U.S. Department
of Transportation

**Federal Aviation
Administration**

Advisory Circular

Subject: FLIGHT OPERATIONAL QUALITY ASSURANCE	Date: 4/12/04	AC No: 120-82
	Initiated By: AFS-230	Change:

1. PURPOSE. This advisory circular (AC) provides guidance on one means, but not necessarily the only means, of developing, implementing, and operating a voluntary Flight Operational Quality Assurance (FOQA) program that is acceptable to the Federal Aviation Administration (FAA).

a. FOQA is a voluntary safety program that is designed to make commercial aviation safer by allowing commercial airlines and pilots to share de-identified aggregate information with the FAA so that the FAA can monitor national trends in aircraft operations and target its resources to address operational risk issues (e.g., flight operations, air traffic control (ATC), airports). The fundamental objective of this new FAA/pilot/carrier partnership is to allow all three parties to identify and reduce or eliminate safety risks, as well as minimize deviations from the regulations. To achieve this objective and obtain valuable safety information, the airlines, pilots, and the FAA are voluntarily agreeing to participate in this program so that all three organizations can achieve a mutual goal of making air travel safer.

b. A cornerstone of this new program is the understanding 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. Information submitted to the FAA pursuant to this program will be protected as "voluntarily submitted safety related data" under Title 14 of the Code of Federal Regulations (14 CFR) part 193.

(1) In general, aggregate FOQA data provided to the FAA under 14 CFR part 13, section 13.401 should be stripped of information that could identify the submitting airline prior to leaving the airline premises and, regardless of submission venue, should include the following statement:

> **WARNING: This FOQA information is protected from disclosure under 49 U.S.C. 40123 and part 193. It may be released only with the written permission of the Federal Aviation Administration Associate Administrator for Regulation and Certification.**

(2) However, if an airline voluntarily elects to provide the FAA with aggregate FOQA data that includes airline identifying information, then it should include an additional statement that it is the proprietary and confidential property of [Airline Name].

c. As defined in this AC, operator FOQA programs include provisions for the identification of safety issues and development and implementation of corrective actions. FOQA can provide objective safety information that is not otherwise obtainable. No aircraft operator is required to have a FOQA program. No operator that conducts a FOQA program is required to obtain FAA approval of that program. However, an aircraft operator that seeks the protection available in part 13, section 13.401 from the use by the FAA of FOQA information for enforcement purposes must obtain FAA approval of its program. For that purpose:

(1) The elements of a FOQA program are set forth by an aircraft operator in an Implementation and Operations (I&O) Plan that is submitted to the FAA for review and approval. Guidance on the appropriate content of a FOQA I&O Plan is provided in appendix A of this AC.

(2) The guidelines contained herein are based on the extensive experience of the FAA and the airline industry in developing FOQA programs and constitute a compilation of best practices. The provisions of this AC neither add nor change regulatory requirements or authorize deviations from regulatory requirements.

2. BACKGROUND. In recent years, the FAA and the air transportation industry have sought additional means for addressing safety problems and identifying potential safety hazards. Based on the experiences of foreign air carriers, the results of several FAA-sponsored studies, and input received from government/industry safety forums, the FAA has concluded that wide implementation of FOQA programs could have significant potential to reduce air carrier accident rates below current levels. A reduction in the already low U.S. airline accident rate is needed to preclude a projected growth in the number of accidents, which is expected to occur due to increased future traffic volume. The value of FOQA programs is the early identification of adverse safety trends that, if uncorrected, could lead to accidents. A key element in FOQA is the application of corrective action and follow-up to assure that unsafe conditions are effectively remediated.

3. SCOPE AND APPLICABILITY. The information contained in this AC applies primarily to air carriers that operate under part 121 or 135, but may be applicable to operators under other parts. The aircraft operator voluntarily enters into a FOQA program.

4. RELATED REGULATIONS (14 CFR).

- Part 13
- Part 119
- Part 193

5. KEY TERMS. The following key terms and phrases are defined for the purposes of FOQA to have a standard interpretation of the guidance offered in this AC. Abbreviations are listed in paragraph 11.

a. Aggregate Data. The summary statistical indices that are associated with FOQA event categories, based on an analysis of FOQA data from multiple aircraft operations.

b. Aggregation. The process that groups and mathematically combines individual data elements based on some criterion (e.g., time, geographical location, event level, aircraft type). Each aggregation is based on factors of interest to the analyst at a particular point in time.

c. Data Management Unit (DMU). A unit that performs the same data conversion functions as a Flight Data Acquisition Unit (FDAU), with the added capability to process data onboard the aircraft. Additionally, this unit has a powerful data processor designed to perform in-flight airframe/engine and flight performance monitoring and analysis. Some DMUs have ground data link and ground collision avoidance systems incorporated into the unit.

d. Data Validation. A process during which flight data are reviewed to see that they were not generated as a result of erroneous recording or damaged sensors.

e. De-identified Data. Data from which any identifying elements that could be used to associate them with a particular flight, date, or flightcrew has been removed.

f. Event. An occurrence or condition in which predetermined values of aircraft parameters are measured. Events represent the conditions to be tracked and monitored during various phases of flight and are based on the sensory data parameters available on a specific aircraft fleet.

g. Event Category. Event categories are areas of operational interests (e.g., aircraft type, phase of flight, geographical location) on which FOQA event monitoring and trend analysis is based.

h. Event Levels. The parameter limits that classify the degree of deviation from the established norm into two or more event severity categories. When assigning levels to an event, consideration is given to compliance with federal regulations, aircraft limitations, and company policies and procedures.

i. Event Set. A collection of events designed to measure all aspects of normal flight operations for a particular aircraft type at a particular air carrier. Individual events within the event set would be customized to the approved limitations for the aircraft type and in accordance with the air carrier's operational procedures. The event set for a particular fleet may be limited by the available parameters on the aircraft.

j. Event Validation. The process in which an event is determined to be a valid sample of operation outside the established norm. Even though aircraft parameter limits may have been exceeded, a valid event may not have occurred (e.g., significant localizer deviation may have occurred when an aircraft was making a sidestep approach to a parallel runway).

k. Flight Data Acquisition Unit (FDAU). A device that acquires aircraft data via a digital data bus and analog inputs and that formats the information for output to the flight data recorder in accordance with requirements of regulatory agencies. In addition to the mandatory functions, many FDAUs have a second processor and memory module that enables them to perform additional Aircraft Condition Monitoring System (ACMS) functions/reports. The FDAU can provide data and predefined reports to the cockpit printer, directly to Aircraft Communications Addressing and Reporting System (ACARS) for transmittal to the ground, or to a Quick Access Recorder (QAR) for recording/storage of raw flight data**.** The FDAU can also display data for the flightcrew.

l. Flight Data Recorder (FDR). A required device that records pertinent parameters and technical information about a flight. At a minimum, it records those parameters required by the governing regulatory agency, but may record a much higher number of parameters. An FDR is designed to withstand the forces of a crash so that information recorded by it may be used to reconstruct the circumstances leading up to the accident.

m. Flight Operational Quality Assurance (FOQA). A voluntary program for the routine collection and analysis of flight operational data to provide more information about, and greater insight into, the total flight operations environment. A FOQA program combines these data with other sources and operational experience to develop objective information to enhance safety, training effectiveness, operational procedures, maintenance and engineering procedures, and air traffic control (ATC) procedures.

n. FOQA Monitoring Team (FMT). A group comprised of representatives from the pilot group, if applicable, and the air carrier. This group is responsible for reviewing and analyzing flight and event data and identifying, recommending, and monitoring corrective actions.

o. FOQA Plan. An internal air carrier planning document that contains detailed information on FOQA implementation and operation and serves as the basis for the I&O Plan.

p. FOQA Steering Committee. An oversight committee formed at the beginning of FOQA program planning to provide policy guidance and vision for the FOQA effort. Membership may include a senior management person and representatives from key stakeholder departments, such as flight operations, maintenance, training, and safety. A representative from the pilot association is also typically included on this committee.

q. Gatekeeper. The FMT member who is primarily responsible for the security of identified data. The gatekeeper is the individual(s) who can link FOQA data to an individual flight or crewmember. The gatekeeper is normally a member of the pilot association.

r. Ground Data Replay and Analysis System (GDRAS). A software application designed to:

- Transform airborne-recorded data into a usable form for analysis
- Process and scan selected flight data parameters

- Compare recorded or calculated values to predetermined norms using event algorithms
- Generate reports for review

s. Implementation and Operations Plan (I&O Plan). A detailed specification of key aspects of a FOQA program to be implemented by an air carrier, including:

- A description of the operator's plan for collecting and analyzing the data
- Procedures for taking corrective action that analysis of the data indicates is necessary in the interest of safety
- Procedures for providing the FAA with de-identified aggregate FOQA information/data
- Procedures for informing the FAA as to any corrective action being undertaken

t. Logical Frame Layout (LFL). A data map that describes the format in which parameter data are transcribed to a recording device. This document details where each bit of data is stored.

u. Parameters. Measurable variables that supply information about the status of an aircraft system or subsystem, position, or operating environment. Parameters are collected by a data acquisition unit installed on the aircraft and then sent to analysis and reporting systems.

v. Phase of Flight. The standard high-level set of activities performed by pilots on all operational flights (i.e., preflight, engine start, pushback, taxi, takeoff, climb, cruise, descent, holding, approach, landing, taxi, and postflight operations).

w. Quick Access Recorder (QAR). A recording unit onboard the aircraft that stores flight-recorded data. These units are designed to provide quick and easy access to a removable medium on which flight information is recorded. QARs may also store data in solid-state memory that is accessed through a download reader. QARs have now been developed to record an expanded data frame, sometimes supporting over 2,000 parameters at much higher sample rates than the FDR. The expanded data frame greatly increases the resolution and accuracy of the ground analysis programs.

x. Routine Operational Measurement (ROM). A "snapshot" look at a selected parameter value at predefined points in time or space during every flight being analyzed by the GDRAS. ROMs provide standard statistics (e.g., minimum, maximum, average) for the specified parameter for a particular period of time or condition. Since ROMs are collected on every flight, they provide valuable trending insight into normal operations. Routine operational measurements are also useful in establishing a baseline for normal aircraft operation across a fleet.

y. Sample Rate. The number of times per second that a specific parameter value is recorded by the onboard recording system. Normally, most parameters are sampled once per second. Increasing or decreasing the sample rate will directly increase or decrease the amount of data recorded by the onboard system. The ability to change a parameter sample rate is a function of the measurement source and the onboard recording system capabilities. Varying the parameter sample rate can be useful in enhancing time critical analysis capabilities.

z. Stakeholder. Constituencies that are potential users of FOQA data and that have a stake in the program's success.

aa. Wireless Data Link (WDL). A system that allows the high-speed transfer of onboard aircraft data to ground facilities using various wireless technologies. It may also allow for upload of data to the aircraft. Sometimes referred to as Ground Data Link (GDL).

6. FOQA PROGRAM OVERVIEW.

a. FOQA Program Components. The primary components of a FOQA program include:

(1) Airborne Data Recording Systems. These systems acquire and capture the necessary in-flight information. They include specific aircraft data input sources and the equipment to record and store the collected data. Data are gathered via onboard sensors that measure significant aspects of aircraft operation. Most sensor information is carried to its eventual destination via several data buses. Data are collected by interfacing with these buses. Other airborne equipment can be used to process and analyze the collected data, display the data to pilots during flight or on the ground, and transmit data to a GDRAS.

(2) GDRASs. These systems can:

- Transform flight-recorded data into a usable format for processing and analysis
- Process the data
- Detect events and ROMs that are being monitored and tracked
- Generate various reports and visualizations to help air carrier personnel interpret events
- Process information from a variety of recorded data formats and recorder types

(3) Air/Ground Data Transfers. One of the most labor intensive and costly aspects of a FOQA program is determining and implementing the process of getting the data from the aircraft onboard recording system to the GDRAS for analysis. Operators must pay strict attention to identifying the process that meets their FOQA program needs. Items to consider are:

(a) Scheduling of the Removal of the Recording Medium. This will normally require close coordination with the operator's maintenance control and line maintenance departments. Most likely, maintenance will want to remove the medium at a scheduled overnight maintenance location so that the removal process can be included as part of a regular work package or routine. This removal time period must coincide with recording medium memory capability and meet the operator's needs for timely analysis of FOQA data as defined in the I&O Plan. Specific procedures on process for data removal will have to be defined for line maintenance personnel to permit proper data download. Sufficient spare recording medium will have to be maintained at the maintenance facilities so that the medium can be replaced back into aircraft systems after download.

(b) Forwarding of Data to the GDRAS Location. Depending on the size of the operator's route structure, the location of where the data is removed in relation to the location of the GDRAS can be great. Methods for transferring the data to the GDRAS may consist of the following:

1 Ground-Based Transportation. The storage medium can be mailed from the maintenance location using regular mail, company mail, or private overnight forwarding companies. If this type of process is used, a tracking system should be developed so that the recording medium removal timing and location can be verified and documentation of aircraft data retrieval can be maintained. This will prevent a loss of recording medium so that the timing of data acquisition into the GDRAS can be tracked.

2 Electronic Transmission. This is a remote data transmission from the aircraft maintenance location to the GDRAS by the use of download equipment or milking-type machines that interface with the aircraft or by removal of the storage media from the onboard system. This process, while more efficient, requires a larger capital outlay and requires sufficient data transmitting capability from the remote maintenance locations to the location of the GDRAS. Coordination with an operator's information services department will be needed to accomplish this. Data security issues must be considered when incorporating this process.

3 Wireless Transmission. This is an emerging technology that enables direct transmission of aircraft flight data to a network that interfaces with the GDRAS using wireless technology. The download is accomplished automatically, thus removing the requirements for maintenance involvement. Incorporation of this technology involves aircraft and ground-based data transfer systems to be installed. Data security issues must be considered when incorporating this process. Close coordination with an operator's engineering and information services departments will be needed.

b. FOQA Program Description.

(1) The improvement of flight safety is the driving force behind the implementation of FOQA programs. A FOQA program is used to reveal operational situations in which risk is increased in order to enable early corrective action before that risk results in an incident or accident. FOQA should interface and be coordinated with the operator's other safety programs. The FOQA program should be part of the operator's overall operational risk assessment and prevention program as described in part 119, section 119.65 and FAA guidance materials. Being proactive in discovering and addressing risk will enhance air safety.

(2) In a FOQA program, data are collected from the aircraft by using special acquisition devices, such as QARs, or directly from the FDR. Using one of several available transmission methods, data are periodically retrieved and sent to the air carrier's FOQA office for analysis. This office usually resides within the flight safety organization at the air carrier. The data are then validated and analyzed using specialized processing and analysis software, known as GDRAS, designed to convert the flight data into usable information.

NOTE: The quality and capability of a carrier's FOQA program will be directly dependent on the number of parameters available. The carrier should see that sufficient parameters are available for collection from the acquisition device or FDR (see appendix A, Example of a FOQA Implementation and Operations Plan).

(3) The GDRAS transforms the data into an appropriate format for analysis and generates reports and visualizations to assist personnel in analyzing the collected data. It extracts FOQA events from the raw digital data stream based on parameters, threshold values (e.g., descent rate in excess of 1,000 feet per minute on approach), and/or routine operational measurements that are specified by the air carrier. The analysis may focus on events that fall outside normal operating boundaries, event categories, or ROMs, as determined by the air carrier's operational standards (as well as the manufacturer's aircraft operating limitations). The FOQA FMT then reviews the events to assess their validity and potential significance. FOQA events are then marked for appropriate handling.

