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FLIGHT OPERATIONAL QUALITY ASSURANCE FOR UNIVERSITY AVIATION OPERATIONS

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TABLE OF CONTENTS

	Page
LIST OF ABBREVIATIONS.....	ii
EXECUTIVE SUMMARY.....	iii
SECTION 1. INTRODUCTION.....	1
1.1 Problem Statement	1
1.2 Research Question	1
1.3 Scope	1
1.4 Significance.....	2
1.5 Assumptions.....	3
1.6 Limitations	3
1.7 Delimitations.....	4
1.8 Summary	5
SECTION 2. REVIEW OF LITERATURE	6
2.1 Introduction.....	6
2.2 Previous Recording Systems	7
2.2.1 Quantitative Data Collection	7
2.2.2 Qualitative Reporting Systems	8
2.3 Flight Operations Quality Assurance (FOQA)	10
2.3.1 FOQA History and Development	10
2.3.2 FOQA System Operations	12
2.3.3 FOQA Program Implementation	13
2.4 Safety Culture	14
2.5 Advanced Qualification Programs	15
2.5.1 AQP Necessity	16
2.6 Data Security Issues	17
2.6.1 FERPA Considerations	18
2.7 Summary	19
SECTION 3. FRAMEWORK AND METHODOLOGY.....	21
3.1 Study Design	21
3.2 Sampling Methods and Sources	21
3.3 Methodology.....	23
Table 1: FOQA Programs in the Flight Training Environment: Methodology	23
3.4 Summary.....	25
SECTION 4. RESULTS	26
4.1 Findings	26
4.2 Data Analysis	41
4.3 Discussion.....	43
4.4 Recommendations.....	44
4.5 Conclusion.....	46
LIST OF REFERENCES	48
APPENDICES	50
Appendix I: Research Interview Subjects.....	51
Appendix II: Research Interview Questions	52
Appendix III: Guidelines for Collegiate FOQA Program Development.....	55

LIST OF ABBREVIATIONS

AQP	Advanced Qualification Program
ASAP	Aviation Safety Action Program
ASRP	Aviation Safety Reporting Program
ASRS	Aviation Safety Reporting System
ATC	Air Traffic Control
FAR	Federal Aviation Regulations
FDR	Flight Data Recorder
FERPA	Family Educational Rights and Privacy Act
FSDO	Flight Standards District Office
FSF	Flight Safety Foundation
FOQA	Flight Operations Quality Assurance
GDRAS	Ground Data Replay and Analysis System
ICAO	International Civil Aviation Organization
IEP	Internal Evaluation Program
NTSB	National Transportation Safety Board
QAR	Quick Access Recorder
ROM	Routine Operational Measure
SMS	Safety Management System
VDRP	Voluntary Disclosure Reporting Program

EXECUTIVE SUMMARY

The ability to use quantitative, objective flight data in order to improve training and operations has dramatically changed in the last decade. By taking advantage of hundreds of sensor collecting digital data on single engine aircraft, the use of Flight Operations Quality Assurance (FOQA) programs become more feasible for non-airline operations. With the integration of FOQA data use into university aviation operations, multiple opportunities exist for a complete utilization of this data in a variety of applications.

There are many barriers to overcome during implementation and use of FOQA data in the training environment. The goals and efforts of university flight school operations vary drastically from airlines. Primarily, flight schools are in business to educate and train new pilots while airlines aim to operate at a profit while serving transportation needs of the public. These operational goals necessitate different FOQA program needs.

This research established a template which may serve as a guide during FOQA program implementation at a university flight school. Attention has been paid to university-specific needs in the development of this template, including but not limited to student privacy issues, turnover of instructors and students, and FAA program approval. Ultimately, protocols are developed that not only preserve pilot privacy, but also ensure compliance with Institutional Review Board (IRB) requirements and the Family Educational Rights and Privacy Act (FERPA) - all while allowing data to be useful for future internal and external research.

SECTION 1. INTRODUCTION

Flight Operations Quality Assurance (FOQA) programs are voluntary safety programs that use cumulative flight data to identify unsafe flight conditions or deviations from policy. In recent years, airlines have developed and successfully implemented these programs (FAA, 2004). However, the author has found no previous efforts to develop such a program for a university flight school setting. After researching airline FOQA programs as well as the needs of university aviation flight training schools, this project guides the reader in the development of a FOQA program for a university flight training environment. The research scope, significance, assumptions, limitations and delimitations follow in this section.

1.1 Problem Statement

Many domestic and international airlines currently operate successful FOQA programs. FOQA programs are crucial for safety systems and can enhance training operations, safety and efficiency (FAA, 2004). To date, the author could not find any efforts made by others to tailor airline FOQA programs to the unique needs of the university flight school environment. This research will suggest implementation methodology for a university to establish its own functional FOQA program.

1.2 Research Question

The research question for this project is as follows: What steps and processes are necessary for a university flight school to take to establish an FAA approved FOQA program?

1.3 Scope

This project aimed to evaluate airline FOQA guidelines and develop the requirements and processes needed to implement a collegiate FOQA program. Pilot training procedures were compared in terms of training requirements and standards currently mandated by the Federal

Aviation Administration (FAA) and United States Code of Federal Regulations (CFR).

Additionally, professionals in the university aviation field were consulted regarding collegiate FOQA program requirements. A list of guidelines for the establishment of a collegiate FOQA program is provided as the final outcome of this work.

1.4 Significance

As digital aircraft enter the general aviation market, numerous safety advancements become possible. Developing a collegiate FOQA program has the potential to optimize the use of data collected from aircraft. Evidence-based training for flight schools is made possible from objective programs that accompany FOQA efforts, such as Advanced Qualifications Programs (AQPs) or similar initiatives. AQPs can only be developed after data collection and analysis is successfully established at the flight training school. Efficiency may be improved by student-tailored training made possible from the collection of user-specific data. Instead of utilizing uniform training procedures as prescribed under standard Federal Aviation Regulations (FARs), FOQA data allows for individual performance analysis, training and skill improvement. This can enhance each student's flight training experience as well as increase efficiency for the university and individual student.

Training redesign has already occurred for commercial airlines through successful FOQA implementation, but efforts have not yet been made to convert such programs for use in general aviation pilot training. After careful comparison of commercial pilot and general aviation pilot training requirements, this project provides the guidelines for the implementation of a collegiate FOQA program. This information can aid university flight programs in the development of a FOQA program. Improved safety and cost savings may be realized by flight departments if they so choose to develop a FOQA program based on the guidelines provided in this project.

1.5 Assumptions

The following assumptions are specific to this research and must be assumed if the reader is to understand the scope of this work:

- Advisory Circular 120-82 regarding Flight Operations Quality Assurance (FOQA) programs for airlines was up to date and provided all pertinent information for FOQA program establishment.
- The Family Educational Rights and Privacy Act (FERPA) used for this research was up to date and provided the most recent law interpretations.
- The guidelines provided can serve as a template for use by collegiate flight training schools. A university wishing to implement these suggestions would still need to adapt the FOQA program for their own unique operations.
- Collegiate flight programs desire such flight training improvement programs in order to provide students with the most advanced training available.

1.6 Limitations

Limitations serve to set a boundary around the research. Limitations specific to this project were as follows:

- The analysis was conducted using Advisory Circular 120-82, the FAA's FOQA guide for airlines.
- Though many safety reporting systems currently exist in the aviation industry, only the FOQA program and NASA Aviation Safety Reporting System (ASRS) were studied at length.
- The ideas of a research university's faculty members were used for this project, as these professionals are available to the researcher during this work.

- The results of the research effort are only applicable to operations in a collegiate environment in which digital aircraft are operated. Because flight training requirements for general aviation pilots are the same for all users, findings pertain to any school that operates as an FAR Part 61, 141, or 142 flight training facility.
- Only one university's personnel were interviewed for this research project, therefore the results may not be directly applicable to other aviation schools
- Only a template for a collegiate FOQA program was developed. No efforts were made to actually develop a FOQA program for the university the researcher worked with or any other university.

1.7 Delimitations

Delimitations state what will specifically be left out of the research efforts. The following delimitations have been identified:

- This research does not intend to create a FOQA program. It only aims to create guidelines for the creation of such.
- The development of a FOQA program is left to the entity wishing to establish the program, and tailoring to individual needs is also the responsibility of the implementing organization.

The researcher will not make efforts to create guidelines for the creation of a FOQA program for any program other than collegiate flight training schools which operate digital aircraft.

1.8 Summary

This section serves to introduce the research and provide an outline for applying FOQA programs to the university flight setting. Defining the scope and significance launches the research efforts and identifies the need for such work to be undertaken. The assumptions,

limitations and delimitations help the reader understand the boundaries of the project efforts and why such boundaries have been set.

SECTION 2. REVIEW OF LITERATURE

In the following section, the author summarizes previous efforts made in the improvement of flight training. This review also establishes a need for new research work to be undertaken which is tailored towards collegiate aviation flight programs. This literature review outlines the history and development of Flight Operations Quality Assurance (FOQA) programs. Also, the importance of a functioning safety culture and the available integration of FOQA into Advanced Qualification Programs (AQP) are discussed.

