

**Task 18: Assessing Flight Operations Quality Assurance (FOQA) Impact among Small-Scale Operators: FAA Aviation System Standards as a Development Testbed (Chidester)**

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**University/Contract Performing Organization:**

None

**Project Start Date:** 10/15/2009

**Anticipated End Date:** 6/30/2011

**Requirements Statement**

**Operational Shortfall or Knowledge Gap**

FOQA programs enhance flight safety by providing greater insight into routine operational practices. FOQA entails the use of various types of Quick Access Recorders (QAR's), which allow flight data to be easily removed from the aircraft for analysis and review. The total flight operations environment can be analyzed through the systematic collection and review of the automated recordings of flight data generated during routine line operations. While FOQA programs have resulted in significant enhancements to large air carrier (FAR Par 121) training programs through the detection, analysis and understanding of "deviations," "exceedances," or "unsafe events" gathered under a FOQA program from a set of pre-determined operating parameters, methods for extending the benefits to the Tech Ops fleets in an optimal and cost-effect manner remain a work in progress. The broader purpose of this study is to understand the methods that could be most important to successful implementation of FOQA programs in small air carrier and commercial operations.

The Aviation System Standards directorate of the Technical Operations organization operates fleets of Lear, Challenger, and Beech aircraft to monitor and test radio nav aids and procedures throughout the National Airspace System. AJW operates a fleet of ten business jet aircraft (Challenger 601, 604, Lear 60) and eighteen turbo-propeller aircraft (Beechcraft 300). The directorate implemented Flight Operational Quality Assurance Programs (FOQA) on the Lear and Challenger fleets beginning in 2006 and will begin implementation on the Beech in 2009.

Large airlines have been able to integrate lessons learned from their programs throughout their training, procedures, and flight publications. Both anecdotal and time-series analyses of safety benefits of FOQA programs have been shared in a variety of public forums for more than a decade. Tech Ops has so far invested its resources in fleet deployment and data analytic capabilities. Feedback to line pilots has been limited to newsletters, field briefings, and office-specific analyses. More generally, the most critical activities for rapid realization of the safety benefits from FOQA programs have not been extensively explored, or systematically evaluated largely due to the concerns about public disclosure of confidential information with the associated negative publicity for individuals and the organization.

Research is required to understand the methods that could be most important to FOQA-driven safety improvements in Technical Operations, which may generalize to small air carrier and commercial operations. AJW uses independently owned and operated training centers, regulated under FAR Part 142, for advanced

simulation training for all their flight crews in lieu of owned and/or operated simulators. Educational efforts, including newsletters and ground training programs, have been developed for all personnel in the Aviation System Standards organization as the FOQA program has expanded over the preceding three years. Experimental modification of classroom and simulator training will be evaluated under this requirement to determine the most effective means for addressing safety issues identified through flight data analysis. We require a quasi-experimental time-series investigation of the impact of training on exceedance rates and pilot attitudes about FOQA.

#### Benefit in Closing the Shortfall or Gap

Direct benefits are expected to the Tech Ops fleet in the form of training advancements for the AJW pilot group. Exceedance rates have stabilized and been reduced to some extent on the Lear and Challenger fleets by newsletters and briefings. Subject matter and analytic expertise from human factors researchers will assist AJW in designing requirements for classroom and simulator training delivered by training center instructors and structuring their implementation in a manner that allows their impact to be assessed. As AJW deploys FOQA on the Beech aircraft, this will enable rapid, cost-effective improvements to safety on this fleet. Broader impacts are possible for similar small airlines or commercial operators. Reports of experimental findings may allow those operators to more quickly and effectively deploy FOQA programs and ensure their impact.