(4) In terms of determining the root causes of systemic problems that need correction, aggregate FOQA data have proven to be of greater value than detailed parameter data gathered during a single flight. Individual data records are typically aggregated into categories to assist the analyst in looking for trends and patterns. For example, an analysis may be conducted on the average maximum rate of descent below 2,000 feet by airport by fleet type. This may be useful to better understand the meaning of the data once related events indicate that this is an area requiring investigation. This analysis may suggest that all fleets are experiencing high descent rates at a certain airport or just a specific aircraft type. This type of information can be used to pinpoint the potential source of the problem and, hopefully, suggest the nature of appropriate corrective action.

(5) Data that could be employed to determine flight crewmember identity are removed from view in the electronic record as part of the initial processing of the airborne data. However, air carrier FOQA programs typically provide for a gatekeeper, who is provided with a secure means of determining identifying information for a limited period of time, in order to enable follow-up inquiry with the specific flightcrew associated with a particular FOQA event. Such contact is usually limited to situations when further insight into the circumstances surrounding an event is needed. The gatekeeper is typically a line captain designated by the air carrier's pilot association (if applicable). The concurrence of the gatekeeper is required in order to initiate a follow-up with an individual pilot. Follow-up inquiries with individual crewmembers concerning FOQA events will normally be accomplished by a line captain designated as a gatekeeper by the air carrier's pilot association (if applicable).

c. FOQA Analysis Process.

(1) Overview. The FOQA analysis process must be developed based on the objective and scope of the intended program. At a minimum, the process will be determined depending on whether information will be used to evaluate or effect change in any or all of the following areas:

- Operational Safety
- Aircraft Performance
- Aircraft System Performance
- Crew Performance
- Company Procedures
- Training Programs
- Training Effectiveness
- Aircraft Design
- ATC System Operation
- Airport Operational Issues
- Meteorological Issues

NOTE: Data analysis may be different for each of these groups, depending on the intended use of the information. What type of analysis is available will be a function of the aircraft recording capability, available parameters, and GDRAS hardware and software capabilities. Extensive coordination between the FOQA FMT and other airline departments is crucial in maximizing analysis capabilities within the FOQA program.

(2) Data Recording. The available parameters and their associated sample rates and recording accuracies will directly affect FOQA analysis. The minimum core recorded parameters are those specified in part 121, sections 121.343 and 121.344 for FDRs. Aircraft that have been further outfitted with programmable FDAUs or DMUs may have parameters in excess of the minimum required. FDAUs or DMUs can be programmed to provide these additional parameters dependent upon storage medium capability. These FDAUs and DMUs may also be able to modify the sample rate through reprogramming. This will be a function of the parameter sensor on the aircraft and recorder medium size. Close coordination with operator engineering personnel will be required to identify available parameters**.**

(3) Analysis Techniques. Two types of analysis techniques can be applied to FOQA data. They are parameter exceedence analysis and statistical analysis.

(a) Exceedence Analysis. This involves setting a specific limit for the GDRAS to detect for a particular parameter. For example, the GDRAS can be programmed to detect each time the aircraft roll angle exceeds 45 degrees. This data can be trended over multiple flights to determine the number of exceedence occurring per flight segment. In addition, the data can be trended to determine which phase of flight, airport, or runway, if appropriate, depending on the event type. Levels of exceedence can be programmed for particular events based on the operator's risk assessment to assist in focusing resources on implementing corrective action on the highest perceived operational risk area. A higher level of risk may be associated with an

occurrence where the bank angle reached or exceeded 60 degrees. The FMT, through the gatekeeper, may choose to contact the crew or conduct a more detailed investigation of the event for this type of exceedence in addition to just maintaining and monitoring the trends where bank angle exceedences reach 45 degrees or greater. Exceedence levels will have to be developed through assessment of a carrier's operations manuals, training programs, and risk assessment process as part of the overall safety program.

(b) Statistical Analysis. This is used to create profiles of flight, maintenance, or engineering operational procedures. The profiles can use several measurements to build distributions of various criteria. A distribution of data will show all flights and enable a carrier to determine risk based on mean and standard deviations from the mean. One procedure a carrier may look at is approach tracks. A profile would be designed to measure the different criteria of an approach, like airspeed, rate of descent, configuration, or power setting. For example, the GDRAS will capture the maximum airspeed of every flight on final approach. A series of distributions will show a picture of how all flights are performing. The carrier can then determine when an approach track may lead to an unstable approach or landing. Similar to exceedence analysis, statistical analysis can use distributions to drill down into the data to look at phase of flight, airports, or aircraft type, if appropriate. Each individual airline working with its FOQA team could establish or modify airline policy and training programs based on the performance of all its flights. Once a baseline is established, the data could be monitored to track the trend of what is occurring. The value of using statistical analysis is that data from all flights is used to determine risk for an airline without focusing on specific event exceedences. The use of data distributions can develop a risk assessment process by establishing a baseline for trending data and determining critical safety concerns. Statistical analysis is a tool to look at the total performance of an airline's operation.

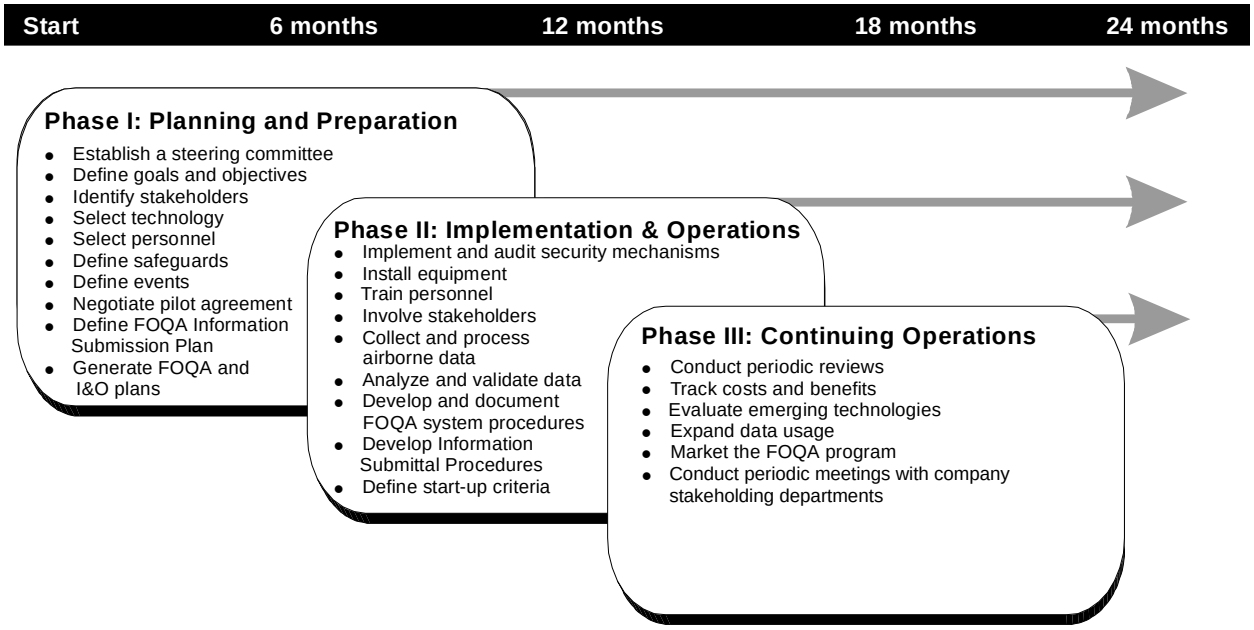
(c) Validated Trend Information. This is reviewed to determine the nature of any required action. Such actions might include the immediate notification of maintenance personnel if limits were exceeded that require inspection of the aircraft, reviews of the event to identify possible corrective measures, or a determination that further information is needed through crew feedback. Depending on the particular event, the flightcrew may be contacted to gather more information about the circumstances and causes of the event. Corrective measures can range from modifications of flightcrew training to revisions of the operating procedures to equipment redesign. Information on valid events is also stored in databases for use in trend analysis.

7. FOQA PROGRAM ESTABLISHMENT AND IMPLEMENTATION. This section presents guidelines for designing, developing, implementing, and evaluating a FOQA program. These guidelines do not reflect any single FOQA program in operation today. Rather, the guidelines describe the best practices culled from various air carriers that currently operate highly effective FOQA programs. The FAA does not require these guidelines to be followed in order for an air carrier to receive approval for its FOQA program. A successful FOQA program should be customized to address an air carrier's individual needs and situation. Air carriers that are considering establishing a FOQA program should visit with air carriers that have already established FOQA programs. Such meetings are intended to foster a clear understanding of what is involved in the entire process. These discussions can provide useful information and practical know-how regarding lessons learned, obstacles to success, and potential benefits. The three

phases of a FOQA program are Planning and Preparation (Phase I), Implementation and Operations (Phase II), and Continuing Operations (Phase III).

NOTE: Each phase contains specific elements, as illustrated in figure 1. Each of these phase elements will be further discussed in the following sections. Activities in each phase may occur in parallel. Also, because implementing a FOQA program is an iterative process, tasks in all phases may be open-ended and continue for the duration of the FOQA program. However, the transition to Phase II begins definitively when the FAA approves the air carrier's I&O Plan.

FIGURE 1. FOQA PHASES



a. Phase I—Planning and Preparation.

(1) Overview. Phase I is the foundation of a FOQA program. This phase begins when the air carrier decides to establish a FOQA program. A FOQA plan that defines the type of system that will meet user needs and how that system will integrate with other areas of the company and stakeholders is then written. Because much of Phase I requires interdepartmental cooperation and communication, many air carriers establish a FOQA steering committee or similar oversight body. During this phase, the air carrier should also establish mechanisms for communicating the current status and progress of the program. These updates should be tailored to the interests of the various users. Planning, organizing, and obtaining resources for a FOQA program can be extremely challenging. The effort required should not be underestimated. Realistic assessments of the required time and resources indicate that designing, developing, and implementing a FOQA program takes months. Educating users and fully realizing the benefits takes even longer.

(2) Establish a Steering Committee. The formation of a FOQA steering committee is optional. However, it is a recommended first step in developing a FOQA program. The steering committee should define its members, meet regularly, and identify all applicable stakeholders early in the process. A typical steering committee might include a senior management member and representatives from flight operations, maintenance, safety, training, and the pilot association, if applicable. As Phase I progresses, the steering committee might invite the purchasing and legal departments to participate. Key issues to be addressed in Phase I are the size and scope of the FOQA program, organizational issues, resources requirements, and support from upper management. Determining where FOQA program responsibility will reside within the organization and ensuring participation of that group or department are important. Experience has shown that the establishment of a steering committee is an important step for the following reasons:

(a) It formalizes the operator's intent to initiate a FOQA program by creating a recognized, corporate-sponsored standing committee. Executive sponsorship demonstrates commitment and fosters this commitment through ongoing communication, thereby ensuring corporate-level understanding of the FOQA program's value as well as its costs. Executive participation also makes FOQA a priority within the organization, supports allocation of required resources, and aids in overcoming any organizational resistance or departmental conflicts.

(b) It provides an early opportunity to identify and include the appropriate stakeholders from various air carrier departments in the FOQA program development process.

(c) It may conceive and articulate the vision for the air carrier's FOQA program. The committee is also a vehicle for communicating that vision to the stakeholders and developing a consensus regarding key program issues.

(d) It can guide the FOQA program through Phase I and the development of the I&O Plan.

(3) Define Goals and Objectives. A key step in Phase I is to clearly define the vision, goals, and objectives of the FOQA program. These goals should be meaningful and measurable, define the expected uses for the FOQA data, identify critical success factors, and be prioritized. Well-defined goals are tools for convincing stakeholders and management why the air carrier should invest in a FOQA program. At the beginning of Phase I, goals will likely be defined broadly, because the air carrier is still determining what the FOQA program will accomplish. By the conclusion of Phase I, a specific set of goals and objectives to achieve in Phase II should be defined.

(4) Involve Stakeholders. To correctly formulate the program's expected output, stakeholders should be identified and involved early in the overall process. Each department is likely to require data analysis/reporting capabilities that are unique to its own needs. Identifying the stakeholders will help to identify their data analysis/reporting requirements, which will facilitate selection of the technology for recording, transporting, analyzing, and disseminating FOQA data. Initial stakeholders should include representatives from safety, flight operations, training, maintenance, engineering, airfield operations or ATC liaison, and the pilot association.

(5) Identify User Needs. The Steering committee should conduct a user needs assessment to develop a better understanding of stakeholder needs and to establish user requirements for the operations, training, engineering, maintenance, or other relevant departments. This study elicits and analyzes users' needs to assist in selecting the proper technology for the program. A clear and comprehensive understanding of the users' needs is essential to the program's success. FOQA's primary benefits are directly related to the usefulness of the data analyses to the stakeholder. Further, the FOQA data analyses need to be distributed intelligently. Determine what pieces of information are valuable to the stakeholder and consider how FOQA data can enhance current processes. An effective user needs assessment may identify user groups reluctant to participate in the FOQA program and help bring them into the program.

(6) Select Technology. Determining the technology and vendors to use is a critical decision. FOQA programs are comprised of at least three interdependent specialized systems. These three systems are airborne data collection, ground data replay and analysis, and data management and analysis. The first generation of programs used by U.S. air carriers was designed around commercial off-the-shelf (COTS) systems similar to those used in European and Pacific Rim FOQA programs. An increase in the number of air carriers implementing FOQA programs has led to an increasing number of vendors and products supporting FOQA programs. The approach taken by these vendors varies widely and the technological solutions offered should be carefully evaluated to assess their suitability to the air carrier's needs. Special consideration should be given to technical issues, such as whether a particular product is compatible with the avionics and bus configurations already on the aircraft. Vendor training, warranty, and support policies are also important considerations in product selection.

(7) Select Personnel. Selecting personnel to staff the FOQA program depends on the program's scope, the size and organization of the air carrier, and the technology that will be implemented to record and analyze information. A typical program includes a FOQA manager, one or more FOQA analysts, and a FMT composed of experienced pilots. FMT members should be technically proficient on the aircraft types used in the FOQA program and have excellent communication and problem-solving skills.

> **NOTE: In order to obtain perspectives from various interested departments, an air carrier may "share" employees across normal departmental lines. For example, two part-time people (one from the safety department and one from the engineering department) may provide a more synergistic approach than a single full-time analyst devoted only to FOQA.**

(8) Define Safeguards. FOQA requires vigilant security and privacy protection for confidentiality of the data and to protect data against unauthorized disclosure, alteration, misuse, or destruction. The issue of data protection and security is sensitive and focuses on the confidentiality of a particular air carrier, flight, date, or flightcrew and a recorded event. The security policy should balance users' needs to access the data against the need to keep the data confidential. From the outset, air carrier policies and procedures for all security and protective aspects of the FOQA program should be carefully designed, documented, implemented, and

periodically reviewed. The person responsible for implementing the security policy, such as the gatekeeper, should be identified.

(9) Define Events/ROMs. The events/ROMs that can be defined are dependent upon the available parameters that are recorded on a given aircraft type. Event/ROM definition and modification starts in this phase and continues for the duration of the FOQA program. Typically, the first phase of a FOQA program focuses on a single aircraft type. Information on defining events/ROMs and associated parameters is contained in appendix A.