2.1 Introduction

The concept of a FOQA program has roots in previous quantitative and qualitative aviation recording programs. Some of these developments include flight data recorders (FDRs), the Aviation Safety Action Program (ASAP), and the NASA Aviation Safety Reporting System. As indicated by program success at the airline level, a FOQA program must be accompanied by safety management systems (SMS) and a sound safety culture (Wiley 2007; FAA, 2006b). Management must fully support the FOQA program initiatives and strong communication channels through all levels of the flight entity must be in place. Finally, confidentiality and protection of data is discussed since it is the largest barrier to FOQA program implementation (FAA, 2004; Flight Safety Foundation, 1998). Airlines have realized much success from FOQA programs, though no efforts have yet been made to tailor these programs to the unique needs of the university flight training setting.

2.2 Previous Recording Systems

Information systems intended to promote and encourage safe operations are not a new concept in the aviation industry. Though a few early systems captured quantitative data, most systems relied on qualitative pilot reports for such data collection (Wiley, 2007; FAA, 1997).

Pilot reports gather subjective information, while information from flight data recorders and quick access recorders provide objective information which provides a different view of events. As aviation has progressed and advanced as a science, reporting methods have as well. Specifically, NASA's Aviation Safety Reporting System can be identified as influencing FOQA program initiatives in the de-identified, non-punitive reporting styles that are characteristic of each (FSF, 1998).

2.2.1 Quantitative Data Collection

Flight data recorders (FDRs) provide flight data information in the event of an accident (Wiley, 2007). These systems, better known as "black boxes" to those outside of the aviation industry, have provided valuable information during accident investigations for years. FDRs are capable of storing up to 25 hours of flight information, and overwrite old data while the aircraft is in operation. According to Wiley (2007), early FDRs were capable of recording only six parameters of flight: time, altitude, heading, airspeed, vertical acceleration, and time of radio transmission. FDRs have since been enhanced to record additional parameters.

Though FDRs are a valuable tool for accident investigation, they are not accessible for routine data extraction; therefore they do not provide the current data necessary for flight operators to use in improving pilot training (Flight Data Services, Inc., 2010). For this reason, FDR data does not prove useful for FOQA data collection needs. An easily accessible system which allows operators to select parameters for measurement most relevant to their particular operations is necessary.

A data recording system which better supports FOQA program needs is the Quick Access Recorder (QAR). According to the FAA (2004), QARs are located onboard the aircraft, and provide fast and easy access to a removable storage medium on which flight information is

recorded. Though the FAA does not specifically require that QARs be used for data collection for a FOQA program, QARs are a better choice than FDRs as they have been “developed to record an expanded data frame, sometimes supporting over 2,000 parameters at much higher sample rates than the FDR” (FAA, 2004, p. 5).

QARs allow for much greater accuracy of ground analysis programs (such as FOQA) with increased resolution (FAA, 2004). This information easily demonstrates the value QARs bring to FOQA programs, as compared to the more simplistic and less accessible FDR units. In airline FOQA program development, the FAA (2004) recommends the installation of QARs onboard aircraft for data collection. In developing guidelines for a FOQA program that meets collegiate training needs, a QAR or similar recording device is necessary.

2.2.2 Qualitative Reporting Systems

Many qualitative reporting systems are currently operated in the aviation industry. The Aviation Safety Action Program (ASAP) is a qualitative, airline specific pilot-initiated reporting system. Self-reporting systems of this type are non-punitive and the best way to keep abreast of potential hazards and risks in an airline operation (Corrie, 1997). Wiley (2007) states that these reports are beneficial in acknowledging the existence of discrepancies, but usually fall short of addressing the real problems at hand, since all information gathered is subjective and biased from pilot recounts of actual flight scenarios. Furthermore, “humans, and pilots in particular, have an innate tendency to underestimate risk and overestimate their own capabilities” (Wiley, 2007, p. 81). Though information collected from ASRS reports has occasionally assisted operators in finding problems and safety-compromising conditions in the past, there is still a large amount of relevant qualitative safety information that operators miss from events due to

this subjective reporting style. In contrast to previous programs, however, ASRS information is analyzed through an independent agency (Corrie, 1997).

2.2.2.1 NASA Aviation Safety Reporting System

The military and non-aviation entities have long realized the importance of voluntary incident reporting (Aviation Safety Reporting System, 2010). Unfortunately, the aviation industry did not realize this importance until the NTSB's investigation of TWA Flight 514 accident in December 1974 (Aviation Safety Reporting System, 2010). After this accident, a study of the National Air Transportation System was conducted. A year after the accident, the Aviation Safety Reporting Program (ASRP) was implemented (Aviation Safety Reporting System, 2010). This later became the Aviation Safety Reporting System (ASRS) (Corrie, 1997; Aviation Safety Reporting System, 2010). This program was designed to allow users of the National Airspace System (NAS) to report actual or potential discrepancies and problems in the safety of aviation operations to NASA (FAA, 1997).

To encourage incident reporting, the FAA provided for limited immunity from enforcement action (Corrie, 1997). At first, pilots were reluctant to report their mistakes to the FAA as they feared fines and the revoking of licenses would follow. The FAA soon determined that the effectiveness of the ASRP would be enhanced if the receipt, processing, and information distribution was completed by NASA instead of the FAA (Corrie, 1997; FAA, 1997). An agreement was soon established with NASA, an independent agency which has no regulatory civil aviation enforcement powers.

Though the Aviation Safety Reporting Program has had much success in the aviation industry, the 1996 White House Commission on Aviation Safety and Security made a different recommendation to the aviation community. According to Corrie (1997), the Commission was

formed to investigate how aviation regulation could be changed to take advantage of emerging technologies. The Commission decided “The FAA should develop better quantitative models and analytical techniques to inform management decision-making” (Corrie, 1997, p. 5). The FAA was soon successful with the development of airline FOQA programs, but the programs have yet to be developed for non-commercial use (FAA, 2004).

2.3 Flight Operational Quality Assurance (FOQA)

FOQA is a significantly different program than all previous safety programs discussed. Unlike the ASRP or various FAA Aviation Safety Action Programs (ASAPs), FOQA uses quantitative, objective data from flights to enhance trend monitoring and address operational risk issues (FAA, 2004; FSF, 1998). FOQA programs can lead to the development of advanced training programs such as Advanced Qualification Programs (AQPs). Specifically, FOQA data can accurately verify pilot learning outcomes required by AQPs (FAA, 2006a).

2.3.1 FOQA History and Development

Formal FOQA efforts began in the late 1980s, long before the FAA became formally involved. The Flight Safety Foundation (FSF) first presented a workshop in Taiwan in 1989 discussing the benefits of FOQA programs, encouraging their adoption worldwide (FSF, 1998). According to the Flight Safety Foundation (1998), their blueprint for FOQA has been the backbone for FOQA progress in the United States, though there is much more work to be done. The FAA took the initiative to develop a formal FOQA program in 1990 by hosting a FSF workshop in Washington, DC, and in 2001 developed a rulemaking committee to further work in this area (FAA, 2003; FSF, 1998). This committee was developed to provide a method whereby professionals from the industry could give the FAA advice on creating FOQA policy and decide on whether further FOQA rulemaking would be appropriate (FAA, 2003). The committee

consisted of FAA employees as well as members of the public who brought various viewpoints from company and labor associations with a vested interest in FOQA development. According to the FAA (2003), the committee existed from 2001 until 2005 and made significant progress during that time. In 2004 Advisory Circular 120-82 was initiated by the Voluntary Safety Programs Branch AFS-230 of the FAA. AC 120-82 was published detailing procedures to be followed for the establishment of a FOQA program for commercial operators (FAA, 2004).

Before FOQA received full support from the FAA, a demonstration project was carried out to assess the costs, benefits, and safety enhancements associated with the program (FSF, 1998). During this project, the FAA provided hardware and software to four airlines who agreed to implement FOQA programs and share data with the FAA. As a result of the project, the FAA determined that FOQA programs would be made voluntary, as data collection and use for advanced FOQA programs was still in primitive form. The project demonstrated the use of FOQA in an airline environment by allowing enhanced trend monitoring and the identification of operational risks (FSF, 1998).

The FAA did not attempt to create a FOQA program for non-commercial use during their three year demonstration project (FSF, 1998). A FOQA program for general aviation, including collegiate flight operations, would improve safety and operational performance and assist in the training of new pilots (Mitchell, et al., 2007).

2.3.2 FOQA System Operation

FOQA is a voluntary safety program that intends to make aviation safer through the recording of objective, quantitative data gathering and analysis (Wiley, 2007; Mitchell, K., Sholy, B., & Stolzer, A., 2006; FAA, 2004; FSF, 1998). FOQA programs function primarily through analysis of the immense amount of data collected onboard an aircraft during flight.