#### Description of the Desired Product

1. Survey of AJW pilots concerning their understanding of FOQA implementation, policy, and lessons-learned; their opinions of the value of the program; and their recommendations for program improvement. Survey to be accomplished prior to FOQA deployment on Beech aircraft and at least once after implementation of experimental enhancements to classroom and simulator training on the selected fleet (Lear).
2. Identification of alternative analysis strategies that may be unique to AJW operations.
3. Assessment of impact of training on exceedance rates.
4. Exploration of methods for communicating FOQA lessons to the pilot group, who are trained through contract providers.
5. Recommendations for small-scale operators based upon the AJW experience

#### Schedule

Phase I: Collection of baseline measures:

During this phase (Q1FY10), attitudes about FOQA will be assessed among AJW pilots currently participating in FOQA (Lear, Challenger) and those for whom implementation is imminent (Beechcraft). In addition, weekly baseline exceedance rates will be documented for the existing fleets over the preceding three years. These rates are relatively stable on the Lear and stabilizing on the Challenger (measurement and feedback have already reduced exceedance rates) and a time-series design documenting and controlling for existing variance will be required to assess the impact of training. In addition, dates of previous training implementation will be documented as potential effects on the exceedance time series.

Phase II (Q2-Q4FY10): Implementation and preliminary assessment:

During this phase, data collection will begin and existing FOQA feedback methods (base presentations) will be implemented among the Beech pilot group and continued among the Lear and Challenger pilot groups. Two forms of experimental training will be implemented by office within the Lear fleet. One office (either SAC or ACY) will be selected as a control group and continue to receive only FOQA briefings. A second office will receive enhanced classroom training, consisting of video-based classroom materials re-creating known events and trends of concern. A third office (OKC) will receive enhanced classroom and simulator demonstration and practice of events leading to exceedances. Weekly exceedance rates will continue to be documented for all fleets. Preliminary analyses of the exceedance rate time series between Lear offices fleets will be completed with the end of the first training cycle. If experimental training is effective, we would expect differences in exceedance rate trends by office. Pilot attitude data will be collected again and compared among fleets.

Phase III (Q1-Q3FY11): Assessment of impact of experimental training

During this phase, the experimental training will be implemented for Lear ACY and SAC pilots and on the remaining two fleets. Impact will be assessed on exceedance rates following the end of the first training cycle during the third quarter of FY11. If experimental training is effective, a change in trend should appear among previously untreated offices and fleets, corresponding to, but lagging behind the trend for the OKC

Lear pilot group.
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## Research Objective

This research seeks to optimize the effectiveness of the FOQA program in the Tech Ops fleet by assessing the impact of feedback provided to date and experimental classroom and simulator training on rates of exceedances within the fleets' operation. Further, this research may offer guidance for methods that could be most important to successful implementation of FOQA programs in small air carrier and commercial operations.

## Background

Flight Operational Quality Assurance Programs (FOQA) enhance flight safety by providing greater insight into routine operational practices. FOQA entails the use of various types of Quick Access Recorders (QARs), which allow flight data to be easily removed from the aircraft for analysis and review. The total flight operations environment can be analyzed through the systematic collection and review of the automated recordings of flight data generated during routine line operations. FOQA programs have resulted in significant enhancements to large air carrier (FAR Par 121) training programs through the detection, analysis and understanding of "deviations," "exceedances," or "unsafe events" gathered under a FOQA program from a set of pre-determined operating parameters.

The benefits of FOQA programs have been largely limited to large air carriers operating heavy jet equipment with access to advanced simulators and extensive training departments. Large air carriers own and/or operate advanced simulators that enable the re-creation of "unsafe events" to be replayed in the classroom during periodic aircrew flight training or to demonstrate in simulator training. In addition, aggregate FOQA data sets are used in training newsletters enabling improved awareness, learning, and subsequent operational performance. Both anecdotal and time-series analyses of safety benefits of FOQA programs have been shared in a variety of public forums for more than a decade.