(10) Negotiate Pilot Agreement (if necessary). Establishing an air carrier FOQA program may necessitate the negotiation of an agreement between the air carrier and its pilots' collective bargaining agent. This agreement defines the specifics of the FOQA program and its objectives and administration. This agreement is crucial for obtaining buy-in from the pilot community and for ensuring that line pilots play an integral part in the process.

(11) Generate FOQA I&O Plan. The FOQA I&O Plan is the most important output of Phase I. The I&O Plan describes key aspects of the FOQA program. Preparing this document is one of the last steps of Phase I. Work done on the FOQA Plan can serve as a basis for the I&O Plan. The I&O Plan must be submitted to the FAA for review and approval in order to obtain protection from FAA civil enforcement actions. See section 13.401(c) for specific guidance for the development of the I&O Plan, including a template and checklist, is provided in appendices A and B.

b. Phase II—Implementation and Operations.

(1) Work-Intensive. Phase II is the most work-intensive phase of a FOQA program. During Phase II, the FMT performs the tasks outlined in the I&O Plan. The airborne and GDRAS equipment selected in Phase I are installed. Phase II initially focuses on a single fleet and a limited number of equipped aircraft (usually 15 to 25). A major milestone in this phase is the first time that the air carrier records FOQA data, processes the data, and performs an analysis. During this phase, activities transition from designing the FOQA program to implementing and administering the program. The FOQA steering committee will begin to function in more of an advisory capacity as the FMT begins to assume its leadership role.

> **NOTE: Experience has shown that it takes approximately three to six months from when data are first recorded until official program startup can commence. The transition to Phase III occurs when the air carrier is convinced that FOQA data are accurate, reliable, and secure.**

(2) Implement and Audit Security Mechanisms. The security policies and procedures defined in Phase I should be implemented and thoroughly tested to see that they are effective. The actual mechanisms for protecting the data will be based on the capabilities of the hardware and software used in the program. The gatekeeper should be trained on how to implement and manage these mechanisms to protect data and control access. All GDRAS users should receive instruction about the protective provisions and how to handle problems. Periodic audits of the

security mechanisms should be conducted, and the results should be used to fine-tune the policies and procedures.

(3) Install Equipment. A schedule should be established for installation of all equipment, including airborne and GDRAS. If installation of airborne equipment requires obtaining a Supplemental Type Certificate (STC), additional time and resources must be budgeted for this process. Coordination with maintenance and vendors will be required to track progress and resolve problems.

(4) Train Personnel. Personnel who install airborne systems may require training before or during equipment installations. For the GDRAS, the different levels of users may benefit from separate training classes tailored to their needs. The individual responsible for the GDRAS, typically the FOQA analyst, should receive training on system installation, configuration, and administration. Training for end-users should be tailored to their analysis needs and be provided as close to the initial exposure to the system as possible. End-users should be educated on product usage and the data. The training should occur after the system is fully operational and when the air carrier's actual data are available so that users learn to effectively utilize the system with their data. Additional documentation may need to be developed to supplement materials provided by the vendors and to cover carrier and fleet-specific topics.

(5) Involve Stakeholders. To realize value from the FOQA investment, information derived from FOQA data must reach the appropriate user groups. Stakeholders will value the FOQA program only if they can obtain useful information that was not available before or obtain information faster than they can by using their current methods. The stakeholders will need to know what information is available to them. Education sessions should be held to promote user awareness of the information available, the program's capabilities, and the information's potential uses. Initial education should explain the FOQA program, including concepts, technology, benefits, and implementation schedule. Just because FOQA data are available does not guarantee widespread usage. Follow-up educational sessions may be required and should focus on instructing stakeholders on how to access and use the information available from FOQA data. Using a variety of methods and media (newsletters, e-mail, corporate Intranet, formal presentations, one-on-one meetings, team meetings, and videos) may attract a wider audience to the program than using only a single vehicle.

(6) Collect and Process Airborne Data. Procedures for retrieving the media on which FOQA data are recorded, such as optical disks or Personal Computer Memory Card International Association (PCMCIA) cards, or for downloading data from solid-state recorders using hand-held readers, are needed. These procedures need to be developed and tested for accuracy, completeness, and resource requirements. The procedures should address the retrieval of recorded media, storage and distribution of unrecorded (blank) media, and installation of unrecorded media. Typically, media containing the flight data are removed from the recording device during a scheduled maintenance check. Retrieved media are sent to a central location for transmission or processing. New media are then inserted into the devices for the next round of flights. Schedules for retrieving the media are determined by the capacity of the media, the amount of data recorded, and the schedule of maintenance checks. The media retrieval schedule may range from 3 to 20 days. The same kind of schedule would apply if hand-held download

devices were being used. Wireless data link systems, which transmit information directly to a ground system, eliminate the scheduling and staffing logistics associated with media or data retrieval. Using wireless data links may also reduce the potential for data loss when recording media reach capacity.

(7) Analyze and Validate Data. Stakeholder confidence in the FOQA program is directly proportional to the data's accuracy, reliability, and completeness.

(a) Data reliability is determined by validating the integrity of the airborne and ground systems' hardware and software. "Reasonableness" and consistency checks need to be performed on the recorded data. These checks can be accomplished by a variety of means, including:

- Validation by the vendor
- Comparison of Digital Flight Data Recorder (DFDR) data readings with FOQA readings
- Sensor validation
- Comparison of FOQA data with onboard, in-flight observations

(b) Data integrity and validity standards should be established to see that the data and associated analysis and reporting are performed in a consistent, standardized manner.

NOTE: Data validation activities tend to take much longer than anticipated.

1 Event sets will probably need to be fine-tuned after data from the first flights are analyzed to determine that what is being recorded is exactly what is needed and that appropriate data are being recorded at the proper resolution. Faulty sensors, modified LFLs, or missing software updates for acquisition units or analysis programs can cause errors. Fine-tuning event sets is a time-consuming and reiterative process. Failure to properly fine-tune the event sets can yield information of no use to stakeholders or worse**,** unreliable and invalid data. Appendix A contains a suggested list of events to use (with modifications, as needed) and analyze in a basic FOQA program.

2 Any modifications to event sets or their associated parameters should be carefully tracked and documented to preserve the integrity of the process. Be aware that changes to event definitions may diminish the usefulness of trend or aggregate data if those data were captured under a combination of old and new event definitions.

(8) Store Data. FOQA programs yield vast quantities of raw data. The average amount of FOQA data collected from a single, digital aircraft is approximately 7.2 megabytes (MB) per day, resulting in 2.6 gigabytes (GB) per year. The air carrier that fails to plan ahead for data storage from all the aircraft covered will soon be awash in data. Although air carriers may choose to retain only a small portion of these data, establishing and maintaining a data storage program is critical for success.

(9) Develop and Document FOQA Program Procedures. As the program transitions through shakedown to production status, the FMT should develop and document procedures for operating and managing the program.

(a) Manual and/or automated procedures should be developed and documented for data security and data management (including backup and recovery, data archiving and restoration, monitoring and fine-tuning databases, defining and fine-tuning event sets, and data de-identification). Written procedures describe how to:

- Define, update, and delete user accounts
- Manage libraries of reports and graphics created by users
- Control security and access permissions for users and groups

(b) Documentation of all procedures is important for promoting consistent administration of the program. The importance of good documentation becomes evident when there are personnel changes on the FMT.

(10) Satisfy Startup Criteria. The criteria that indicate when a FOQA program is official and can transition from shakedown status into a mode of formal continuing operation should be established. The official start date defines when FOQA data will be used for formal analysis and trending. The FOQA manager and members of the FMT should periodically review the startup criteria to identify and correct problem areas, as well as certify criteria completion. Satisfaction of the startup criteria heralds the start of Phase III.

c. Phase III—Continuing Operations.

(1) Startup Criteria. Phase III begins once the startup criteria have been satisfied. Airborne and ground-based data systems must have been tested and confirmed, data accuracy and integrity must have been checked, and methods of analysis must be validated. At this phase, the FOQA program has stability, reliably providing high-quality, readily usable data to the FOQA program's stakeholders.

(2) Iteration and Review. Phase III shifts the focus from implementing the technology to optimizing available data and the processes required to obtain the desired information. Periodic reviews of all aspects of the FOQA program will determine whether the program is working as well as it could or whether revisions are required. These reviews will also identify when the program needs to be updated and modernized. Air carriers typically go through several iterations of experimentation and learning before mature FOQA processes are achieved. Following the full cycle of analysis, design, implementation, operation, and evaluation for each iteration of upgrade or change is important. At the end of each iteration, the lessons the team has learned should be captured and documented so that subsequent efforts benefit from the team's experience.

(3) FOQA Program Changes. Changes are likely to occur in an air carrier's FOQA program as air carriers assimilate new technologies, modify event definitions, and change structures to meet the stakeholders' growing needs. When changes to an air carrier's FOQA

program result in disparities between the program as implemented and the program as documented in the approved I&O Plan, the I&O Plan should be modified accordingly and changes must be submitted for acceptance by the FAA in order for section 13.401(c) to continue to apply to the FOQA program.

(4) FOQA Program Expansion. A FOQA program is neither static nor finite. It is meant to undergo controlled expansion and evolution as stakeholder demand for information grows and new technologies become available. The program should be able to accommodate new uses for FOQA data. These may require new equipment to capture and analyze the data. Additional stakeholders may wish to make use of available FOQA information. Once successes are achieved, the process of expanding usage of FOQA information will likely accelerate. The real payback begins when FOQA capabilities are widely recognized and used throughout the air carrier. Phase III has no distinct end-point. It is deliberately "open-ended" to allow for enhancements to airborne, ground, and processing system technology; to allow program expansion to other fleets; and to allow broadened data usage. The program's long-term plans will span several years, but incremental evolution should occur in carefully planned and well-documented 6- to 12-month cycles.

(5) Communicate FOQA Program Benefits. A comprehensive program to continuously promote FOQA should be established, along with mechanisms for implementation. The FOQA promotion effort should focus on gaining widespread support for the program. A variety of communication methods should be considered. For example, a newsletter can be used to inform users of significant program accomplishments, additional capabilities, and program evolution. Bulletin boards in pilot crew rooms are useful in disseminating FOQA information. Video presentations on FOQA findings might be useful in pilot annual recurrent training classes. Speaking at departmental and staff meetings and publishing testimonials about FOQA successes are also useful methods to spread the word about the program's progress.

(6) Conduct Program-Wide Periodic Reviews. Periodic reviews and assessments should be conducted to determine that the program stays relevant to stakeholders' new and existing interests and to identify areas for potential improvements. These assessments should determine if anticipated benefits are being realized and whether the information provided to end-users is accurate, timely, and usable. Ongoing user feedback mechanisms can be a valuable tool for capturing comments on the efficacy, usefulness, perceived shortcomings, and desired improvements of the current program. Likewise, efforts should be made to maintain current awareness of new technological alternatives and product enhancements. An audit of the quality of the aggregate data should also be performed along with an assessment of the accuracy of the reference and descriptive information. The tools employed to create aggregate and trend data should be periodically reviewed to determine if new technology would be more effective.

(7) Track Costs and Benefits. Justifying the investment in a FOQA program is an ongoing task. Capturing the initial acquisition and recurring costs is straightforward, as long as all categories of recurring costs are identified. Tracking the less tangible benefits is much more difficult. Benefits of a FOQA program, savings achieved and costs avoided, are spread across many departments. The safety department is an obvious beneficiary. However, placing a dollar value on an unknown number of aircraft accidents or incidents that were prevented because of

FOQA is almost impossible. The training department benefits from more effective training that is focused on documented problem areas, rather than using a standard syllabus that may not address areas where pilots are having problems. The maintenance department benefits from FOQA because of improved monitoring and documentation of maintenance problems, as well as having more data available for timely troubleshooting. This may result in fewer unscheduled component changes, better preventive maintenance procedures, and reduced requirements for spare part inventories.

(8) Evaluate Emerging Technologies. As the air carrier's FOQA program expands to cover greater numbers of aircraft and fleets, the ability of current systems to accommodate growth and change should be carefully considered. Emerging technologies have the potential to increase the efficiency and effectiveness of all facets of a FOQA program. For example, newer data capture devices may be able to record more parameters more frequently, the handling of recorded data may require less human intervention, analysis programs may become more automated, and new visualization capabilities may enhance the ability to understand flights and events. Technological advances can also provide solutions for many of the day-to-day data handling problems that FOQA generates. During the next few years, the market for FOQA equipment may grow rapidly and vendors may offer new products and technology. Keeping apprised of new technologies can help to optimize the overall investment in a FOQA program.

(9) Expand Data Usage. Expansion of data analysis is controlled by the limitations of the data generated by the GDRAS and the degree to which the data are stored in proprietary formats. COTS products can be used for statistical analysis and data mining, particularly when GDRAS supports industry standards for data access and exchange. The integration of FOQA data with other internal safety-related programs (such as the Aviation Safety Action Program (ASAP)) should be considered to further enhance the safety value of the information.

(10) FOQA Meetings. Conduct periodic FOQA meetings (preferably every 30 days) to provide company stakeholders with updated trends, information, and evaluation of previously implemented corrective actions.

8. INFORMATION-SHARING WITH THE FAA AND INDUSTRY. Section 13.401 requires operators of approved FOQA programs to provide the FAA with aggregate FOQA data in a form and manner acceptable to the Administrator. There are various ways and levels on which to accomplish this sharing, which are described below. The operator's director of safety or designated representative should be responsible for approving the release of de-identified aggregate FOQA data to any third party after obtaining the prior input and approval of all appropriate parties within the carrier, including the pilot association (if applicable).

a. Regular Briefings with the FAA Certificate Management Office (CMO). The first level of sharing is between the carrier and its local CMO/Flight Standards district office (FSDO). To accomplish this, a regular meeting should be established with local FAA personnel, as identified in the operator's FAA-approved I&O plan, to review FOQA program status and data trend analysis. Scheduling of these meetings should at least be quarterly, but can be held more often depending on the scope of the operator's FOQA program. Normally, this meeting is held on the operator's property and does not include the physical exchange of data, but a review of

trend analysis and corrective action plans. Aggregate data has been further clarified by the FOQA Aviation Rulemaking Committee (ARC) as the de-identified summary, statistical FOQA information that is normally acquired within a carrier's FAA-approved FOQA program. The degree of data de-identification will be determined by the respective air carrier, as described in its approved FOQA I&O Plan. For these briefings, the carrier may provide the aggregate data in oral, written, graphical, or digital format.

b. Intra-Carrier Information-Sharing. The sharing of FOQA information from an operator's program with other operators can provide benefits to an operator's overall safety program. This sharing can be accomplished through industry associations or directly between operators depending on the scope of the issue. Issues such as ATC or issues specific to a particular aircraft type are examples of subjects that can be shared between operators. Maintaining confidentiality of the information between operators is important in providing a cooperative environment.

c. Industry Sharing with the FAA. Issues may be identified from FOQA data that can't be solved through modifications or enhancements to an operator's existing operational procedures or approved training programs or through aircraft modifications under the control of the carrier. Also, issues may not be evident when individual carrier information is viewed independently. Therefore, industry sharing with the FAA may be helpful in identifying and resolving broad, industry issues. The FAA, working with carriers, has adopted an incremental approach to this requirement. The specific provisions of this approach will be developed over time in collaboration with the FOQA ARC and operators of approved programs. As an interim means of establishing initial compliance with section 13.401, operators of approved FOQA programs should provide the FAA with at least quarterly briefings on observed trends. These operators should also provide any other applicable information of potential safety significance. The FAA will specify the location of the briefing. For the purpose of these briefings, carriers may provide the aggregate data in oral, written, graphical or digital format. As the FOQA ARC works collaboratively with the FAA to develop a more systematic approach to the future sharing of aggregate FOQA information, guidance to industry on acceptable means of compliance with section 13.401 will be updated as appropriate.

d. Need for Appropriate Background and Expertise. While it is recognized that the sharing of FOQA information between operators and the FAA has significant potential for identifying system safety issues, FOQA data (even in aggregate form) has important limitations. A detailed understanding of the operator's route structure, equipment types, operating procedures, measurement criteria, and data collection procedures is required so that conclusions drawn from FOQA data will result in effective or productive safety interventions. Analysis of FOQA data should be accomplished by the operator and/or trained representatives from the operator's pilot association (if applicable) and by individuals thoroughly familiar with its characteristics. FOQA data analysis is a tool for managing safe operations, not an independent objective. FOQA is but one element of a comprehensive operator safety program.