Specialized processing and analysis software called the Ground Data Replay and Analysis System (GDRAS) is used to convert information from a QAR to usable data relevant to managers, pilots, and maintenance personnel (FAA, 2004). FOQA data differs from that gathered from an FDR in the amount of data recorded and purpose for data use. A standard FDR typically collects the last 25 hours of flight information leading up to an accident, and the data is then only accessed in the event of an accident (Wiley, 2007). A QAR for FOQA use records parameters at one second intervals, with data available for collection and analysis upon upload at the user's request. This electronic upload usually occurs between three and 20 operating days after the flight during which it was recorded, or during scheduled maintenance (FAA, 2004; Wiley, 2007).

The aforementioned data gathering processes must not occur as a stand-alone process, but rather must be built into a program which outlines all operations and impacts the data gathering will have on the organization. For airline purposes, the FAA (2004) lists multiple set-up phases for FOQA programs. These include the integration of the FOQA program into other systems within the aviation operation. Data uses, security, and analysis must be stipulated and approved by the FAA for airline FOQA program commencement (FAA, 2004).

In order for FOQA data to be of use by a collegiate flight program, baselines must be established and caution must be taken in trending (Wiley, 2007). Wiley also cautions that pilots must operate under the same rules and using the same tools, or else data collection could cause an apples to oranges type comparison. To assist with the necessity to determine trends from which to later measure deviations, Routine Operational Measure (ROM) identification is a capability of the GDRAS system. ROMs provide a snapshot look of a chosen parameter from which statistics such as mean, minimum and maximum can be determined (FAA, 2004). This

information can lead to the establishment of baselines for normal operation (FAA, 2004).

Establishing user-specific ROMs is a necessary part of the FOQA program adoption and set up.

2.3.2.1 FOQA Variations

As many benefits have been realized by airlines with established FOQA programs, non-commercial flight operators such as the military and helicopter companies have begun to adapt the program for their specific needs. Different flight operations require modified FOQA systems, which are beginning to gain momentum with a number of different aircraft operators. Helicopter, military, corporate, regional, and general aviation operators are the most prominent users (Mitchell, et al., 2006). Though none of the stated efforts are nearly as developed as airline FOQA operations, it is likely that these programs will provide benefits to the industry in the future.

University flight schools are able to develop FOQA programs but will need to tailor airline FOQA programs to the needs of the university operation. A need exists to modify airline FOQA programs to the needs of general aviation, and subsequently flight training markets (Mitchell, et al., 2007). Specifically, Mitchell et al. (2007) states the largest benefits to flight schools operating FOQA programs could be the playback of dual or solo flight training with a much better operational picture than previously available.

2.3.3 FOQA Program Implementation

An airline FOQA program development guideline is available in Advisory Circular 120-82, which discusses the benefits, set up, and maintenance of such a program (FAA, 2004). This document also provides a template for the Implementation and Operations (I & O) plan set-up as well as key definitions that must be addressed during program establishment (FAA, 2004). In order to be fully operational in a university flight school setting, a FOQA program must fit into

the safety program goals and be supported by the university flight department. A safety culture must exist if additional programs, such as FOQA, are to be successful (Wiley, 2007).

2.4 Safety Culture

Before a FOQA program or further safety management system can be developed and implemented at a university flight school, it must be determined if the cultural environment is in place to support it (Wiley, 2007). The FAA (2006b) states that, “the principles that make up the [Safety Management System] functions will not achieve their goals unless the people that make up that organization function together in a manner that promotes safe operation” (p. 4). This organizational aspect is termed a safety culture (Block, Sabin, & Patankar, 2007; FAA, 2006b; Wiley, 2007). “The safety culture consists of psychological (how people think), behavioral (how people act), and organizational elements” (FAA, 2006b, p. 4). Organizational elements are those that management has the most control over within an organization, and it has been discovered that if this element does not exist and thrive, a safety culture will likely fail (Wood, Dannatt, & Marshall, 2006).

An important aid to the development and sustainability of a safety culture is to hold regular safety meetings with personnel from a wide range of departments and levels (Wood et al., 2006). Wood et al. explains the goal of such meetings is to share information, highlight and discuss any known threats, and make sure that all personnel have the same perspective on the threats. This assists in developing the feeling of safety within operations being a shared responsibility within the company (Wood et al., 2006).

This safety culture must be in place before a FOQA program can be successfully implemented. Airlines have discovered that after FOQA programs are in place, additional programs can be developed to improve training (FAA, 2006a). The most developed program

which uses FOQA data is the Advanced Qualifications Program (AQP), which again has only been developed for use by airlines (Wright, 2003).

2.5 Advanced Qualifications Programs

According to the FAA (2006a), “AQP is a systematic methodology for developing the content of training programs for air carrier crewmembers and dispatchers. It replaces programmed hours with proficiency-based training and evaluation derived from a detailed job task analysis that includes crew resource management” (FAA, 2006a, p. i). Furthermore, the goal of an AQP is to create the “highest possible standard of individual and crew performance” (FAA, 2006a, p. i). Traditional Federal Aviation Regulations (FARs) are prescriptive, stipulating minimal levels of required performance, knowledge, or skills to be demonstrated before pilots may be certified. Wright (2003) states that this approach traditionally fosters a “teach to the test” mentality, which administers the exact same training to all flight students. AQPs take a different approach by utilizing feedback and evaluation to conduct proficiency-based training (FAA, 2006a). This feedback, however, can only be made possible through the use of reliable quantitative data. Airlines that have established AQP programs have first gained FAA approval for the use of FOQA data (FAA, 2006a). As both programs are non-regulatory, airlines that have taken initiative to develop them and receive FAA program approval have successfully met or exceeded FAR requirements.

Airlines have been largely successful with training program redesign made possible from AQPs (FAA, 2006a). The potential for redesign of general aviation flight training, such as that which occurs in the university flight school setting, is possible. The FAA (2006a) states that additional benefits to developing an AQP include the ability to modify training curricula as it pertains to user needs, evaluate crews, achieve standardization across fleets, and potentially

achieve more efficient training. In terms of collegiate operations, more efficient training translates to cost savings in terms of fewer flight instructor paid hours, as well as better allocated tuition dollars or a decrease in the overall cost of student tuition. However, these efforts can only be made after a collegiate data gathering program is developed.

2.5.1 AQP Necessity

Wright (2003) points out that training in the general aviation sector is not given the same attention as commercial pilot training, which is opposite from the traditional training hierarchy developed and supported by the FAA. That hierarchy stipulates that pilots must progress from a private pilot certificate through instrument training and then to commercial ratings (Wright, 2003). Wright comments, “A modernized general aviation flight training approach must use the latest training concepts and technologies, while overcoming regulatory issues and providing incentives for adoption” (p. 1). An AQP would allow for redesign of training methods for general aviation pilot training.

Because of the need for detailed and precise data collection for the evaluation of pilot training under AQPs (FAA, 2006a; Wright, 2003), digital aircraft must be used if an AQP is to be successful. Digital aircraft, or those with digital flight displays and systems capable of recording flight data and operational parameters, are quickly being developed for the general aviation market (Wright, 2003). As digital aircraft become more abundant in the general aviation and university flight training sectors, the implementation of an AQP may seem more appropriate. However, as previously stated it is first necessary for the collegiate environment to establish a functioning FOQA data collection program. Without FOQA, AQPs cannot be created.

2.6 Data Security Issues

Airline officials, pilot union representatives and the FAA recognized that data protection issues were the biggest roadblock for FOQA program implementation (FSF, 1998). Initially, pilot unions were reluctant to sign FOQA agreements with airlines as they feared a lack of protection for collected FOQA data. FSF (1998) highlights three concerns airline pilot unions had with program implementation:

“[first,] that the information may be used in enforcement/discipline actions; [second,] that such data in the possession of the federal government may be obtained by the public and the media through the provisions of FOIA; and [third] that the information may be obtained in civil litigation through the discovery process” (FSF, 1998, p. 7).

To address these concerns, 14 CFR Part 13 Section 13.401 was created. This document mandates FOQA data be stripped of any information that may identify the submitting airline before the data is passed to the FAA (FAA, 2004). The FAA ensures that “aggregate data that is provided to the FAA will be kept confidential and the identity of reporting pilots or airlines will remain anonymous as allowed by law” (FAA, 2004, p. 1).

2.6.1 FERPA Considerations

Airline FOQA programs may attribute some of their success to the previously mentioned method of confidentiality. However, collegiate FOQA programs must address and conform to additional protocols for data protection due to their educational requirements. The most important law pertaining to the protection of student educational records is The Family Education Rights and Privacy Act (FERPA) of 1974 (U.S. DoE, 2008). Data collected from students in the collegiate training environment may be subject to protection under FERPA, necessitating a review of the laws and their applicability. Education records are those that

directly relate to a student and are maintained by the University or a third party acting for the institution (DoE, 2008). By definition, data collected by a collegiate flight training school for use in a department-operated FOQA program would likely fall under the category of a student record.