On the other hand, there is little, if any, research evidence of benefits of FOQA programs to small air carriers and commercial operators and FOQA programs have not been broadly generalized to these operations. Smaller air carrier operators using business class size jets and turbo-propeller aircraft have not entered and received the potential benefits of FOQA programs. The Technical Operations fleet is very similar to a small airline or commercial operation. It has benefited from FOQA, as evidenced by stabilizing and declining exceedance rates, but can continue to improve through implementation on the remaining fleet and more extensive training making use of lessons learned from FOQA data. This can serve both the FAA's internal safety goals and serve as a model for other small operators.

FAA administrator Babbitt has called for renewed emphasis on the benefits of FOQA programs as a key component of continuous safety improvements in air carrier safety. Also, concern for "equivalent safety levels" among both large and small air carriers has been raised within the FAA and by Congress, following a recent regional air carrier accident. Thus, the FAA and the air carrier industry must continue to expand FOQA programs beyond the large air carrier industry. The regional air carrier industry and small "on demand" air carrier and corporate commercial operators using independently owned and operated training centers for their advanced simulations (without the benefit of large flight training departments) may require different implementation strategies than those of larger organizations. In addition, the most critical activities for rapid realization of the safety benefits from FOQA programs have not been extensively explored, or systematically evaluated largely due to the concerns about public disclosure of confidential information with the associated negative publicity for individuals and the organization.

## Previous Activity on this Task

None

## **Proposed or Planned Research**

Over a two year period, CAMI researchers will assess baseline attitudes in all three fleets and document baseline exceedance rates in the Lear and Challenger fleets, assist AJW in developing experimental classroom and simulator training requirements, and employ a quasi-experimental time-series design to assess the impact of experimental training on attitudes and exceedance rates.

## **Research Question(s)**

What are the most cost effective approaches to improving safety of operations within the Tech Ops fleet?  
 What is the relative impact of publication, classroom, and simulator training on crewmember attitudes towards FOQA and exceedance rates?  
 What recommendations should be made to other small airlines and commercial operators based upon AJW's experience?

## **Technical Approach**

### **Current Year**

CAMI personnel will assess attitudes about FOQA among Tech Ops pilots currently participating in FOQA (Lear, Challenger) and those for whom implementation is imminent (Beechcraft). In addition, weekly baseline exceedance rates will be documented for the existing fleets over the preceding three years. These rates are relatively stable on the Lear and stabilizing on the Challenger (measurement and feedback have already reduced exceedance rates) and a time-series design documenting and controlling for existing variance will be required to assess the impact of training. In addition, dates of previous training implementation will be documented as potential effects on the exceedance time series.

CAMI will work with AJW leadership to identify key types of exceedances for which rate reduction is needed and will explore options for providing further feedback and training. We will specify classroom and simulator scenarios and curriculum outlines for several exceedances, document examples, and brief training center personnel on the desired training objectives, methods, and targeted outcomes.

### **Out-Years**

CAMI personnel will analyze attitude and exceedance data to assess the impact of experimental training on the Lear fleet and verify training impact as the Beech fleet is brought into the FOQA program and experimental training is implemented on the Challenger and Beech fleets.

## **Air Traffic Resources Required**

None

## **Information Technology Resources Required**

Permission for AAM-500 designee to access FOQA files on AJW network drives. Ability to run SPSS on files stored on AJW network drives

## **Calibration**

None

<b>FY10 Milestone Schedule</b>		
Description	Proposed Start Date	Proposed Completion Date
Assess reliability of FOQA attitude measure by collaboration with interested small airline	FY10 Q1	FY10 Q2
Attitude data collection via AJW survey	FY10 Q1	FY10 Q2
Explore exceedance data to understand its variance and seasonality, assess effects of previous interventions, identify candidate events for experimental training	FY10 Q1	FY10 Q2
Identify targets for experimental training	FY10 Q2	FY10 Q2
Complete specifications for experimental classroom and simulator training	FY10 Q3	FY10 Q3

<b>FY10 Deliverables</b>		
Description	Proposed completion date	Actual completion date
Report results of baseline attitude survey	FY10 Q3	
Recommend targets for experimental training	FY10 Q3	
Provide specifications for experimental training	FY10 Q3	