9. FOQA IMPLEMENTATION AND OPERATIONS PLAN.

a. Overview and Plan Development.

(1) Under section 13.401, an operator seeking protection from the use of FOQA data for enforcement by the FAA must obtain FAA approval of its FOQA I&O Plan. The document that describes an air carrier's FOQA program for FAA approval purposes is the FOQA I&O Plan. A FOQA I&O Plan is submitted to the FAA for review and approval, as described in paragraph 9a(2) of this AC. The FAA will determine whether an air carrier's FOQA program is approved and notify the air carrier by letter of any concerns and/or formal approval.

(2) The I&O Plan specifies the organization, technology, policies, procedures, and operational processes used by a certificate holder for its FOQA program. The FAA approval process for an I&O Plan is designed so the air carrier has identified adequate procedures, organizational resources, and material resources to collect, analyze, and act upon information provided by the FOQA data. The I&O Plan should describe the following elements:

(a) Program goals.

(b) Fleet(s) to be equipped for FOQA.

(c) Airborne hardware, analysis software, and other equipment to be used in the program.

(d) Organizational structure for the FOQA program.

(e) FOQA program personnel and associated roles and responsibilities.

(f) Procedures for data acquisition and handling.

(g) Procedures for data analysis and reporting.

(h) Procedures to implement corrective action(s) when adverse safety trends are discovered.

(i) Policies on data retention, data security, and crew contact.

(j) Policies on providing FAA with de-identified aggregate data on the operator's premises and information on corrective actions undertaken.

(k) Policies and procedures for maintaining and revising the I&O Plan.

(l) A glossary of terms used in the I&O Plan.

(m) Appendices, which should include:

- A copy of the Letter of Agreement on FOQA with the pilots' collective bargaining unit (if applicable)

- List of events, parameters, and threshold values to be used in the program for each FOQA-equipped aircraft fleet
- A list of the documents referenced or cited

(3) An air carrier should identify its planned FOQA airborne and ground-based equipment in its initial I&O Plan. Subsequent revisions of the I&O Plan should identify any changes to the planned or implemented equipment. The purpose of this information is to ascertain proposed system capabilities, rather than to approve an air carrier's selection of a particular brand or vendor. Decisions with respect to the selection of software and equipment vendors are left entirely to the air carrier. However, the FAA may assess, for the initial plan and any subsequent revisions, whether the proposed products' functionality appears to be adequate to accomplish the program's goals.

(4) The FAA prefers to interact closely with applicants during the development of the I&O Plan, rather than to wait for the formal submittal of the finished plan before establishing substantive dialogue. A discussion and review of rough drafts of document sections early in the development process will facilitate approval. The submittal of the final documents then becomes a formality, with minimal changes required.

(5) To assist air carriers in developing their I&O Plans, a checklist of items to be included in the plan is provided in paragraph 9a(3). Paragraph 9a(4) contains a sample I&O Plan template. Although specific areas should be addressed in the plan, the I&O Plan template is flexible enough to allow the air carrier to tailor the plan to its individual needs.

b. FAA Approval.

(1) Operators seeking approval of a FOQA I&O Plan should submit the plan and a completed I&O Plan checklist to the FAA. The checklist should be used as an aid to see that all required material is included in the plan. The submittal should include a cover letter addressed to the air carrier's assigned Principal Operations Inspector (POI) that requests approval of the plan. A copy of the cover letter, plan, and checklist should be sent simultaneously to HQ FAA, Attn: AFS-230. Electronic transmission of this documentation to AFS-230, Volunteer Safety Program Branch, is encouraged (for which purpose signatures are not required).

(2) The FAA will evaluate the I&O Plan based on the adequacy of the proposed means and methods identified for the collection and analysis of data, as well as procedures for taking corrective actions. The joint evaluation by AFS-230 and the POI will allow the FAA to maintain standardization and continuity throughout the industry while accommodating carrier-specific organization and resource differences best understood by the POI.

(3) The POI and AFS-230 will review the proposed I&O Plan and establish a consensus as to whether the plan should be approved. The FAA procedures for I&O Plan approval are contained in FAA Order 8400.10, Air Transportation Operations Inspector's Handbook. AFS-230 and the POI will communicate any plan inadequacies to the air carrier in writing. Similarly, once AFS-230 and the POI concur that the plan should be approved, the air carrier will receive an approval letter with the signatures of the POI and the manager of AFS-230. Once

an I&O Plan is approved by the FAA, the air carrier's FOQA program may continue for an indefinite period, unless the carrier elects to terminate the FOQA program or the FAA withdraws its approval.

(4) The I&O Plan is a "living document" and should be updated as necessary. Changes will occur in the FOQA program as an air carrier assimilates new technologies, adds new fleets, modifies event definitions, and changes structures to meet its program's growing needs. Changes are likely to be particularly frequent during the early stages of an operator's FOQA program. When changes occur to previously approved I&O Plan content, the I&O Plan should be revised to incorporate those changes.

(5) A revision control methodology should be established for the I&O Plan (and any subsequent revisions) and included in the I&O Plan. A list of affected pages, or a revision control page that identifies the pages to be added/removed/replaced, should be submitted with any revised pages. Each revised page should contain the page number, revision number, and revision date. Revisions to the I&O Plan are required whenever changes occur to the nature of the FOQA program (e.g., changes to fleet composition, system configuration, flight operating procedures, organizational structure, schedule, and key milestones).

(6) Revisions to approved I&O Plans do not require FAA letters of approval. Because such changes can be potentially frequent and voluminous, revisions to approved plans will be considered to be accepted by the FAA, unless the FAA notifies the carrier in writing within 45 days of revision submittal that the revision is not accepted, except as follows: notwithstanding this 45 day period, if at any time the FAA discovers that the content of a FOQA I&O Plan is not consistent with section 13.401, or is otherwise unacceptable to the FAA, the FAA may notify the operator that revisions are required in order to maintain program approval. In addition to the POI, AFS-230 should be provided with an information copy of all revisions. The POI may permit an air carrier to consolidate and submit revisions on a quarterly basis throughout the calendar year, rather than submit each revision as it occurs. The air carrier should request this authority from the POI. This procedure is intended to reduce workload for the air carrier and FAA.

(7) FOQA is a voluntary program, and the air carrier may elect at any time to terminate its program. The FAA may also elect at any time to withdraw approval of an air carrier's I&O Plan for failure to comply with the requirements of section 13.410. The protections from civil enforcement actions are predicated upon the expectation that the operator will act upon FOQA information indicative of an adverse safety trend or a continuing violation. If the FAA determines that insufficient effort to develop or implement a plan of corrective action is taking place, and the air carrier is not responsive to FAA efforts to elicit compliance with this requirement, withdrawal of program approval may be appropriate. Withdrawal of FAA approval of the I&O Plan will be transmitted, in writing, to the air carrier.

c. I&O Plan—Topics. The following topics should be included in an I&O Plan:

(1) Background. This section summarizes the foundation and relevant FAA references for FOQA programs.

(2) Introduction. The introduction section should state the goals and objectives of the airline's FOQA program.

(3) FOQA Program Stakeholders. This section should identify the key stakeholders in the FOQA program. There may also be stakeholders outside the company that should be identified here.

(4) Protective Provisions, Pilot Association Agreement (if Applicable), and Corporate Policy Statement. Summarize the salient points of the protective provisions that the airline and its pilots are afforded from FAA certificate action or civil penalties from information and data collected and analyzed by the FOQA program. In addition, the protective provisions from the pilots association agreement should be summarized. Provide a copy of the agreement in Appendix 1 of the I&O Plan. If a pilot association agreement is not applicable to the airline, a corporate policy statement should be included in the I&O Plan that establishes protective provisions to its pilots against disciplinary or other pejorative action from the airline from data or information produced by the FOQA program.

(5) Data Protective Provisions and Security.

(a) In this section, include a summary of the protective provisions to be incorporated into the FOQA program that will gain acceptance by all participants, including the pilot association (if applicable).

(b) Describe the pilot association agreement (if applicable) as it pertains to individual protection and data usage. At a minimum, discuss the following security considerations:

- The team member(s) responsible for data protection and security
- Data protection methods (including those provided by the GDRAS, physical security of FOQA media and facilities and information dissemination safeguards, etc.)
- De-identification requirements and procedures
- Methods for ensuring confidentiality
- Data retention policies and procedures
- Data storage policies and procedures
- Procedures for auditing and refining the security policy, methods, and procedures

(6) FOQA Program Components. Describe the specific technology components proposed for use in the FOQA program. The I&O Plan will need to be amended when changes or additions to the fleet types or changes to other technology components are made in the airline's FOQA program. Program components described should include the following:

(a) Aircraft Fleet. Describe the following:

- How the initial aircraft fleet(s) were selected for participation in the FOQA program
- Number of parameters to be collected from each fleet
- Future plans for program expansion to additional fleets and aircraft within the current fleet

(b) Airborne Data Acquisition System. Describe the selection criteria and product selection process.

- What technical criteria were evaluated (recording capacity, media handling, and download capabilities)?
- How were service and support considered (warranty, repair station locations)?
- What compatibility issues with existing systems were raised (power considerations, size, weight)?

(c) Describe the airborne system configuration and provide information concerning the following:

- Strategy for acquiring airborne data
- Equipment to be installed in the aircraft (including vendor, part number, and other pertinent information) and the technology to be used
- Availability of the STC for each component installed on the aircraft or the plan for obtaining an STC
- Method used for loading and maintaining the LFL
- Fleet installation plan, including equipment installation requirements and schedule
- Support to be provided by the vendor (including a description of repair facilities and warranty policies)

(7) Airborne System Maintenance and Support. Describe whose responsibility it is within the operator to maintain the airborne acquisition and recording system, including parameter maps and configuration. This should also include interface between the FOQA FMT and the responsible party.

(8) GDRAS. Describe the GDRAS selection criteria and product selection process. Describe the GDRAS to be used for the FOQA program, including:

- Specify the vendor, product name, hardware, software, operating system configuration, and communication network
- Summarize the proposed GDRAS's functionality
- Describe vendor support and training
- Specify how LFLs, events, and parameters are defined, configured, and maintained
- Describe user configuration capabilities

- Describe how the system complies with de-identification and security requirements defined by the air carrier and pilot association

(9) Other Equipment. Describe any other FOQA components, such as:

- Software for trend analysis, statistical analysis, and flight animation
- Remote data collection systems and communication infrastructure, as applicable
- The vendor, product name, and associated hardware, software, communication, and operating system requirements
- The selection criteria and product selection process

(10) Equipment Upgrade, Modification, or Replacement. Describe the procedures, including criteria, which will be used for upgrading, modifying, or replacing the FOQA program components once those components have been approved for use.

(11) FOQA Organization. This section explains the context of the FOQA program within the air carrier's departmental settings and the individuals who will serve on the FOQA program team. The following subsections contain topics that should be incorporated into the I&O Plan:

(a) Organization Structure. Describe the following:

- The organization and management of the FOQA program, including the organizational entity responsible for the FOQA program
- Any oversight body (such as a steering committee or FOQA committee), including information on membership, charter, duties, meeting schedule.
- Provide an organizational chart that illustrates the organization and management structure of the FOQA program

(b) Personnel. Describe the skills, knowledge, duties, and responsibilities of the following anticipated key personnel associated with the FOQA program:

- Person providing corporate oversight
- FOQA manager
- Gatekeepers
- FOQA analyst
- FOQA intern, if applicable
- Members of the FMT, along with any other committees in the organizational structure

(12) FOQA Program Implementation.

(a) Describe the air carrier's concept of the FOQA program. Include operational procedures for:

- Data processing and analysis

- Investigating results
- Determining corrective actions to be taken for significant events
- Communicating findings to all effected stakeholders
- Obtaining feedback and follow-up for corrective actions
- Data trending
- Generating periodic reports
- Providing local FAA with aggregate FOQA information on the operator's premises

(b) The FOQA Implementation Process. Describe the following:

1 Schedule and timeline for FOQA implementation, including required resources.

2 Training that will be provided to team members and key stakeholders.

3 Location of FOQA facilities, including central processing and any remote sites.

4 Program startup criteria, including milestones (e.g. on system training, education, infrastructure, data validation) that should be met before collected data are used for analysis of line operations. If a user needs assessment has been conducted, summarize the methods used, users interviewed, and results.

NOTE: When developing a scheduled timeline for starting a FOQA program, many of these tasks may require considerable time for completion (i.e., beyond the month in which they are listed as occurring) and that preliminary work will have commenced on these tasks prior to where they appear on the checklist. Obtaining financial approvals and commitments for equipment expenditures and personnel, contracting for equipment purchases, and delivery of equipment may all have very long lead times.

(13) Education and training. Describe the following:

- How officers, senior management, team members, and stakeholders will be educated about the FOQA program
- How pilots will be educated about the program
- How team members will be trained

(14) Data Analysis Procedures.

(a) Data Usage and Management. Describe the anticipated usage of FOQA data for safety, operations, training, and maintenance/engineering. Also describe the framework/technology architecture that will be used for managing the data.

(b) Flight Data Collection and Analysis. Describe the following:

- Procedures for the physical retrieval of data from aircraft

- Procedures for transferring data from airborne systems to the GDRAS, including media logistics and schedule for data retrieval
- Manual and automated methods to verify the quality and integrity of collected data, including any data quality standards
- Methods for logging and tracking airborne-collected data
- Procedures for handling invalid data and diagnosing airborne equipment problems
- Include a process flow diagram that shows the transit and direction of FOQA data through the system, including key systems, entities, and decision points

(c) Data Classifications and Definitions. Describe the following:

- Team member(s) involved in developing the event set
- Methods used to develop the event set
- Source documents
- Event categories, classifications, and severity levels

NOTE: Provide initial event set classifications by operational mode in Appendix B.

(d) Data Definition Maintenance.

1 Describe how event definitions will be validated, reviewed, and defined by the FMT. The following boilerplate can be used as a baseline, but should be modified, as appropriate, to the air carrier's specific situation:

NOTE: Documentation of event definition, validation, and modification will be maintained in the FOQA office and will be made available on request.