Recently, a flight school communicated to the U.S. Department of Education Family Policy Compliance Office Director with an inquiry regarding release of student pilot violation of an FAR to the FAA. The flight department questioned whether students may be required or allowed to “sign a waiver allowing the University, without notice to the student, to report FAR violations to the FAA based on a student’s educational information” (L. Rooker, personal communication, August 15, 2005). In a FERPA law interpretation monumental for any school attempting to establish a data collection program, the Director concluded that “FERPA does not permit the University to disclose education records to the FAA without prior consent of the student. However, a student may provide his or her consent in accordance with 34 CFR 99.30 that will permit the University to disclose the FAR violation to the FAA upon discovery” (L. Rooker, personal communication, August 15, 2005). Because the U.S. Department of Education (2008) provides that educational records may only be released to University officials (including teachers) with legitimate educational interests, it may be deduced that the Director’s forbearance of release of educational records to the FAA extends to additional non-University parties as well.

Finally, FERPA law contends that a lawfully issued subpoena or a health or safety emergency which arises does allow for the release of student education records. However, law enforcement personnel outside of the University and those inside the institution do not have rights in obtaining educational records such as flight data (DoE, 2008). In establishing a

collegiate FOQA program, it would be in a flight department's best interest to review and understand FERPA law and its implication in this area.

2.7 Summary

The possibilities FOQA programs offer are too beneficial to be ignored by university flight school operations. Quantitative data gathering programs have proven beneficial because of the objective nature of the collected information. It is not necessary to limit quantitative programs to commercial carriers; any aircraft equipped with a flight data recorder such as a QAR may receive similar accurate and accessible data. The 1996 White House Commission on Aviation Safety and Security, which is not limited to commercial flight, made the strong recommendation that better quantitative models should be developed for decision-making and reporting. University training facilities may benefit immensely from the development of such quantitative models.

Guidance from previous systems may assist with collegiate FOQA development, but attention must be paid to the legalities of data collection which relate to collection of student data as well as the operational goals of the collegiate setting. Primarily, airlines strive to turn a profit while flying aircraft safely. Collegiate flight training schools operate to educate students on all areas of flight, while improving the accuracy and knowledge of pilot's skills and abilities in the aircraft. The professionalism and execution of students in training is not at the same level as airline pilots; this fact is crucial when developing programs and determining acceptable error levels for a flight training environment. With support from management and a solid safety culture in place, a data collection system can be developed, standardized, and effectively implemented in a collegiate flight setting. Hopefully with a unique collegiate system, university

flight schools would obtain operational benefits similar to those that airlines have realized from FOQA programs.

This section has provided an overview of previous literature regarding FOQA programs and other relevant safety programs. It also indicates a need for the development of FOQA programs for a university flight training school as a means to improve student education and safety.

SECTION 3. FRAMEWORK AND METHODOLOGY

The research process is detailed below, including the study design, sampling methods and sources, and action plan. A chart is provided which states each source of information the researcher used as well as the reasoning behind that selection. This research intended to answer the following question: What steps and processes are necessary for a university flight school to take to establish an FAA approved FOQA program? The final outcome of this work is a proposed template for an FAA-approved collegiate FOQA program.

3.1 Study Design

This research was qualitative in nature as the project required the analysis of FOQA program establishment from Federal Aviation Administration (FAA) documents and consultation with professionals in the field. Requirements of airline FOQA programs were evaluated and tailored for suggested use in the university setting. Timelines and implementation schedules as recommended by the FAA were changed to reflect university flight training needs. Advisory Circular 120-82 (FAA, 2004) was referenced as a main template. Specific numerical differences were compared, but the research was qualitative rather than quantitative because no numerical calculations or values were used for manipulation in the research effort.

After airline FOQA establishment guidelines were analyzed, it was necessary to gather information from a variety of professionals in the university flight training field. This information was important for the next and final project step, which was creating guidelines for the establishment of a collegiate FOQA program.

3.2 Sampling Methods and Sources

The most influential document for this research was Advisory Circular No. 120-82 (FAA, 2004). This document is the standard for airlines to use when developing a FOQA program, and

helped direct the formulation of guidelines for general aviation FOQA development. To address data security and student privacy issues, the Family Educational Rights and Privacy Act (FERPA) (U.S. DoE, 2008) was examined. Advisory Circular 120-82 and FERPA were both publicly accessible online through government document holdings.

After preliminary research and a review of published literature was completed by the author, an informative meeting was held with all interested faculty members at a Midwestern flight training school. The meeting was attended by approximately 12 professionals in the aviation training department, where the researcher sought to gain opinions of feasibility of a university FOQA program. The meeting uncovered areas of concern which would pertain to a university that may not pertain to previously developed airline programs. Topics of discussion were the need for leadership in collegiate FOQA development, the possibility of creating student data files to follow a pilot into their professional career, and legal concerns of collecting student flight data. All of these points assisted the researcher in developing discussion questions for interviews to follow.

Data collection hardware vendors were sought for their expertise regarding the proper selection of data capture units. Similarly, a university's Information Technology (IT) department was questioned as to data collection unit installation and integration with current university systems. In order to ensure compliance with legal requirements regarding student records and FERPA policies, a university's Registrar's Office was consulted. The advice of maintenance department management was also used regarding data requirements in their operations. Advice for many topics was sought from a large research university's aviation department leader and director of flight training, as they serve supervisory roles and have the most direct authority over faculty in the aviation department. Lastly, local FAA Flight Standards District Office (FSDO)

employees were consulted for their view on program enforcement in accordance with established FAA regulations. Two FSDO employees completed the interview, acting as one individual. These two respondents assisted each other in answering questions and gave additional information as they discovered ideas from one another's discussion points. All interaction for the purposes of this research effort was conducted through face-to-face discussions and phone interviews.

3.3 Methodology

The results of this research effort directed the creation of collegiate FOQA program guidelines. The following table depicts each of the steps described in Phase I of Advisory Circular 120-82 regarding airline FOQA development. Beside each airline requirement is the methodology for converting the requirement into collegiate terms. Additionally, the subject matter expert (SME) in each area is listed as well as the reasoning for their selection.

Table 1 <i>Applying FOQA Programs in the Flight Training Environment: Methodology</i>	
AC 120-82 airline FOQA recommendation	List and justification of documents and/or persons consulted
1. Establish a steering committee	1. A university's department leader will be consulted as this person is familiar with aviation department organizational structures
2. Define goals and objectives	1. A university's director of operations will be consulted as this person is aware of flight departments operation 2. A university's director of flight safety will be consulted because this person is aware of safety implications in a university flight setting
3. Involve stakeholders	1. A university's department leader will be consulted as this person is familiar with aviation department organizational structures
4. Select technology	1. A university's director of operations will be consulted as this person is aware of aircraft hardware and software capabilities 2. Technology vendors will be consulted as they are most

	<p>familiar with data collection units and their operation</p> <p>3. A university's information technology department will be consulted for data collection unit installation and integration with university software</p>
5. Select personnel	1. A university's technology department will be consulted as this person is familiar with aviation department organizational structures
6. Define safeguards	<p>1. FERPA laws will be consulted for applicability to FOQA data collection as the university environment requires compliance with student educational rights laws</p> <p>2. A university's Registrar Office staff member will be consulted for advice on legal compliance in regards to use of student flight data records, as they understand student records legality and must approve of data use within the aviation department</p>
7. Define events	<p>1. A university's director of aviation operations will be consulted since this person is familiar with critical aircraft events and normal operating parameters</p> <p>2. A university's aviation maintenance manager will be consulted for advice on events concerning data useful for maintenance personnel since this person best understands maintenance implications</p> <p>3. Technology vendors will be consulted regarding data collection capabilities and programmed events because they are most familiar with the use of the units and normal operating parameters in varying aircraft types</p>
8. Negotiate pilot agreement	<p>1. A university's flight director will be consulted regarding the applicability of this section of Phase I, as this person is most familiar with daily student pilot activities</p> <p>2. FERPA laws will be studied to determine the appropriateness of this section since the educational environment is different from the airline operational environment</p> <p>3. Local FSDO personnel will be consulted on this topic as they best understand enforcement of FAA regulations pilot rights in the training setting</p>
9. Generate FOQA and I&O plans a. Background b. Introduction	1. A university's aviation department leader will be consulted as this person has final say in many of these areas

<ul style="list-style-type: none"> c. FOQA stakeholders d. Protective provisions, pilot agreement, and corporate policy statement e. Data protective provisions security f. Airborne system management and support g. GDRAS h. Other equipment i. Equipment upgrades, modifications, or replacement j. FOQA organization k. FOQA program implementation l. Education and training m. Data analysis procedures n. Program and data documentation o. I&O plan revision control p. FAA access q. I&O appendices 	<ol style="list-style-type: none"> 2. Equipment vendors will be consulted for many data collection unit questions, since they have the most expertise with the capabilities of the units 3. A university's director of operations will be consulted to find answers to many managerial and operational program-specific questions as this person is most familiar with the flight training operation 4. A university's flight director will be consulted on matters regarding student pilots since that is this person's area of expertise 5. Local FSDO personnel will be questioned regarding the applicability of I&O plan sections to the collegiate training setting, as they have most direct jurisdiction over FAA enforcement at the university
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3.4 Summary

In an effort to develop guidelines for a user to create an FAA approved collegiate FOQA program, the author followed the aforementioned methodology. People from various areas within a local aviation research university were questioned for this project, as well as technology vendors and professionals from a Flight Standards District Office. AC 120-82 and FERPA laws were also consulted in this research. Finally, a timeline of activities for program completion was displayed so as to give the reader a better understanding of activities occurring for project completion. The following section contains a discussion of results of the interviews, analysis of the data collected, conclusions and recommendations.

