

OC19. Management tries to get around safety requirements whenever they get a chance.

OC20. Management views regulation violations very seriously, even when they don't result in any serious damage.

OP21. Chief pilots do not hesitate to contact line pilots to proactively discuss safety issues.

OP23. As long as there is no accident or incident, chief pilots don't care how flight operations are performed.

OP24. Chief pilots have a clear understanding of risks associated with flight operations.

OP27. Dispatch inappropriately uses the MEL (e.g., use when it would be better to fix equipment).

OP29. Dispatch would rather take a chance with safety than cancel a flight.

FS40. When a pilot reports a safety problem, it is corrected in a timely manner.

FS41. Pilots are satisfied with the way this Aircraft Management Company (AMC) deals with safety reports.

FS42. My Aircraft Management Company (AMC) only keeps track of major safety problems and overlooks routine ones.

FS47. Safety personnel demonstrate a consistent commitment to safety.