2 Also, describe the following:

- Procedures for validating, reviewing, and refining event definitions
- Procedures for creating and verifying new events
- Procedures for tracking modifications to event definitions

(e) Data Review and Evaluation. Describe the following:

- Procedures for periodic review of FOQA event data and trends, including personnel responsible and proposed schedule for review of data and trends
- Procedures for joint FAA/air carrier periodic review of aggregate trend data
- Procedures for notifying appropriate personnel (e.g., flightcrews, engineering/maintenance, and training) about events requiring immediate action
- Processes for maintaining event information for trend analysis, including databases and methods to have invalid events and associated data removed

- Procedures for generating periodic reports to convey FOQA trends and findings
- Methods for detecting and analyzing data trends
- Procedures for crew contact and follow-up
- Procedures for determining corrective actions to be taken for identified events and/or trends
- Methods for obtaining feedback/follow-up for resolution

(f) Data Trending and Record Retention. Describe the following:

- The data retention policy for FOQA data and trend analyses, which should include requirements by maintenance to satisfy manufacturer warranty claims
- Archiving procedures and process for archiving and retrieval of archived data

(15) Program and Data Documentation. Describe how this I&O Plan will be maintained, who the review process will involve, how changes will be tracked, and how revisions will be submitted to the FAA. With the approval of the POI, the air carrier may submit quarterly updates of the I&O Plan to reflect changes that were made during the preceding quarter.

(a) Operational Development. Describe the overall development of FOQA program documentation in support of the program in cases of personnel transitions or program changes.

(b) Information and Data Control. Describe how changes to the FOQA Program will be documented. This should include the following:

- A description of the identified use
- Analysis that was accomplished
- Specific corrective actions or recommendations taken or made
- Personnel who were notified
- Resolution of actions or recommendations

(c) I&O Plan Revision Control. A revision control methodology should be incorporated into the I&O plan. This revision control methodology should include controls for page revisions, deletions, or replacements. The I&O Plan should also stipulate that the operator will submit all revisions to the POI and AFS-230.

(16) FAA Access.

(a) Procedures for joint FAA/air carrier periodic reviews of FOQA program effectiveness.

(b) Procedures for the operator's handling and marking of company proprietary and confidential information submitted to the FAA.

(17) I&O Appendices.

(a) Appendix I (Pilot Association Agreement, if Applicable). If the implementation of the FOQA program depends on obtaining a signed pilot association agreement, insert the agreement or side letter in this section. The agreement should describe how the pilot association will be involved in the operation of the FOQA program.

(b) Appendix II (Event Parameters and Definitions). This appendix should contain list of events and minimum parameters to be monitored and analyzed in a basic FOQA program. When establishing a new FOQA program, the events and parameters in this appendix should provide a good starting point. Note that there are many more parameters available for recording on modern aircraft than are listed in the appendix. Although many such parameters are not used in FOQA event creation, they can be useful to develop a more complete understanding of the causes of events and for aircraft maintenance troubleshooting purposes. Following initial establishment and validation of its program, operators are encouraged to consider expanding upon the basic parameter list provided in this appendix. Ideally, the aircraft fleet initially involved in starting a FOQA program should have a data bus capable of supplying the parameters listed in this appendix and a means of capturing and recording those parameters. It is important to understand, however, that the list of available parameters on any given aircraft will be a result of those provided by the airframe manufacturer, ordered by the air carrier, or a combination of both.

1 Event Selection. Depending on the GDRAS used, selecting events to be included and analyzed can be simple or complex. Developing a list of events from scratch can be extremely time-consuming, particularly during event validation. GDRAS vendors can also create and deliver event sets, but this may entail considerable expense. If an event list is available from another carrier or the list contained in this appendix is adequate, then the event selection process will be relatively simple and much less expensive.

> **NOTE: The event list should be tailored to the specific air carrier and aircraft type. The parameters used to measure the event need to be recorded on that aircraft type. Next, the tolerances that trigger the events should be set to account for applicable federal regulations, aircraft limitations, and company policies and procedures. The FMT and FOQA analyst should work together to evaluate and adjust event triggers. Since maintenance will also be an important stakeholder, creating events that maintenance would be interested in analyzing would be advantageous.**

2 Event Standardization.

(aa) If an operator has multiple aircraft type or model variance within its fleet, attempting to standardize events within the GDRAS analysis function may be advantageous. Numerous events will be common to all types and models of aircraft in an air carrier's fleet (e.g., V_{MO}, M_{MO}, and V_{LE} exceedences). These "common" events can be monitored and analyzed across fleets. However, there will be differences in the triggering limits, which will

be dictated by an aircraft's specific operating limitations. Analysis of these events across fleet or model types must account for the difference in triggering.

(bb) To assist in standardization of the analysis, the events can be organized or grouped in different categories. One method of organizing the events could be by "phase of flight." Another method may be to use the sections in the operator's manuals where aircraft limitations or flight procedures are outlined or defined. Users should choose the method that best suits their needs.

(cc) The events may be categorized by the flight phase in which they are most likely to occur, although they may also occur in other phases. However, the flight phase is not used as a discriminator in the creation of these events. Each event is designed to work even if the software used does not use flight phase in its analysis process. The use of flight phase is a common method and may speed the processing of raw data.

(dd) Maintaining documentation of event definitions used in an operator's analysis may be useful. Documentation of the events can assist the operator in validating trend analysis and serves as a guide to program history as events change or are modified during the maturation of the program. Documentation could include the name for specific events, a description that clarifies what the event is designed to measure, suggested event-triggering conditions, the needed parameters to create the event, a possible way of defining the event, and explanatory notes or comments that go beyond the event description. In the event definition, user-defined variables that need to be extracted from Approved Flight Manual (AFM), Flight Operations Manual, Flight Standards/training guidance, or other applicable corporate guidance should also be included.

(ee) Some parameters used in events are derived, meaning they are not directly measured by sensors in the aircraft, but are calculated as part of the processing done by the analysis software. Height Above Takeoff/Touchdown (HAT) is a good example of this. Many events require an altitude component in relation to the airport elevation. This is most accurately done by using the elevation at takeoff or touchdown, calculating altitudes above this elevation, and then measuring actual aircraft performance at these points. There are many possible ways to calculate events, and those presented here may not be compatible with parameters available on a particular aircraft or the capabilities of particular analysis software. Maintaining documentation of events will assist the carrier in trend analysis and the development of events as the program matures. Appendix II of the example I&O plan in Appendix A of this AC contains a representative sample of event documentation.

CAUTION: Each air carrier should review all events to see that the limits defining each event account for applicable federal regulations, airplane flight manual limitations, and company policies and procedures.

(c) Appendix III (Glossary). Definitions of all acronyms used in the document should be included. The definitions should cover more than just what the acronym stands for, the reader should be able to understand what the acronym means. In constructing the glossary,

assume that the reader of the I&O Plan is unfamiliar with FOQA, as might be the case with senior management, union officers, legal staff, or local FAA representatives.

(d) Appendix IV (References). Include citations for all referenced documents including, but not limited to:

- Title 14 CFR Part 193, Protection of Voluntarily Submitted Information
- Title 14 CFR Part 13, Section 13.401, Flight Operational Quality Assurance Program
- AC 00-46 (as amended), Aviation Safety Reporting System (ASRS)
- AC 00-58 (as amended), Voluntary Disclosure Reporting Program
- AC 120-59 (as amended), Air Carrier Internal Evaluation Programs: Air Carrier Internal Evaluation-Model Program Guide
- AC 120-66 (as amended), Aviation Safety Action Program
- Flight Safety Foundation, FAA Contract Report, Air Carrier Voluntary Flight Operational Quality Assurance (FOQA) Program, 1992
- General Accounting Office, GAO/RCED-98-10, Aviation Safety—Efforts to Implement Flight Operational Quality Assurance Programs, December 1997

10. APPENDICES.

- Appendix A: Example of a FOQA Implementation and Operations Plan
- Appendix B: FOQA I&O Plan Checklist

11. ABBREVIATIONS

ABBREVIATIONS

Abbreviation	Term
AAC	Airline Administrative Control
AC	Advisory Circular
ACARS	Aircraft Communications Addressing and Reporting System
ACDF	Airline Common Data Format
ACMS	Aircraft Condition Monitoring System
ACSF	Airline Common Statistical Format
AEEC	Airlines Electronic Engineering Committee
AFE	Above Field Elevation
AFM	Approved Flight Manual
AFS	Aviation Flight Standards Service
AFS-230	Volunteer Safety Program Branch
ALPA	Air Line Pilots Association
AOC	Aircraft Operational Control
AQP	Advanced Qualification Program
ARC	Aviation Rulemaking Committee
ARINC	Aeronautical Radio Incorporated
ASAP	Aviation Safety Action Program
ASCII	American Standard Code for Informational Interchange
ASRS	Aviation Safety Reporting System

ABBREVIATIONS

Abbreviation	Term
ATC	Air Traffic Control
BASIS	British Airways Safety Information System
CAS	Computed Air Speed
CMO	Certificate Management Office
COTS	Commercial Off-The-Shelf
CSV	Comma Separated Value
CVR	Cockpit Voice Recorder
DAR	Digital ACMS Recorder
DAS	Designated Alteration Station
DAU	Data Acquisition Unit
DBMS	Database Management System
DFDAR	Digital Flight Data Acquisition Recorder
DFDAU	Digital Flight Data Acquisition Unit
DFDMU	Digital Flight Data Management Unit
DFDR	Digital Flight Data Recorder
DMU	Data Management Unit
EGT	Exhaust Gas Temperature
EGT	Exceedance Guidance Team
EMT	Event Monitoring Team
ERC	Event Review Committee
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
FDAU	Flight Data Acquisition Unit
FDR	Flight Data Recorder
FMT	FOQA Monitoring Team
FOD	Foreign Object Damage
FOIA	Freedom of Information Act
FOQA	Flight Operational Quality Assurance
FSDO	Flight Standards District Office
g	Gravity (G-Force)

ABBREVIATIONS

Abbreviation	Term
GB	Gigabyte
GDL	Ground Data Link
GDRAS	Ground Data Replay and Analysis System
GPWS	Ground Proximity Warning System
HAA	Height Above Airport
HAT	Height Above Takeoff/Touchdown
HQ	Headquarters
HTML	Hypertext Markup Language
I&O	Implementation and Operations
IT/IS	Information Technology/Information Systems
LAN	Local Area Network
LFL	Logical Frame Layout
LRU	Line Replaceable Unit
MB	Megabyte
MEL	Minimum Equipment List
M_{MO}	Maximum Mach Operating Speed
MTBF	Mean Time Between Failure
N_1	Low Pressure Compressor
N_2	High/Intermediate Pressure Compressor
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NTSB	National Transportation Safety Board
ODBC	Open Database Connectivity
OQAR	Optical Quick Access Recorder
Order 8400.10	Air Transportation Operation's Inspectors Handbook
PAI	Principal Avionics Inspector
PCMCIA	Personal Computer Memory Card International Association
PDF	Portable Document Format
PMI	Principal Maintenance Inspector
POI	Principal Operations Inspector
PPH	Pounds Per Hour
PPM	Partial Program Manager
PSI	Pounds Per Square Inch
QA	Quality Assurance
QAR	Quick Access Recorder
RA	Traffic Alert and Collision Avoidance System (TCAS) Resolution Advisories
RFP	Request for Proposal
ROM	Routine Operational Measurement
SRU	Shop Replaceable Unit
SSFDR	Solid State DFDR
STC	Supplemental Type Certificate

ABBREVIATIONS

Abbreviation	Term
TA	Traffic Alert and Collision Avoidance System (TCAS) Traffic Advisories
TC	Type Certificate
TCAS	Traffic Alert and Collision Avoidance System
TE	Triggered Event
V_1	Critical Engine Failure Speed
V_2	Takeoff Safety Speed
V_{LE}	Maximum Landing Gear Extend Speed
V_{MO}	Maximum Operating Limit Speed
V_{REF}	Reference Velocity
WAN	Wide Area Network
WDL	Wireless Data Link
14 CFR	Title 14 of the Code of Federal Regulations
49 U.S.C.	Title 49 of the United States Code

/s/ James J. Ballough
Director, Flight Standards Service

APPENDIX A. EXAMPLE OF A FOQA IMPLEMENTATION AND OPERATIONS PLAN

This section contains an example of an Implementation and Operations (I&O) Plan. Section numbering and section names in this example are suggestions only. They represent the topics that should be included in the I&O Plan. The text of this example is boilerplate content only. It should be used as a baseline and modified accordingly. Instances of [Airline Name] should be replaced with the name of the actual air carrier or operator. Name references to particular equipment should also be modified appropriately.

1. BACKGROUND

Flight Operational Quality Assurance (FOQA) is defined as a program to improve flight safety by providing more information about, and greater insight into, the total flight operations environment through selective automated recording and analysis of data generated during flight operations. Analysis of FOQA data can reveal situations that require improved operating, training, and maintenance procedures, practices, equipment, and infrastructure.

In support of the public safety objective, the FAA has publicly endorsed the development and implementation of voluntary FOQA programs as a tool for continuously monitoring and evaluating operational practices and procedures. In Advisory Circular (AC) 120-59 (as amended), Air Carrier Internal Evaluation Programs, the FAA states, “public safety is enhanced if deficiencies are identified and immediately corrected when they are discovered by the certificate holder rather than when they are discovered by the FAA.” FOQA programs can provide the quantitative and objective information needed to identify deficiencies during the certificate holder’s internal audit and evaluation process.

FOQA programs are based on the premise that air carriers have primary responsibility for continuously monitoring and ensuring that their operations are safe and in compliance with their operating standards and the regulations. A FOQA program will assist [Airline Name] in identifying and addressing operational deficiencies and trends that are not generally detectable with other procedures. Additionally, analysis of some FOQA program data may contribute to improved safety and efficiency in the design and operations of air traffic control (ATC) systems, aircraft, and airports. Many potential applications of FOQA data have been identified to date. These applications aim to improve safety, evaluate and enhance training practices, revise operating procedures, assist aircraft engineering programs, improve maintenance efficiency, and assist manufacturers in aircraft design and modification.

Several foreign air carriers have successfully implemented FOQA-type programs that use flight-recorded data to improve operational safety and performance. Lengthy track records in effective usage of this information (over 20 years in the cases of British Airways and Scandinavian Airlines System) have provided foreign carriers with clear evidence that FOQA program data represent a source of valuable information that, when used appropriately, can contribute greatly

to aviation safety. Airlines that currently have FOQA-type programs agree that the insights derived from these programs have prevented serious incidents and accidents and have led to improved operating efficiencies.

FOQA information can be included in the voluntary audits and evaluations described in AC 120-59 to determine the causes of deficiencies and to suggest enhancements to operating practices. Title 14 of the Code of Federal Regulations (14 CFR) part 13 states the conditions under which information obtained from an approved voluntary FOQA program will not be used in legal enforcement actions against an operator or its employees. In addition, 14 CFR part 193 contains provisions for certain protection from public disclosure of voluntarily submitted safety related information, when such information has been designated by an FAA order as protected from disclosure under that part.

2. INTRODUCTION

The I&O Plan presented in this document specifies the organization, technology, policies, procedures, and operational processes used in the [Airline Name] FOQA program.

The core objective and intent of the [Airline Name] FOQA program is to facilitate the free flow of safety information. The FOQA program will:

1. Collect operational flight data.
2. Develop methods to analyze the collected flight data, such as triggered events and routine operational measurements.
3. Establish procedures for comparing the collected data with established procedures and standards and the use of analyzed data in formal awareness and feedback programs to enhance safety in the following areas:

    a. Flight procedures
    b. Flight training procedures and qualification standards
    c. Crew performance in all phases of flight
    d. Air traffic control procedures
    e. Aircraft maintenance and engineering programs
    f. Aircraft and airport design and maintenance

4. Perform trend analyses of FOQA data to identify potential problem areas, evaluate corrective actions, and measure performance over time.