SECTION 4. RESULTS

In this section, the results of the research are stated and analyzed. The nine interviews conducted provided many insightful answers that were helpful in establishing a template for a collegiate FOQA program. Results of the interviews are discussed, as well as recommendations for future research and a final conclusion of the project.

4.1 Findings

Of the nine subjects interviewed, seven were previously familiar with FOQA programs. The two people not familiar with FOQA programs were given a short description of the operations of a FOQA program at the air carrier level. No indication was given of the use of this type of program in other forms besides airlines, so as not to influence interviewees' opinions of this program's implications at the collegiate level. The professionals were then asked if they believed a FOQA program would be beneficial for a collegiate flight training environment. All nine people interviewed answered yes to this question, with one interviewee elaborating, "anytime data can be gathered and fed back into the system it will be beneficial." Several questions throughout the interview were only asked of seven or less interviewees due to the specific interviewee's knowledge of FOQA systems and flight school operation.

4.1.1. Steering Committee

Seven people were asked if a steering committee would be beneficial to establish a collegiate FOQA program, to which all answered "yes." When asked which faculty members should be on the steering committee, many different answers were given. The only common answer was "a member of the flight operations team" which all seven interviewees agreed. Six of the seven interviewees stated that a representative from the maintenance department should be on the steering committee. Two of the interviewees felt the department head should be directly involved, while others answered more broadly that "administrative members" should be

involved. Other members mentioned for inclusion on the steering committee were a director of safety (mentioned by three interviewees), flight instructors (three interviewees), a representative of flight students (three interviewees), director of flight training (two interviewees), and technology professionals (one interviewee). Two respondents felt that a person with airline FOQA or other direct FOQA program knowledge from outside the university may be helpful to include on the steering committee.

When asked what the steering committee's function should be, six interviewees responded. Four of the six interviewees directly stated that the steering committee's job should be to facilitate implementation of the FOQA program, including designing the program. Two respondents stated that the steering committee should determine the program's goals and objectives, a topic covered in detail later.

4.1.2. Goals and Objectives

Due to their expertise on the matter, seven interviewees were asked if goals and objectives needed to be created in the developmental stages of a collegiate FOQA program. All seven answered "yes" to this question. When asked who should be involved in creating the goals and objectives, three believed the steering committee would be best while two felt all constituents of the program should be given the opportunity to become involved if they wished. One person stated all constituents should be involved because those ultimately responsible may not be aware of what is really going on in the operation, and including all constituents would create a better listing of program goals and objectives. Conversely, one person felt that there should be one designated "champion" of the FOQA program and that this person should be in charge of developing the goals and objectives.

When asked the best way to establish goals and objectives, two people thought it best to have the steering committee write the list and circulate ideas with other program stakeholders. One person believed a qualitative assessment was necessary and that currently operational FOQA programs could be used to create collegiate goals and objectives. One person stated that the school's operation should be viewed in segments, end results should be analyzed, and training events leading to end results should be highlighted in order to best create FOQA program goals and objectives. One respondent suggested looking at other programs in the industry to gain clues on the development of goals and objectives, while tailoring the list to the needs of the collegiate program.

When asked how a collegiate FOQA program should fit into the operational environment of the current aviation program, five people responded. Three people mentioned feedback loops and stated the program's importance in improving processes and training this way. One person highlighted the ability to improve efficiency and quality of the program in terms of the aviation experience of the student and the safety of the operation. Additionally, a different interviewee mentioned the potential to integrate information learned from the FOQA program into regular safety meetings and a routine review process for students and instructors.

In a discussion of safety improvements pertinent to the development of goals and objectives, four of five respondents felt that safety was the most important aspect of the entire FOQA program. The other interviewee felt that safety improvements could not be directly stated during the program formulation stages because without aggregate data the school will not yet know all of the safety problems they have. For this reason, the interviewee felt that safety improvement goals would need to be defined after the program was established for a period of time. Lastly, one respondent discussed the need for a FOQA program to improve

communication regarding safety issues and the opportunity for FOQA data to communicate messages directly.

4.1.3. Identification of Stakeholders

Seven people were asked if it was necessary to identify stakeholders in the development stages of a collegiate FOQA program, to which all responded “yes.” One person highlighted the importance of identifying stakeholders by saying, “[schools] want a positive change in performance so [they] need to know who the end user of the data is to make that change.” Another respondent stated that identifying stakeholders was important in conjunction with developing goals and objectives, since it is important to identify each group’s role in the program.

Respondents agreed that students, faculty, instructors, safety program personnel, and the university were all major stakeholders in the program. Additional stakeholders mentioned by two or less interviewees included regulators such as the FAA (if a program is approved), insurance companies (risk management), equipment manufacturers, service providers, and the general public (enhanced safety). One interviewee stated that stakeholders would be involved for as long as the FOQA program was in existence, whereas the steering committee’s functions should dissolve once the program is fully operational.

4.1.4. Technology

When asked if a collegiate aviation program would need additional technologies in order to implement and operate a FOQA program, seven respondents answered “yes.” One person elaborated, “non-advanced technology airplanes could have done a FOQA program but the new equipment makes it so easy to collect data.”

All interviewees agreed that in order to operate a collegiate FOQA program, training aircraft must have the capabilities to collect flight data. Alakai and Garmin were discussed, though respondents agreed that there is not one unit that is universally necessary in order to operate a collegiate FOQA program. Portable units were discussed by one interviewee, though it was stated that these units limit the type of information the flight school may receive. All agreed that the information must be collected electronically in order to be useful in a data analysis program.

All three individuals who answered a question regarding the steps necessary to integrate data collection and analysis into the established university structure stated that it is important to have the technology and manpower to deal with the data that the program collects. One interviewee stated that graduate students may prove helpful in advancing the integration along, as their graduate projects may facilitate this. Two of the three interviewees addressed internet security issues, stating that internet firewall issues need to be addressed in a university system in order for the data to flow unrestricted between aircraft and analysis units. Interviewees also mentioned the need for university security protocols to be matched with aircraft abilities in order to maintain levels of security and encryption that the school has already established.

4.1.5. Personnel Selection

Seven people were asked if they felt it important to identify personnel for specific tasks in the operation of a collegiate FOQA program, to which all responded “yes.” When asked about daily FOQA tasks that require human input, all seven agreed that data analysis is an important task which needs a specific person or group of people assigned to it. Interviewees also mentioned the need to assign personnel to variations of data-specific jobs, such as validation, review, collection, and dissemination. Two of the seven interviewees also mentioned the need

for personnel to create reports to be sent to appropriate departments within the aviation operation. In recognizing the importance of a feedback loop, three individuals discussed a job duty which included following up on errors discovered by the FOQA program. One person described the need for a team or individual to deal with the turnover of instructors and students every year ensuring that new stakeholders know how to use and understand the data.

Implementing new procedures and analyzing aggregate data trending over weeks and months were also tasks recognized by interviewees which necessitate personnel assigned to them.

The next question asked interviewees if they believed personnel need to be solely assigned to FOQA tasks or if they could hold other roles within the university flight program. Although some stated that full-time attention would need to be paid to the program in the beginning, all seven interviewees agreed that once the FOQA program was up and running personnel should have other jobs within the university. However, interviewees' reasoning for reporting this varied. Six of the seven interviewees stated size of the university flight program as the main reason not to assign personnel to program tasks full time, mainly because they do not feel a collegiate program would be large enough to necessitate full-time attention as airline FOQA programs do. The seventh interviewee stated that full time personnel would not be necessary because they would fall out of touch with university operations if their focus was so narrow (i.e. only working on data collection, analysis, etc.). This respondent felt that actual involvement in everyday flight operations by personnel is necessary for them to keep a broad view of the program.

Lastly, interviewees were asked if they believed additional personnel should be hired to perform or manage daily FOQA tasks. All but one respondent said that it would not be necessary to hire outside personnel. The one respondent that did suggest hiring people outside of

the educational setting said it would provide a buffer between university students and university management. This person suggested that the third party would act as a labor group for the students, the ultimate stakeholders in a FOQA program, since the third party would not have what they called a “dog in the fight.” The interviewee stated this third party could act as a gatekeeper by providing objective information to each university party, while also aiding in keeping integrity of the FOQA program. However, the six other interviewees felt outside personnel were not necessary for the operation of a FOQA program because of the costs incurred to involve them. Three interviewees said that outside parties could be used as consultants, if their expertise on similar programs proved helpful in the collegiate program development stages. Additionally, one person stated that for auditing or quality assurance reasons a third party may be helpful, though again not necessary. None of the respondents mentioned the FAA when considering outside personnel to be of assistance in a collegiate FOQA program.

4.1.6. Safeguards

Seven interviewees answered “yes” when asked if safeguards needed to be defined during the developmental stages of a collegiate FOQA program. Elaborating on this question, one responded, “issues need to be raised but it is not necessary to find all answers at this stage [of program development].” Interestingly, as follow up questions to the first were asked, interviewees did not respond with such similar answers.

When asked if student information should be de-identified from pilot records, respondents hesitated to answer. All seven interviewees gave a yes-and-no type answer. Across the board, respondents agreed that data for aggregate and long term use needed to be deidentified; there is no reason to match identifiable student information with the data for these purposes. However, everyone agreed that identifiable information needed to be within reach for

administrators and instructors to access if the health and safety of the student or others were at stake. Many interviewees discussed “intentional deviations” in their responses, citing that instructors and decision makers in a collegiate program need to be aware of critical events of this sort and have the means available to take corrective action. Some respondents favored storing identifiable information for a period of time before scrubbing the student information from the flight data. The time period interviewees felt acceptable to keep identifiable information ranged from 48 hours to one or two weeks. Many agreed that this is a subject that would need much attention by the steering committee and that individual flight schools establishing FOQA programs would need to determine data security needs for their own purposes.

In a further discussion of data collection safeguards, interviewees were asked if they were aware of any safeguards that need to be developed to meet university requirements. Four respondents were familiar with the Family Educational Rights and Privacy Act (FERPA), which was later discussed in detail. Two interviewees mentioned the Institutional Review Board (IRB) and discussed the need for IRB approval if data were to be used for research endeavors by anyone within the university program. Also, two interviewees discussed the Freedom of Information Act (FOIA) and the legalities they were aware of regarding the use of collected flight data in a court of law.

When asked of the data security requirements that should be met to ensure compliance with university and other requirements, five out of seven respondents mentioned password protection as a necessity. One respondent stated that it is important during program development to make decisions on who has access to what data, and that students should always have access to their own flight data. This person also believed that the safety officer should have access to

identifiable student flight data. Other respondents agreed that the internet connection must be secured so that data transmission from aircraft to collection/analysis units was secure. One of the seven respondents mentioned the need for a gatekeeper much like airline FOQA programs use, though others did not mention this role specifically for the collegiate flight setting. Lastly, one respondent stated that data encryption should be used so that if flight data were unrightfully obtained it would not be immediately readable.

4.1.7. Critical Flight Performance Events

The next question set asked interviewees if critical flight performance events should be defined before a collegiate FOQA program is developed. All seven people questioned answered “yes.” When asked which events must be defined for a collegiate program, many answers were given. In the pre-flight category, taxi speed, engine run-ups and rpm exceedences were discussed by more than one interviewee. In-flight events such as altitude of operations, speeds throughout flight, climb profiles, temperature limits, bank angles, g-loads, climb, cruise, descent, approach, and landing were discussed. One respondent viewed this question in terms of progress made by flight students and discussed the need to vary the definition of critical events in relation to the phase of training a student was in. This interviewee suggested looking at pre-solo versus post-solo flights and altering the definition of critical events based on that skill difference. One of the seven respondents highlighted the need to take the operational environment of the flight school into account, such as the differences in climates between flight schools. This emphasizes the fact that each school would need to develop critical events for their own needs, in accordance with their operation and aircraft limitations.

Interviewees were next asked what baseline operation they would use to compare a student’s progress with, since the environment of a collegiate FOQA program is much different

(i.e. much less professionally developed) than that of experienced airline pilots. Many respondents stated this was a “good question” and took a while to answer. Five of the seven respondents said that a good place to begin would be with the operational limitations of the aircraft, since these numbers should never be exceeded no matter a pilot’s experience level. One interviewee suggested looking at data from other aircraft operators, such as general aviation if the data is available. This person pointed out that once collegiate FOQA programs become more utilized and data is available from multiple sources, the establishment of normal operating parameters will become easier. Lastly, one interviewee stated that lesson plans are a good place to utilize in the development of norms, as they would not change much in a FOQA program. Lesson plans already have maneuvers with standards set and performance guidelines provided by the FAA. These may aid in establishing normal operating parameters for a FOQA program.

Besides critical events necessary for student training improvement, interviewees were asked which critical events would be necessary for maintenance personnel in order for appropriate aircraft health monitoring to be conducted. Broadly, four of the seven respondents answered that predefined aircraft limitations are necessary for maintenance personnel to be aware of, as well as any red or yellow line event. Specifically, interviewees mentioned temperatures (including oil, exhaust, cylinder head, EGT, and CHT), oil pressure, manifold pressure, fuel flows, alternator life, magneto life, stresses on the airframe and engine, and hard landings as points of interest for maintenance personnel. Four of the seven respondents to this question stated that the school would need to develop this list, similar to the list of training critical events, relative to the needs of their aircraft and their particular operation.

Interviewees were asked what they believed was the best way for a maintenance department to receive health monitoring data from a FOQA program. All agreed that data should

be sent electronically, and that reports sent to maintenance personnel be selective. One interviewee stated that a flight school should first understand what data they were receiving, second it should know the value of the data, and lastly determine how often the school wished to receive it. All five respondents to this question agreed that data on events which trigger immediate action should be sent to the maintenance department right away so that action may be taken quickly. Beyond that, interviewees agreed that reports should be created as snap shots of aircraft health, allowing maintenance personnel to perform phase checks more efficiently. One respondent mentioned that this hierarchy of data dissemination would vary based on the school's needs and would need to be developed by the steering committee and relevant personnel during the FOQA program creation phases.

4.1.8. Student Educational Records Implications

Only one interviewee had enough technical knowledge of student rights in an educational setting to answer questions on this topic. This person began by stating that flight data collected by a FOQA program would be considered an educational record per FERPA guidelines. This has many implications when considering how collected student data may be used.

The interviewee was asked if a student pilot agreement regarding the collection and use of flight data would need to be completed before data may be collected and used for a collegiate FOQA program. The respondent stated that this would depend on how the data was going to be used. Instructors and those with a legitimate need to know (which the interviewee stated may include those analyzing the data and creating reports) could have access to the identifiable FOQA data as they would any other educational record on a particular student. The interviewee stated that if university employees needed access to the student data in order to perform their duties, then no written consent would be needed by the student. However, if the university

wished to share identifiable FOQA data with an outside party, the student would have to provide previous written consent before the college could share that information.

The interviewee stated that there have been no FERPA laws written specifically for student flight data collection, and entering this area needs to be done with caution. The interviewee stated the importance of the four student rights regarding all student records: the right to inspect, right to request an amendment, consent to disclosure of information to others, and right to file a complaint. All of these areas would be important when determining the needs of a collegiate FOQA program.

Furthermore, the interviewee stated that it is not appropriate for a school to require students to release their records to outside entities (such as the FAA). Schools must honor the student's choice in this matter, although the school may establish a consequence if a student does not wish to release this information. The interviewee encouraged a flight program establishing a FOQA program to be in close communication with the Registrar's Office or equivalent student rights office during the development phases of the program.

Lastly, the interviewee was asked of the rights of the FAA or other outside agency in using flight data for enforcement needs. The interviewee did not have a specific answer for this, though stated that it is possible for student records to be released without the student's consent in the event of a lawsuit or subpoena. In this case, the interviewee stated that university officials would make a determination of whether or not it was appropriate to release the student's information for the health and safety of the student or others. The interviewee suggested a school developing a FOQA program should determine that process as to be better prepared should the situation arise.

4.1.9. Implementation and Operations Plan

In the last set of questions, interviewees were asked if they believed a formal Implementation and Operations (I&O) plan would be necessary to write when developing a collegiate FOQA program. Seven people were asked this question, and it was the only opening yes/no question to which one person responded “no.” The interviewee who felt an I&O plan was not necessary believed that it would not be necessary to involve the FAA in a collegiate FOQA program, as the I&O plan ties the FAA to an airline FOQA program. This respondent stated that since airlines and flight schools have very different goals and operations (i.e. the airline’s economic reasons for operation and time pressures, the college’s goals of proper flight training and lack of time constraints) it would not be necessary to follow this section of FOQA program set-up. One respondent mentioned that a school may wish to seek FAA approval and subsequent enforcement from punitive action through an approved FOQA program, and this plan would be necessary to do so.

Because one person stated that they did not feel the I&O plan would be necessary for a collegiate FOQA program, only six interviewees were asked follow up questions on this topic. The other six respondents felt that it would be best to follow the airline I&O plan model to some extent, while tailoring needs to a collegiate setting and diverging from airline phraseology and irrelevant topics. One person remarked that because FAA employees are “creatures of habit,” it would be best to follow the airlines pre-developed I&O model with which the FAA is familiar. Another respondent pointed out that besides the size and goals of operation, the collegiate setting also differs from the airlines in that the airlines do not typically use collected flight data for research purposes. This person felt that a large amount of data could be useful for research

purposes, particularly at the graduate level, within a collegiate flight setting. For this reason, the I&O plan would need much tailoring from the established airline model.