3. FOQA PROGRAM STAKEHOLDERS

The FOQA program will provide large amounts of previously unavailable data to significantly improve the problem definition process and allow assessment and resolution of systemic safety and efficiency issues. Beneficiaries or stakeholders within [Airline Name] include, but are not limited to, the following:

1. Flight Safety
2. Flight Training and Standards
3. Flight Operations
4. Maintenance and Engineering
5. Operations Control and Dispatch
6. Pilot Association

Cooperation with stakeholders outside of [Airline Name] will also benefit the [Airline Name] FOQA Program. These stakeholders may include, but are not limited to, the following:

1. FAA
2. NASA
3. ATC
4. Aircraft manufacturers
5. Other industry safety groups.

4. PROTECTIVE PROVISIONS, PILOT ASSOCIATION AGREEMENT (IF APPLICABLE), AND CORPORATE POLICY STATEMENT

Key to the success of the [Airline Name] are specific protective provisions that will protect both [Airline Name] and its employees from FAA certificate action or civil penalties as a result of information and data that are collected and analyzed by the FOQA program. In establishing these protective provisions, [Airline Name] has pursued the following distinct courses of action. [Airline Name] has established a corporate policy endorsed by senior management providing that no pilot shall ever be subject to disciplinary or other pejorative action by [Airline Name] from data or information that is produced by the FOQA program, and [Airline Name] has formalized that policy in a FOQA agreement that has been negotiated and accepted by the [Airline Name] Pilot Association [If applicable]. [Airline Name] will establish procedures for sharing of FOQA trend analysis and other pertinent de-identified data with the FAA, as specified in this I&O Plan. These actions are intended to create a framework of cooperation between the Pilot Association [if applicable], the FAA, and [Airline Name] that will permit the most effective use and analysis of FOQA data.

5. DATA PROTECTIVE PROVISIONS AND SECURITY

General

Key areas that were considered in developing the protective provisions for the FOQA program include:

1. Confidentiality—Provides that the identity of individual crewmembers cannot be associated with any FOQA data, except for the purposes of crew-contact as provided for in this I&O Plan.
1. Anonymity—Provides that any identification of airline flight and/or flightcrews with specific FOQA flight data necessary during an analysis is eliminated permanently at the earliest possible time and in accordance with the pilot association agreement.
2. Data access and control—Identifies data that require protection and assigns overall responsibility for data protection. In addition, data access and control provides guidelines and procedures to protect data; provides authorized access to data, data processing and storage locations; provides authorized access to reports and other data outputs, and requires the destruction of data after the retention period has expired.
3. FOQA facilities—Provides secure, controlled access facilities for all systems, offices, equipment, workstations, computers, and peripherals associated with the FOQA program. Additionally, secure systems will also be provided for storage of all FOQA-related materials, including paper, media, and backup devices.

FAA FOQA Enforcement Policy

The [Airline Name] FOQA Program incorporates the protections codified in the FOQA Rule, part 13, section 13.401, which states that except for deliberate or criminal acts, the Administrator will not use [Airline Name]'s FOQA data or aggregate FOQA data in an enforcement action against [Airline Name] or its employees when such FOQA data or aggregate FOQA data is obtained from a FOQA program that is approved by the Administrator.

Legislation

In the Federal Aviation Reauthorization Act of 1996, Congress included specific provisions pertinent to the public release of safety-related information that was voluntarily submitted to the FAA. Specifically, the Reauthorization Act added a new section—49 U.S.C. § 40123—to the FAA's governing statute to protect voluntarily submitted information from disclosure if the Administrator finds that (1) the disclosure of the information would inhibit the voluntary provision of that type of information and that the receipt of that type of information aids in fulfilling the Administrator's safety and security responsibilities; and (2) withholding such information from disclosure would be consistent with the Administrator's safety and security responsibilities.

The Administrator has issued a rule, 14 CFR part 193, which accomplishes the purposes set forth in this legislation. This rule describes the provisions for designating information that would be protected. Information collected under an FAA-approved voluntary FOQA program has been designated by FAA Order 8000.81 as coming under the provisions of this rule.

6. FOQA PROGRAM COMPONENTS

The principal components that will compose the FOQA program at [Airline Name] are described below and are illustrated in Figure 1.

Aircraft Fleet

The [Aircraft Model/Type] aircraft will be the launch aircraft for the [Airline Name] FOQA program. Twenty of these aircraft will be used to initiate the FOQA program. These aircraft will be equipped with the [Product Name] Flight Data Acquisition Management System on a schedule established by [Airline Name] Maintenance and Engineering. Additional aircraft will be added to the FOQA program pending approval from the FOQA Monitoring Team (FMT) as sufficient experience is gained on data acquisition and analysis.

Airborne Data Acquisition System

[Airline Name] will be utilizing the [Product Name] Quick Access Recorder. This recorder collects continuous flight data parameters and stores this information on the [Specify Storage Media, e.g., PCMCIA card].

Data Download and Airborne System Maintenance and Support

The Flight Data Acquisition Management System and Quick Access Recorder will be maintained per the FAA-approved [Airline Name] aircraft maintenance program. Avionics Engineering will be responsible for managing this process. The [Storage Media] will be downloaded [specify frequency] by means of [Specify Downloading Methodology, e.g., removal and replacement of PCMCIA cards]. The FOQA Manager will be responsible for coordinating maintenance issues with [Airline Name] Avionics Engineering regarding data download and any Flight Data Acquisition Management System problems discovered during data analysis.

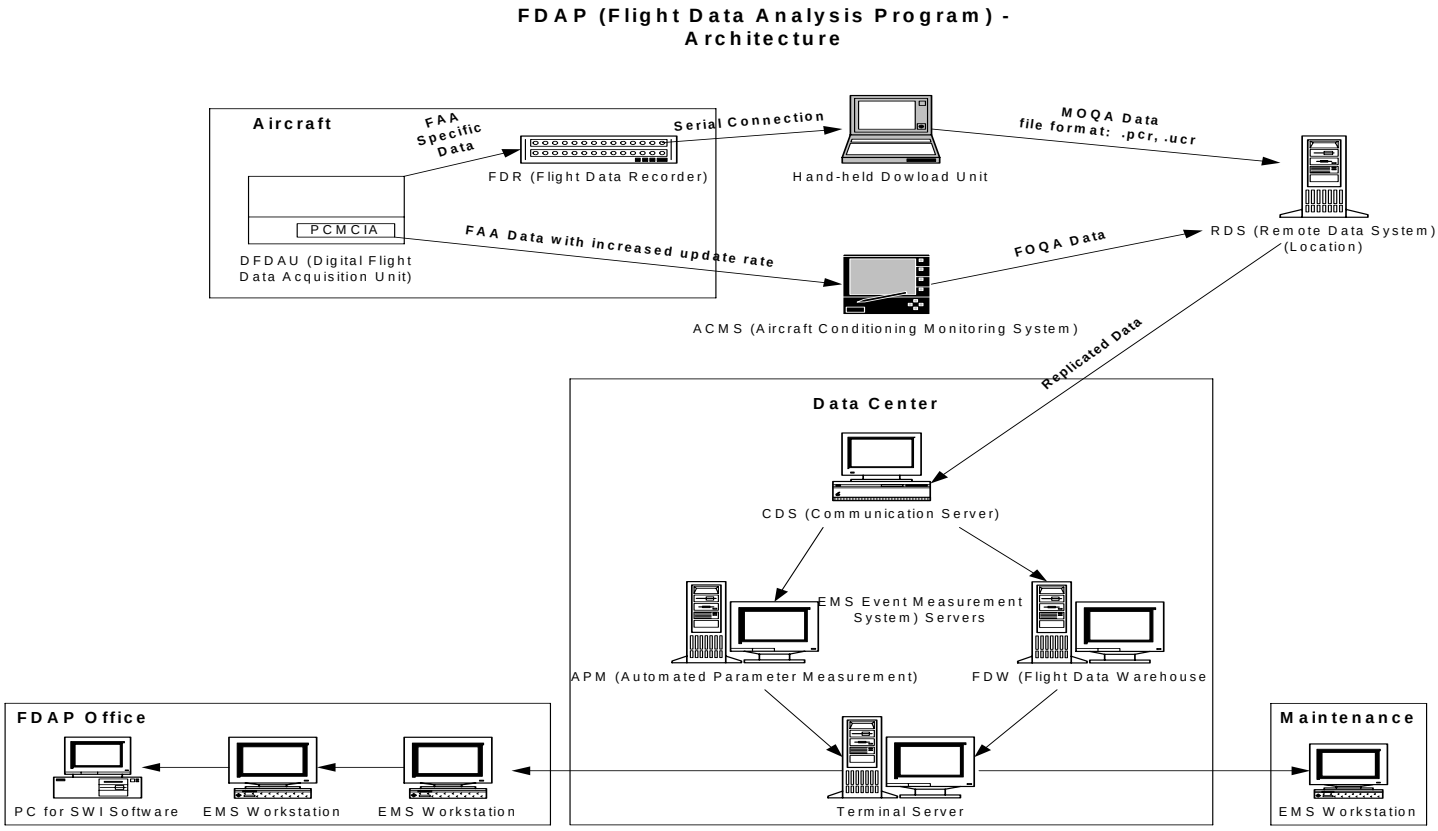
Ground Data Replay and Analysis System (GDRAS)

The GDRAS is designed to process and analyze data from all FOQA-equipped aircraft in the [Airline Name] fleet. It will apply protective mechanisms, including removal of identifying information in accordance with the provisions described in the previous sections. The GDRAS will also include trend analysis capabilities to explore historical data and analyze similar event data from past flights to determine if any patterns exist or if further study is warranted.

Other Equipment

[Airline Name] will be investigating several other components to incorporate into the FOQA program as the technology becomes available and requirements are identified and refined. The addition of these components is subject to approval by the FMT.

FIGURE 1. FOQA SYSTEM ARCHITECTURE



Equipment Upgrade, Modification, or Replacement

The equipment used initially in the FOQA program, including airborne and ground systems, may be upgraded, modified, or replaced with equipment from the same or a different vendor that will provide comparable or superior functionality to the equipment described in this section. Documentation of such changes in airborne or ground systems will be maintained in the FOQA office and will be made available to the FAA on request. This I&O plan will be revised and submitted to the FAA whenever changes to airborne or ground-based systems are made.

7. FOQA ORGANIZATION

Organizational Structure

The [Airline Name] FOQA organization structure is illustrated in Figure 2:

Personnel
The FOQA Program will consist of the following personnel:

1. FOQA Steering Committee

The FOQA Steering Committee is chaired by the Director of Flight Safety and serves as the advisory group for the FOQA program. Members of this committee include the Vice President of Flight Operations, the Pilot Association Air Safety Chairman, Director of Maintenance, and the Director of Flight Training.

2. FOQA Program Manager

The FOQA Program Manager is responsible for the overall management, administration, security, and maintenance of the FOQA program. These duties include interfacing with the FAA, vendors, and other entities. The program manager's primary duties include addressing the FOQA data needs and reporting requirements of Flight Operations, Training, and Safety departments (and any other stakeholders).

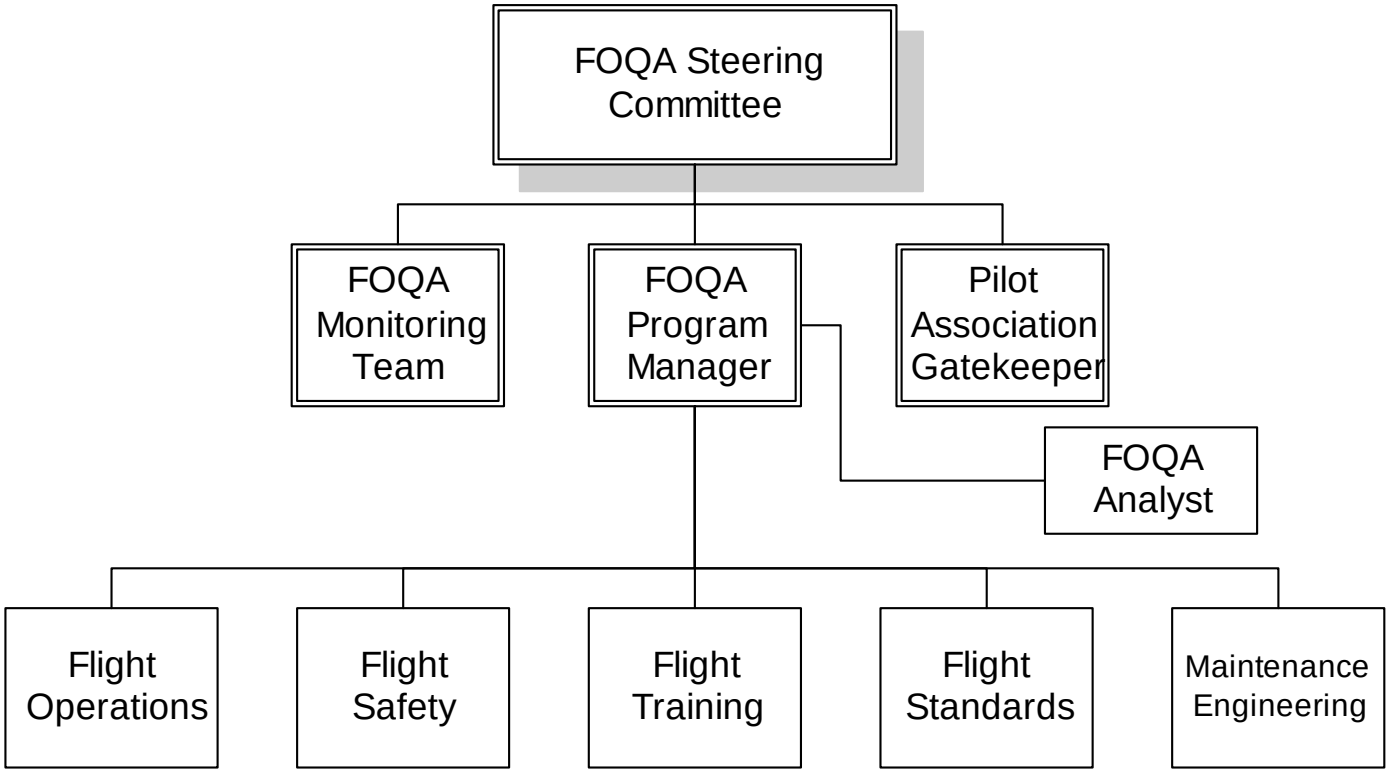
3. FMT

The FMT is chaired by the FOQA Program Manager. The FMT meets once per month to conduct reviews of aggregate trend data to identify recommendations to stakeholders.

4. FOQA Gatekeeper (s) *[or Pilot Association Gatekeeper(s), if applicable]*

The FOQA Gatekeeper(s) [*or Pilot Association Gatekeeper(s), if applicable*] will have access to identifying data, *[in accordance with the Pilot Association agreement, if applicable]*. The gatekeeper will manage password selection and maintenance, control access to identifying data, and perform any necessary crew contacts.

FIGURE 2. FOQA ORGANIZATIONAL STRUCTURE



5. FOQA Analyst

The FOQA analyst will assist the FOQA Manager and is responsible for the day-to-day operations of the FOQA GDRAS, generating GDRAS-related reports, and assisting the FMT in reviewing and analyzing data.