When asked who should be responsible for developing the collegiate I&O plan, four respondents believed that one person should have this task. They agreed that when working with the FAA, it is typically best for one champion to be the point of contact on the project. They mentioned the champion should either be someone from flight operations, the department, a safety representative, or a supervisor of the entire flight operation. One also stated that the steering committee may be involved, but ultimate responsibility should rest with a single individual. The other two respondents believed that the I&O plan should be drafted by the steering committee, with pieces of the plan delegated to each area of specialty. One person stated, “the more people [the school] get[s] involved, the better it will be.” The other interviewee who believed the steering committee should write the I&O plan mentioned contracting parts of the plan out to companies the school was working with (if any) to speed the process along and help in FAA interaction. Ultimately, the developing flight school would need to determine their I&O plan based on their school’s needs and ease of working with the FAA, should they choose to have an approved program.

When asked who should be in charge of reviewing and updating the I&O plan, each respondent stated the same person/people they had said should develop the plan. One interviewee also stated involving the department head in the review and updating process would be beneficial. When asked the time period appropriate for review, five interviewees suggested following the annual schedule recommended by Advisory Circular 120-82 for airline FOQA programs. However, one interviewee of the six felt that annually could be too cumbersome because “to move things through the FAA could take six months or a year.” This person stated

that for the school's needs, reviews and updates could be made every six months to a year, but they cautioned against presenting those changes to the FAA too rapidly due to the FAA's slower processes.

The last question on I&O plan development asked if they believed anyone outside of the aviation department should have input on the writing, reviewing or updating of the formal I&O plan. Four of the interviewees stated that higher university personnel should be involved in the I&O plan development, since these personnel would like to be informed of such a program operating at their flight school. One person mentioned that involving senior level university personnel, such as a dean or president, would give them some responsibility in the program. One person mentioned involving a student level representative, while another interviewee mentioned using advice from the Registrar's Office to ensure FERPA laws were attended to. Lastly, one person mentioned the I&O plan's relevancy in the overall accreditation of the flight program. This person stated that if the school was operating an accredited flight program, the I&O plan would be important during the five-year auditing process and could become an outcome assessment for the overall flight operation.

4.1.10. Additional Notes and Concerns

There were many interesting points discussed by interviewees that were outside of the questions asked. Most importantly in the establishment phases of a collegiate FOQA program, one interviewee stated that it is crucial for the department head to buy into the program if it is to be successful within the flight school. Change management came through in this discussion, as the interviewee pointed out the effects implementing a data collection program of this sort could have. Much like a corporation, some interviewees discussed the effects a FOQA program could have on morale and trust within the student population. When discussing data security, one

respondent mentioned that the culture of the organization is important when establishing a FOQA program. The interviewee stated, “if [the school] wants a fair, just, informed culture that moves forward, [the program] must have trust.”

Regarding technology, one person stated that 4G elements which are not yet fully operational may be helpful in future collegiate FOQA programs. 4G would allow for a more universal wireless internet system and would help in aircraft data transmissions. This technology would need to be integrated into a collegiate FOQA program after it was fully operational in the town or city the school resides, or else it will not be reliable or beneficial.

Finally, two interviewees mentioned employing additional aircraft devices which could validate incoming data. One person mentioned the use of cameras within each cockpit, so that if events were questioned the video from a particular flight could display what the pilot was seeing inside the cockpit, beyond what the data readouts from the aircraft showed. The other respondent mentioned a way to code the flight so that skill level of pilots could be taken into account, to allow the data to better assess the student’s skills and abilities during a particular flight. These options are all above and beyond the scope of this project.

4.2 Data Analysis

Since only nine total interviews were conducted using an open-ended format, it was difficult to make overall generalizations. A few areas of common interest as expressed by the respondents include:

4.2.1. Steering Committee

The technology vendor was the only respondent who felt it important to include an outside person (such as a vendor) to answer technical questions that might arise in the program

development. All other respondents did not state the necessity of including a vendor, which indicates that they do not feel the outside ‘expertise’ is valuable in program development.

4.2.2. Technology

The technology vendor responded very specifically with technology their company currently produces as being the most appropriate to use in a collegiate environment. The other respondents did not limit themselves to one technology, and encouraged the concept that a school developing this sort of program would need to decide what technologies are best for their individual needs.

4.2.3. Development of Goals and Objectives

The two leadership members in the university aviation program felt that all constituents should be involved in the process. In contrast, all other respondents (who were in non-leadership positions) believed that the development of goals and objectives should be the purview of the steering committee. This division of suggested tasks displays a difference of perceived responsibility within the program development stages.

4.2.4. Data Safeguards

The FSDO interviewee answered that it would be best to follow the airline model of de-identification. All university respondents however were more open-minded on this question, stating that there are needs for both identification and de-identification of student data. This suggests that personnel in regulatory positions may favor strict identification policies as already established by the airlines whereas academic personnel might need to deviate from pre-developed methods.

4.2.5. Implementation and Operations Plan

Besides the university department leadership respondent, all other interviewees felt it appropriate to revise a formal Implementation and Operations plan every year. The department leadership stated concern with the speed of which FAA review processes are conducted, and did not believe it appropriate to slow down the operation of a collegiate FOQA program with this process. This difference in opinion between university department leadership and other respondents may indicate differing views of academic leadership and regulatory leadership.

4.3 Discussion

As in any interview conducted with open-ended questions, answers vary drastically depending on the expertise of the interviewee as well as their knowledge regarding a particular question asked. The open-ended format allowed interviewees to respond with any answer they saw fit, which made it difficult for the researcher to define specific answers in some areas. The researcher concluded that there is not a one-size-fits-all FOQA template that can be created for the collegiate environment; instead, the FOQA program will vary depending on an implementing school's size of program and needs and uses of student flight data.

The eleven question sets asked were developed from the airline FOQA program model as found in Advisory Circular 120-82. The format used by the researcher was to first ask a generic question yielding a yes or no response and then to follow up with additional questions if the answer to the opening question was "yes." Each of the opening eleven yes/no questions pointed to program development areas used by the airline FOQA model. All interviewees answered yes to all eleven opening questions except one respondent on one of the questions. Therefore, beside the one respondent who answered "no" to one opening question, each respondent was asked

follow-up questions on each topic. This method allowed for a large amount of detailed information to be gained on each topic presented by the airline FOQA model.

Overall, interviewees found the airline FOQA development model to be appropriate when establishing a collegiate FOQA program. Though many points of difference between airline and university aviation operations were discussed, it may be concluded that the airline FOQA model lends well to the creation of a collegiate FOQA program. A concise template guiding the creation of a collegiate FOQA program may be found in Appendix III.

4.4 Recommendations

After completing interviews with nine professionals with strong knowledge in university flight program operations, the author would recommend that a university could consider the establishment of a collegiate FOQA program following the template provided in Appendix III. This template provides a comprehensive list of guidelines derived from this exploratory study. Additional sections which relate to each individual flight school's operation may be added, and irrelevant sections deleted as desired by individual schools.

There may still be some areas of research that need to be completed with respect to the collegiate FOQA program application. Additionally, the author has discovered some areas that should be improved upon if a similar research effort is to be conducted in the future. Each section of recommendations is further listed.

4.4.1. FOQA Program Recommendations

The following areas need to be studied by future authors to aid in the development of collegiate FOQA programs.

- Specific job duties need to be developed for personnel working in a collegiate FOQA program. In this research, interviewees were not able to decide on specific tasks or job

descriptions for FOQA program personnel, and the author views this as an important area which needs more research.

- Other areas relating to data collection still need attention before a collegiate FOQA program may be fully operational. Technical data specifications need to be determined, as well as how data should be stored and archived. Also, the format of data for clarity and ease of display should be determined, as well as analysis procedures outlined and documented for the program.
- FAA program approval of a collegiate FOQA program would be beneficial though not necessary, which demonstrates a need for additional research on this subject. Interactions between the FAA and university personnel during the development and operational stages of a FOQA program need to be discussed and researched, as well as how the FAA would use the data collected from collegiate FOQA programs.
- Further research should be completed on the FOQA program efforts of military, helicopter, corporate, and other non-commercial operators. Though still in infancy, these programs may lend generously to collegiate FOQA program development efforts as they become more advanced and developed.
- A broader list of interviewees may have valuable knowledge on collegiate FOQA program implementation, including but not limited to airline pilot union representatives, airline FOQA program managers, and Voluntary Flight Services members at Washington, D.C. FAA offices.

4.4.2. Author's Research Methodology Recommendations

If the author were to conduct personal interviews again as part of a similar research project, changes would be made in a few areas. These identified areas are as follows:

- Send a copy of interview questions to each interviewee prior to meeting with them. This would have allowed interviewees time to think of answers and gather more information prior to the interview. Had the researcher provided interview questions to all interviewees prior to our meeting, more information is likely to have been gained.
- Ask interviewees how they would go about establishing a collegiate FOQA program without guiding interviewees with the airline FOQA program template. If this question would have been asked at the beginning of the interview, it is possible the interviewees would have given answers that varied drastically from the pre-developed airline model.
- Ensure that only one person is present to represent each area of the flight operation, rather than allowing two interviewees to answer questions while ‘acting as one’ as occurred with the FSDO professionals. This would have made it easier to report results as well as ensured consistency with the research.

4.5 Conclusion

In conclusion, a FOQA program may prove very beneficial for a collegiate flight training environment. After interviewing university employees in this area, it has been determined that a university wishing to establish such a program should gather a steering committee to oversee the development, establish goals and objectives to guide the program, identify stakeholders of the program and understand their roles, determine technology needs of the training aircraft and data analysis, identify personnel for specific program tasks, define data safeguards to ensure security, define critical flight performance events relevant to the school’s needs, attend to student data protection needs to ensure compliance with school requirements, and develop an Implementation and Operations plan for FAA approval similar to the airline model. Flight schools should tailor

these steps to the needs and size of their operation, and may consult with program experts or vendors when developing a personalized program.

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APPENDICES

Appendix I: Research Interview Subjects

University Aviation Department flight operations leader

University Aviation Department leader

University Aviation Department flight safety leader

University Aviation Department maintenance leader

University Information Technology Department leader

University Office of the Registrar representative

Technology vendors

Flight Standards District Office representative

Appendix II: Research Interview Questions

1. Are you familiar with what a FOQA program is?

DEFINITION: it is a program where objective flight data is measured and fed back into the system in order to improve safety

2. Do you believe a FOQA program would be beneficial for the collegiate flight training environment?
3. Should a collegiate flight program considering the establishment of a FOQA program first establish a steering committee?

DEFINITION: airline definition: an oversight committee formed at the beginning of FOQA program planning to provide policy guidance and vision for the FOQA effort.

If answered yes, please answer the following questions:

- a. What faculty members should be on this committee? Any non-faculty members?
- b. What should the steering committee's function be?
4. Would a university aviation program need to develop goals and objectives while developing a collegiate FOQA program?

If answered yes, please answer the following questions:

- a. How should a university aviation program go about establishing goals and objectives?
- b. Who (in relation to the steering committee or others) should be in charge of developing goals and objectives?
- c. How should a FOQA program fit into the operational environment of a collegiate aviation program?
- d. What safety improvements should be addressed in the formation of goals and objectives?
5. Is it necessary for stakeholders to be identified in the development of a collegiate FOQA program?

DEFINITION: anyone who would be involved or affected by the FOQA program

If answered yes, please answer the following questions:

- a. Who might be some of the stakeholders in a collegiate FOQA program?
6. Would a collegiate aviation program need additional technology for the implementation and operation of a FOQA program?

DEFINITION: technology beyond that already installed in a digitally advanced aircraft and/or already in use by the flight department ground ops-side

If answered yes, please answer the following questions:

- a. What is the most appropriate and cost effective technology (hardware and software) needed for a university aviation program to operate a collegiate FOQA program?
- b. What are the requirements for a training aircraft to have in order to operate a FOQA program?

- c. What steps are necessary for integrating data collection and analyzing results into the established university technology structure?
 - d. What technology changes need to be made to operate a collegiate FOQA program?
7. Is it important to identify personnel for specific tasks for the operation of a collegiate FOQA program?

If answered yes, please answer the following questions:

- a. What daily FOQA operation tasks need specific personnel assigned to them?
 - b. Do personnel need to be solely assigned to FOQA tasks or may they also have other roles in the university flight program?
 - c. Should additional personnel be hired to perform or manage daily FOQA tasks?
8. Do data safeguards need to be defined during the developmental stages of a collegiate FOQA program?

DEFINITION: data protection and security that focuses on the confidentiality of a particular person, flight, or date and a recorded event

If answered yes, please answer the following questions:

- a. Should student information be de-identified from pilot records? Why or why not?
 - b. What safeguards must be developed for a collegiate FOQA program to meet university requirements?
 - c. Are there any other pertinent policies or regulations regarding the collection and use of student flight data?
 - d. What data security requirements must be met in order to ensure compliance with university and other requirements?
9. Should critical flight performance events be defined before a collegiate FOQA program is developed?

DEFINITION: critical flight performance events are those which frequently cause safety concerns or the mastering of which are instrumental to a student pilots success

If answered yes, please answer the following questions:

- a. What critical events must be defined for data collection in a collegiate FOQA program?
- b. In order for FOQA data to be useful, established FOQA programs require individual flight data to be compared with a “normal operation”. How should normal operating parameters for student training aircraft be determined?
- c. What critical events should be recorded by collegiate FOQA programs for maintenance personnel to be able to conduct appropriate aircraft health monitoring?
- d. What would be the most useful way for an aviation maintenance department to receive health monitoring data on aircraft?

10. As airlines and commercial pilot unions require formal agreements to be on file for FOQA program operation, is a student pilot agreement necessary before data can be collected and used for a collegiate FOQA program?

If answered yes, please answer the following questions:

- a. What are the FERPA law implications for the collection and use of student data in a collegiate flight program?
 - b. Do FERPA laws require a signed agreement be on file for each student for which data will be collected?
 - c. Should data collected from flights be identifiable to the student?
 - d. What are student's rights in dealing with collected flight data?
 - e. As an aviation enforcement entity, what are the FAA's rights in using flight data for enforcement or administrative purposes?
11. Is a formal Implementation and Operations (I&O) plan necessary for the development and operation of a collegiate FOQA program?

DEFINITION: for airlines, the I&O plan describes key aspects of the program. For airlines, it is the plan that is submitted to the FAA and reviewed before protection from FAA enforcement is granted.

If answered yes, please answer the following questions:

- a. Should the airline I&O plan format published by the FAA be followed when developing a collegiate FOQA program?
 - b. Who should be responsible for developing the collegiate I&O plan?
 - c. How often should the document be reviewed and/or updated?
 - d. Who should be charged with reviewing/updating the I&O plan?
 - e. Outside of the aviation department, what are the college's rights in having input on, reviewing and/or updating a formal I&O plan?
12. Are there any additional areas of concern that must be addressed prior to the development of a collegiate FOQA program?

Appendix III: Guidelines for Collegiate FOQA Program Development

These guidelines were developed to serve as a template for the creation of a collegiate Flight Operational Quality Assurance (FOQA) program. Though an airline FOQA model has been outlined in Advisory Circular 120-82, to the best of the researcher's knowledge, no previous efforts have been made to develop a collegiate FOQA template. It is important to note that this template is a general guide and must be modified to fit the size and operational needs of a particular implementing school's aviation department. Sections may need to be modified, added, or removed as appropriate.

1. Establish a steering committee

- a. This committee should be comprised of members of the flight operations department, maintenance department, administration (department head or others), flight safety, flight instructor representative, as well as a flight student representative. Assistance from personnel outside of the university may include airline partners or others with direct FOQA program knowledge.
- b. The committee's function is to facilitate implementation of the program, including design and formulation of program goals and objectives.

2. Define goals and objectives

- a. Steering committee members should develop goals and objectives
- b. Development:
 - i. May include feedback from constituents

- ii. May use information from industry programs, while still tailoring to needs of the collegiate program
 - iii. Conduct an assessment of current program, identify training events and processes that can be improved by FOQA program
 - c. Safety improvement goals must be defined
 - i. May further develop goals after aggregate data becomes available
- 3. Identify stakeholders
 - a. Major stakeholders: students, faculty, instructors, safety program personnel, and university administrators
 - b. Additional stakeholders may be appropriate as needed
- 4. Select technology
 - a. Determine school internet security and encryption requirements for data transmission
 - b. Select technology most appropriate for aircraft and school uses
 - i. Data collection units on aircraft
 - ii. Electronic collection
 - 1. Identify storage and archive needs
 - 2. Develop or select data analysis procedures

5. Select personnel

a. Determine tasks that need daily attention:

- i. Data analysis
- ii. Validation, review, collection, and dissemination
- iii. Reporting, follow up, analyzing aggregate data

b. Selection

- i. Make personnel selection within university/aviation program
- ii. Make personnel selection outside of university if needed
 1. Determine outside consultation needs
 2. Consider auditing or quality assurance needs

6. Define safeguards

a. Student identification information

- i. Determine need for student information in collected flight data
- ii. Determine deidentification period and process

b. Additional regulations that may pertain to educational setting and how they affect the proposed FOQA program

- i. Family Educational Rights and Privacy Act
- ii. Freedom of Information Act

- c. Data security issues
 - i. Secure wi-fi internet transmission channel
 - ii. Ensure password protection
 - iii. Ensure data encryption
 - d. Personnel
 - i. Determine which university personnel need access to identifiable data
 - ii. Determine which university personnel need access to deidentified data
7. Determine critical flight events
- a. Phases of flight, including
 - i. Ground Operations
 - ii. Pre-flight
 - iii. In-flight
 - b. Define normal operating parameters
 - i. Start with aircraft limitations
 - ii. Establish norms from lesson plans
 - iii. Additional data collected will assist in creating norms
 - c. Maintenance events necessary for aircraft health monitoring

- d. Determine how often changes will be gathered and presented to FAA
- e. Involve senior level university personnel in development, review, updates