8. FOQA PROGRAM IMPLEMENTATION

Program Startup Criteria

The startup criteria for the program will be defined by the FMT and will include, but not be limited to:

- Completion of installation and testing of airborne equipment and GDRAS
- Successful testing of the complete data analysis system
- Validation of flight parameters
- Validation of data collection system from the recording media to the GDRAS
- Implementation of all data de-identification, protection, security, and retention procedures
- Education of pilots and stakeholders
- Training for FOQA team members
- Specification and validation of event and definitions and operational measurements
- Implementation of procedures to detect and analyze triggered events and operational measurements
- Implementation of procedures to identify and track corrective actions

The FMT will make the decision regarding when the established criteria are met. Once the FMT determines a formal start date, any data collected before the formal start date must be re-analyzed prior to retention in the FOQA database in order to assure that all reported events are valid.

FOQA Implementation Schedule

Table 1 below identifies the FOQA implementation schedule, timelines, and milestones.

TABLE 1. FOQA TIMELINE

Month	Task	
Month 1	1.	Coordinate airborne technology requirements, particularly data maps and LFLs, with maintenance/engineering.
	2.	Acquire airborne data acquisition/recording equipment for aircraft.
	3.	Coordinate with maintenance/engineering for installation of equipment in aircraft.
	4.	Evaluate GDRAS products, including on-site system trials.
	5.	Coordinate with corporate information technology personnel for integration

TABLE 1. FOQA TIMELINE

Month	Task	
		with or installation of any communication networks, compliance with computer-related standards, review of vendor maintenance contracts, and any other assistance required.
	6.	Begin education program for company officers and management personnel regarding FOQA benefits.
	7.	Begin periodic FMT meetings to assist in GDRAS evaluation.
	8.	Meet with stakeholders to review current requirements and to define any additional requirements.
	9.	Generate pilot education materials in conjunction with the pilot association.
	10.	Refine program start-up criteria.
Month 2	11.	Convene FMT to review and refine event definitions.
	12.	Continue development of pilot educational materials.
	13.	Develop equipment acceptance criteria with FMT, FOQA Analyst, and associated vendor(s).
	14.	Select and acquire GDRAS hardware, software, and peripherals and coordinate product support and any integration with corporate communications infrastructure.
	15.	Coordinate with vendors and maintenance/engineering to determine procedures and resources required for retrieving airborne data and transferring to FOQA facility.
	16.	Establish interface with maintenance/engineering for addressing FOQA issues.
	17.	Coordinate with GDRAS vendor to define periodic reporting capabilities and formats.
	18.	Refine methods for retrieving data collected on aircraft.
	19.	Refine I&O Plan and submit to AFS-230 and POI for approval.
	20.	Develop and issue maintenance work cards/bulletins for data retrieval procedures.
	21.	Develop methods for tracking receipt and auditing quality of aircraft-recorded data.
	22.	Define data backup, retention, and archiving policies.
	23.	Develop guidelines for crew contact.
Month 3	24.	Acquire/install computer, communications infrastructure, and operating system for GDRAS and other ground and communication equipment.
	25.	Integrate GDRAS with corporate communications infrastructure as appropriate.
	26.	Obtain and attend GDRAS vendor training for FOQA team members.
	27.	Develop and implement security policy and procedures.
	28.	Continue pilot education process.

TABLE 1. FOQA TIMELINE		
Month	**Task**	
	29.	Evaluate GDRAS reporting capabilities using initial data and coordinate with GDRAS vendor to obtain modifications, if required.
	30.	Implement maintenance procedures for routine retrieval of data from aircraft.
	31.	Analyze and validate initial data to confirm proper operation of airborne equipment and GDRAS.
	32.	Establish vendor problem reporting and tracking system for FOQA equipment and software.
Month 4	33.	Formalize and document procedures for event review, evaluation, and follow-up.
	34.	Generate stakeholder education materials.
	35.	Educate POI regarding the specifics of the FOQA program.
	36.	Continue pilot education process.
	37.	Refine and test parameter conversions.
	38.	Refine and test event definitions.
	39.	Review equipment acceptance criteria and resolve outstanding issues with vendors.
	40.	Verify GDRAS and system components compliance with data security and de-identification procedures.
Month 5	41.	Continue development of parameter specifications.
	42.	Continue development of event definitions.
	43.	Define and document procedures for transferring to maintenance/engineering any maintenance-related events captured by FOQA data.
	44.	Continue pilot education process.
	45.	Modify the I&O Plan as appropriate and submit revisions to the FAA.
	46.	Determine and review format for trend and summary reports.
	47.	Establish procedures to validate data and events and in the review and evaluation of trend and summary reports.
	48.	Establish procedures for defining and implementing corrective actions, and tracking their efficacy.
Month 6	49.	Test all aspects of the data collection, transmittal, and analysis system.
	50.	Continue data validation.
	51.	Implement data retention policies.
	52.	Review start-up criteria.
	53.	Implement procedures for system and data back-up and archiving.
	54.	Finalize trend analysis procedures.
	55.	Define schedule and milestones for formal start-up and entry into continuing operations.
	56.	Develop procedures for maintaining I&O plan revisions.
	57.	Implement stakeholder feedback mechanisms.

TABLE 1. FOQA TIMELINE	
Month	**Task**
	58. Review FOQA data gathered prior to program's official launch and determine how the data will be used based on the [Airline Name's] data retention policy. 59. Continue pilot education process.

9. EDUCATION AND TRAINING

Pilot education about the [Airline Name] FOQA Program will be accomplished through quarterly Flight Operations publications, the Pilot Association publications, and a secure bulletin board at each crew base. These bulletin boards will highlight FOQA issues, including featured events or issues.

Each of the FOQA stakeholders will be provided with information about the FOQA program through reports generated from periodic FOQA meetings, bulletin boards, and an initial FOQA overview report that will be developed and distributed during the initial implementation of the FOQA program.

All FOQA personnel will receive training on the GDRAS software. Additionally, FOQA stakeholders will visit other operators with established FOQA programs. Other training will be provided as new hardware and/or software is added to the program.

10. DATA ANALYSIS PROCEDURES

Data Usage and Management

All processed FOQA data will be maintained by the GDRAS subject to periodic deletion as determined by the FOQA Steering Committee and in accordance with the [Airline Name] record retention policies.

The FMT will be responsible for developing reports summarizing the information obtained through the FOQA Program. The reports will include summaries of the most recent information obtained through the FOQA Program as well as trend information to demonstrate the effectiveness of prior corrective actions. These reports will be distributed to Flight Operations, Flight Training, Flight Safety, Maintenance Engineering, and other involved stakeholders on a regular basis. The FMT will solicit recommendations from the recipients of the reports in order to improve their usefulness as the program proceeds.

Flight Data Collection and Analysis

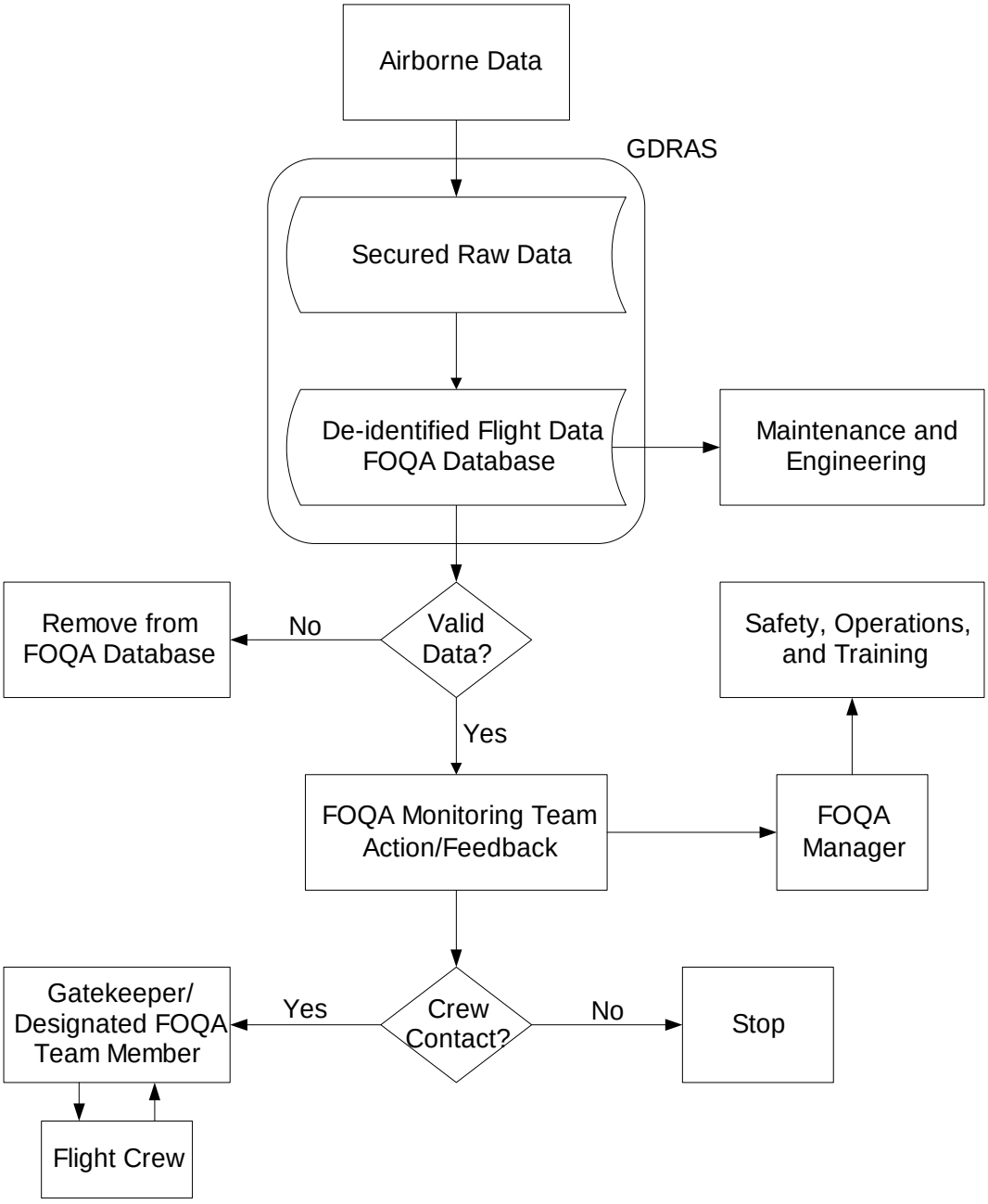
The manner in which FOQA data is processed is illustrated in Figure 3. Maintenance Engineering retrieves data from the aircraft and forwards it to the FOQA office. The ground

analysis station will process the recorded flight data. Provisions for security and tracking of the media will be established through coordination between the FOQA Program Manager and the Maintenance Engineering.

Flight data will be processed by the FOQA Analyst to determine what occurred and whether the recorded information was legitimate. A preliminary analysis will use the GDRAS to interpret identified events or trends and determine whether the information was valid or invalid because of bad data, a faulty sensor, or some other invalidating factor. In the event that the data reveal a situation of immediate concern to Maintenance Engineering, the FOQA Program Manager will notify that department.

NOTE: Preliminary review of the data to assess validity must be completed within 7 business days from the time the data is received at the FOQA office. After 7 days, the data is permanently de-identified per FMT procedures and the Pilot Association agreement preventing the ability to contact flight crewmembers, if needed. Further analysis of the data received is accomplished in relation to existing aggregate information within the FOQA Program. Program trend reports of the aggregate data are developed by the FMT on a regular basis for presentation to stakeholders for use in developing corrective actions or for monitoring of operational issues.

FIGURE 3. FOQA DATA PROCESSING



Data Classifications and Definitions

Parameters and measurements used in the [Airline Name] FOQA program are contained in Appendix II of this I&O Plan. The definitions will be programmed into the GDRAS to measure events and/or monitor trends. The performance limits that define these definitions will be continually reviewed by the FMT to determine they are consistent with the FOQA program goals, applicable publications, and guidance materials, which may include, but are not limited to, the following:

- Flight Operations Manual (FOM)
- Quick Reference Handbook (QRH)
- [Airline Name] flight training materials
- Approved Flight Manual (AFM)
- Manufacturer Maintenance Manuals

The event set for the [Airline Name] FOQA Program is contained in Appendix II. This event set will be modified as deemed appropriate by the FMT and additional event sets will be defined as needed. The FOQA Program Manager will be responsible for maintaining the event sets and coordinating with the FMT.

Data Definition Maintenance

The procedures for validating, reviewing, and defining event and trend definitions will be established by the FMT and they will determine whether the information is valid and reflects [Airline Name's] qualification and performance standards, training practices, and aircraft performance limits. All changes in the event and trend definitions will be logged and the FOQA Program Manager will maintain the records.

Data Review and Evaluation

All data recorded by the [Airline Name] FOQA Program will be evaluated by the FMT on a periodic basis as determined by the FOQA Program Manager. FOQA data should be evaluated to determine if the program is accurately monitoring collected information for events and trends. The review and evaluation of the measurements, profiles, events, and trends used in the [Airline Name] FOQA Program should reflect changes, updates, or enhancements to policy and procedures within all stakeholders' departments. Consideration should also be given to any changes, updates, or enhancements to policies and procedures within the FAA and industry.

Data Trending and Record Retention

De-identified flight data stored in the GDRAS will be periodically deleted as determined by the FOQA Steering Committee. Trend data will be maintained for a period of time as specified by the FMT in consultation with the FOQA Steering Committee. Maintenance Engineering shall retain the data as long as necessary to satisfy manufacture's warranties.

11. PROGRAM AND DATA DOCUMENTATION

Operational Development

The FOQA Program Manager will develop appropriate documentation for support of the FOQA operation. This documentation will be used to provide routine support for the process and facilitate any personnel transitions that may occur during the program.

Information and Data Control

The FOQA Program Manager will maintain a history of the information used in the FOQA program. When a FOQA or safety issue is identified, a log will be maintained to provide a reference document. This document will provide a way to track how [Airline Name] addresses trends revealed by analysis of the FOQA data. This will include:

- A description of the identified issue
- Analysis that was accomplished
- Specific corrective actions or recommendations taken or made
- Personnel who were notified (e.g., flightcrews [de-identified], Engineering Maintenance, Flight Operations, Flight Training, Flight Safety)
- Resolution of actions or recommendations

The log will be used to generate a summary report for presentation to the FOQA Steering Committee and senior management. This log will be maintained in the FOQA office in a secure place. The FOQA Steering Committee will establish the retention period for this log.

I&O Plan Revision Control

Standard revision control methodology and a distribution list will be established for this I&O Plan. A revision control page that identifies the pages to be added, removed, and/or replaced, will be submitted with any revisions. Each revised page will indicate the page number and date. Revisions to the I&O plan will be provided as necessary and appropriate. All revisions to the I&O plan, including event definitions, will be submitted to the [Airline Name] FAA POI and to FAA AFS-230.

12. FAA ACCESS

The [Airline Name] FAA POI (and/or Aircrew Program Managers [APMs]) and PMI (and/or Partial Program Managers [PPMs]) shall be permitted free and open access to de-identified aggregate FOQA data, including fleet-specific trend analysis information. This review will include a quarterly update of FOQA trend information to [Airline Name]'s FAA personnel. Any FOQA data or information shared with the FAA shall be protected from use by the FAA for enforcement purposes in accordance with14 C.F.R. section 13.401 and shall be protected from public disclosure in accordance with part 193 and FAA Order 8000.81. Any de-identified FOQA data or aggregate FOQA data that leaves [Airline Name]'s property will be clearly labeled as follows: "WARNING: This FOQA information is protected from disclosure under 49

U.S.C. 40123 and 14 CFR part 193. This information may be released only with the written permission of the Federal Aviation Administration Associate Administrator for Regulation and Certification." Airline identity and other information that could be employed to derive airline identity will be removed from any FOQA aggregate data submissions which [Airline Name] provides to the FAA in compliance with section 13.401, unless [Airline Name] elects to include that information. In the event that [Airline Name] chooses to allow FOQA data or aggregate FOQA data that includes airline identity information to be removed from [Airline Name]'s property, all such data will be labeled as the confidential and proprietary property of [Airline Name], in addition to the preceding warning.

In accordance with the FOQA Aviation Rulemaking Committee (ARC) recommendations that have been accepted by the FAA, [Airline Name] will participate in industry information sharing activities for FAA-approved FOQA programs. All information included in any industry sharing activity or any request for information will be reviewed and approved by [Airline Name] before release by [Airline Name]. The information released will be considered [Airline Name] proprietary information and will be de-identified so that specific flight information is not included. To the extent possible, the information released will be de-identified to limit the references that identify it as [Airline Name] information. In addition, at such time as the FAA provides guidance regarding future requirements for compliance with part 13, section 13.401(d), [Airline Name] will review those requirements to determine whether to continue its voluntary participation in an approved FOQA program. If the decision is made to continue with the program, this I&O Plan will be revised accordingly.

APPENDICES

APPENDIX I. PILOT ASSOCIATION AGREEMENT

Insert Pilot Association Agreement (if applicable).

APPENDIX II. EVENT PARAMETERS AND DEFINITIONS

Event Name	Event Description	Parameters and Basic Event Definition	Notes
Excessive Power on the Ground	An event designed to measure high power settings on the ground that could result in injury to personnel or damage to equipment.	Air/Ground Switch, Ground Speed, N_1 Air/Ground = Ground, Ground Speed < x knots, N_1 > x% for x seconds	This event would also be used in the After Landing phase.
Excessive EGT – Start	An event designed to detect EGT in excess of flight manual limits during engine start.	Air/Ground Switch, EGT Air/Ground = Ground, EGT > x degrees for x seconds	This event could be included in other flight phases, if desired, although EGT exceedances other than on engine start are extremely rare.
Engine Overtemp	An event to detect engine EGT in excess of in-flight limits.	EGT EGT > x degree for x seconds	
Takeoff Warning	An event that would trigger on the same conditions that set off the takeoff warning horn.	Air/Ground Switch, Flap Position, Speed Brake Position, Throttle Position (or possibly N_1) Air/Ground = Ground, Flaps < approved takeoff flaps, Flaps > approved takeoff flaps, Speed Brake > 0, Throttle Position > x	On some newer aircraft, Takeoff Warning is a discrete parameter. Trim Setting is normally a component that triggers Takeoff Warning, but it is sometimes not a recorded parameter.

Event Name	Event Description	Parameters and Basic Event Definition	Notes
Rejected Takeoff – Low Speed	An event to detect that the takeoff roll has begun and the takeoff has been abandoned below a pre-determined speed.	CAS, N_1 CAS > x knots, CAS < x knots, N_1 > x% for x seconds, followed by N_1 < x% within 60 seconds	Low end CAS should be greater than any anticipated taxi speed. 100 knots is generally accepted as the cutoff between high- and low-speed aborts.
Rejected Takeoff – High Speed	An event to detect that the takeoff roll has begun and the takeoff has been abandoned above a pre-determined speed.	CAS, Gross Weight, N_1 CAS > x knots, CAS < V_1, N_1 > x% for x seconds, followed by N_1 < x% within 60 seconds	If N_1 is not an available parameter, V_2 or Liftoff Speed may be used as the upper limit.
Liftoff Speed High	An event to determine the relationship of the actual liftoff speed to V_2.	Air/Ground Switch, Gross Weight, CAS Air/Ground = Ground, CAS > V_2 + x knots for x seconds	V_2 is calculated based on Gross Weight.
Liftoff Speed Low	An event to determine the relationship of the actual liftoff speed to V_2.	Air/Ground Switch, Gross Weight, CAS Air Ground = Air, CAS < V_2 – x knots for x seconds	V_2 is calculated based on Gross Weight.
Pitch High at Takeoff	An event that measures pitch at takeoff in relation to the angle required to strike the tail of the aircraft.	Air/Ground Switch, Pitch Air/Ground = Ground, Pitch > x degrees	Limits are based on the angle required for the tail cone to contact the ground with struts compressed.
Takeoff Climb Speed High	An event to detect climb speed higher than desired during the Takeoff Phase of flight.	CAS, Gross Weight, HAT HAT > x feet, HAA < x feet, CAS > V_2 + x knots	Altitude ranges should be used to accommodate different desired climb speeds in those ranges. In certain ranges, the climb airspeed will be based on V_2.

Event Name	Event Description	Parameters and Basic Event Definition	Notes
Takeoff Climb Speed Low	An event to detect climb speed lower than desired during the Takeoff Phase of flight.	CAS, Gross Weight, HAT HAT > x feet, HAA < x feet, CAS < V_2 – x knots	Altitude ranges should be used to accommodate different desired climb speeds in those ranges.
Early Flap Retraction	An event to detect any flap movement from the takeoff position prior to reaching the altitude at which flap retraction should begin.	HAT, Flap Position HAT< x feet, Flap Position < Flap Position in the preceding sample	
Excessive Bank Angle at Takeoff	An event to detect when the bank angle exceeds the maximum allowable bank angle.	HAT, Roll HAT > x feet, HAT < x feet, Roll > x degrees for x seconds	Altitude ranges should subdivide this event with different bank limitations in each range.
Turbulence – Flaps Extended	An event to detect excessive G-forces prior to flap retraction.	Vertical Acceleration, Flap Position Flaps > 0, Vertical Acceleration > x g for x seconds	1.5 g is a generally accepted limit for this type of event. This event can also occur during the Approach phase of flight.
Slow Initial Climb	An event to detect a slower than normal climb to the clean-up altitude.	Air/Ground Switch, HAT Time > x seconds from Air/ Ground = Air to HAT = x feet	HAT would be based on clean-up altitude.
Abnormal Flap Retraction	An event to detect slow flap movement between any selected flap position and the previously selected flap position.	Flap Position, Flap Handle Position Time from Flap Handle Position = x degrees until Flap Position = x degrees > x seconds	This event will also detect stuck flaps.

Event Name	Event Description	Parameters and Basic Event Definition	Notes
Height Loss in Climb	An event to detect an interruption in climb in which altitude is lost before the climb resumes.	HAT HAT < than x feet, HAT < HAT in preceding sample	This event might benefit from subdivision in altitude ranges.
Climb Speed High	An event to detect climb speed higher than 250 knots below 10,000 feet.	Altitude, CAS Altitude < 10,000 feet, CAS > 250 knots for x seconds	
Flap Limit Altitude	An event to detect when flaps are operated above the maximum allowable altitude for flap operation.	Altitude, Flaps Position Altitude > x feet, Flap Position > 0 degrees	Altitude would correspond to the maximum operating altitude for flaps extended.
Turbulence – Flaps Up	An event to detect excessive G-force while airborne, indicating an encounter with turbulent conditions.	Air/Ground Switch, Vertical Acceleration Air/Ground = Air, Vertical Acceleration > x g, Vertical Acceleration > -x g	This event will measure turbulence from all sources (convective activity, clear air, or wake induced). Vertical Acceleration limits of +1.5 g to – 0.5 g might be considered.
Holding/ Excess Radar Vectoring	An event to detect excessive delays caused by ATC holding/radar vectoring.	Heading Cumulative Time > x, Heading = Heading + 359 degrees, Time < 600 seconds	The start point for this event would occur after the first 360-degree turn and end 600 seconds after the last turn. The event would trigger when the cumulative time exceeds a user-defined value.

Event Name	Event Description	Parameters and Basic Event Definition	Notes
Operating Ceiling Exceeded	An event to detect operation of the aircraft above its certificated maximum operating altitude.	Altitude Altitude > x feet for x seconds	
Landing Gear Down Speed Exceeded (Mach)	The indicated mach number of the aircraft exceeds the maximum allowable mach for operation with the landing gear in the down position.	Mach, Landing Gear Position Landing Gear Position = Down, Mach > x mach number for x seconds	Limiting mach number would be $M_{LE.}$
M_{MO} Exceeded	An event to detect occurrences of the indicated mach number of the aircraft in excess of the maximum allowable mach number.	Mach Mach > x mach number for x seconds	
V_{MO} Exceeded	An event to detect occurrences of the indicated airspeed of the aircraft in excess of the maximum allowable airspeed.	CAS CAS > x knots for x seconds	
High Descent Rate	An event that measures unusually high rates of descent.	Inertial Vertical Speed, HAT, Altitude Descent rate > x fpm for x seconds, HAT/Altitude > x, HAT/Altitude < x	This event can be subdivided into altitude ranges to capture abnormal rates of descent that might be caused by different ATC facilities.
Excessive Speedbrake Usage	An event that measures the amount of time the speedbrake is used during descent.	Speed Brake Handle, Air/Ground Switch Air/Ground = Air, Cumulative Time Speed Brake > 0	This event is useful in evaluating arrival procedures into specific airports.

Event Name	Event Description	Parameters and Basic Event Definition	Notes
Approach Speed High	An event to detect operation on approach that is in excess of its computed final approach speed.	Gross Weight, CAS, HAT, Flaps HAT > 1,000 feet, HAT < 3,000 feet, CAS > V_{FE} – x knots HAT < 1,000 feet, CAS > V_{REF} + x knots	This event should be broken down into altitude bands. Suggested breakdown would be HAT > 1,000 feet, HAT 500 – 1,000 feet, HAT 50 – 500 feet, HAT < 50 feet. Speeds above 1,000 feet would reference a lookup table.
Approach Speed Low	An event to detect operation on approach that is below its computed final approach speed.	Gross Weight, CAS, HAT HAT > 1,000 feet, CAS < flap maneuvering speed – x knots HAT < 1,000 feet, CAS < V_{REF} – x knots	Speeds above 1,000 feet would reference a lookup table.
Excessive Power Increase	An event to detect an excessive power increase during final phase of approach.	HAT, N_1 Δ of N_1 at 500 feet and N_1 < 500 feet > x	
Abnormal Configuration – Flaps/Speedbrake	An event to detect the simultaneous use of flaps and speedbrakes.	Speedbrake Handle, Flaps Speedbrake handle > 0, flaps > 0	This event would only be included if this type of operation were prohibited in the flight operations manual.
Abnormal Flap Extension	An event to detect slow flap movement between any selected flap position and the previously selected flap position.	Flap Position, Flap Handle Position Time from Flap Handle Position = x degrees until Flap Position = x degrees > x seconds	This event will also detect stuck flaps.

Event Name	Event Description	Parameters and Basic Event Definition	Notes
Landing Gear Down Speed Exceeded (IAS)	An event to detect when the indicated airspeed of the aircraft exceeds the maximum allowable airspeed for operation with the landing gear in the down position.	Landing Gear Position, CAS Landing Gear = Down, CAS > x knots	
Late Landing Flaps	An event to detect flap movement to the landing flap position below a pre-determined altitude.	HAT, Flap Handle Position, Air/Ground Switch Air/Ground = Air, HAT < x feet, Flap Handle Position at x feet HAT < Flap Handle Position at touchdown	This event is slightly different from Late Landing Configuration in that it detects flap movement below a set altitude rather than a flap setting.
Low Power on Approach	An event to detect aircraft engines not spooled or the power reduced to an unspooled condition below a predetermined altitude.	Air/Ground Switch, HAT, N_1 Air/Ground = Air, HAT < x feet, N_1 < x %	
Landing Gear Operation	An event to detect when the indicated airspeed of the aircraft exceeds the maximum allowable airspeed for operation of the landing gear in transit.	Landing Gear Warning, CAS Landing Gear Warning (in transit) = On, CAS > x knots	If the operating limitation is different for landing gear extension and retraction, separate events will need to be created for each limitation.
Operation Left of Localizer Centerline	An event to detect deviation left of localizer centerline.	Localizer Deviation Left, HAT Localizer Deviation > x dots, HAT > x feet	
Operation Right of Localizer Centerline	An event to detect deviation right of localizer centerline.	Localizer Deviation Right, HAT Localizer Deviation > x dots, HAT > x feet	

Event Name	Event Description	Parameters and Basic Event Definition	Notes
Operation Above Glideslope	An event to detect deviation above glideslope.	Glide Slope Deviation High, HAT Glide Slope > x dots, HAT < x feet	
Operation Below Glideslope	An event to detect deviation below glideslope.	Glide Slope Deviation Low, HAT Glide Slope > x dots, HAT < x feet	
Descent Below MDA	An event to detect descent below MDA (followed by a climb back to MDA) on non-precision approaches.	HAT, Altitude HAT < 1,000 feet, Altitude > Altitude in preceding sample + x feet	
Flap Limiting Speed	An event to detect flap operation at a speed that exceeds the maximum placarded airspeed.	Flap Position, CAS Flap Position = x, CAS > x knots for x seconds	This event will be constructed with a different speed limit for each flap setting through the use of a lookup table. It will also detect speed exceedances during retraction in the Takeoff phase of flight.
Go Around	An event to detect that the aircraft has begun its descent for landing, discontinues that descent, and does not land from that approach.	HAT, Altitude, N_1 HAT < 2,000 feet, HAT > 1 foot, Altitude < preceding Altitude sample for 10 seconds, N_1 > 98%, Altitude > any preceding Altitude sample in previous 60 seconds + 300 feet	

Event Name	Event Description	Parameters and Basic Event Definition	Notes
ATC Go Around	An event to detect a go-around event in which no other events are triggered, such as approach instability, indicating the go around was directed by ATC.	HAT, Altitude, N_1, Localizer Deviation, Glide Slope Deviation, CAS HAT < 2,000 feet, HAT > 1 foot, N1 > 98%, Altitude > any preceding Altitude sample in previous 60 seconds + 300 feet, Localizer Deviation < x dots, Glide Slope Deviation < x dots, CAS = V_{REF} ± x knots	
Late Landing Configuration	An event to detect that the aircraft is not configured with landing flaps and landing gear in the down and locked position at 500 feet HAT.	HAT, Landing Gear Position, Flap Position HAT < 500 feet, Landing Gear Warning = On, Flap Position < x flaps	
Tire Limiting Speed	An event to detect if the tire limiting speed is exceeded.	Air/Ground Switch, CAS Air/Ground = Ground, CAS > x knots	
Pitch High – Landing	An event that measures pitch at landing in relation to the angle required to strike the tail of the aircraft.	Air/Ground Switch, Pitch Air/Ground = Ground, Pitch > x degrees from 6 seconds before to 15 seconds after touchdown	Limits are based on the angle required for the tail cone to contact the ground with struts compressed.
Pitch Low – Landing	An event that measures pitch attitude where the aircraft is in a nose down attitude that might result in an initial nose-gear touchdown or three-point landing.	Air/Ground Switch, Pitch Air Ground = Ground, Pitch < x degrees from 3 seconds before to 1 second after touchdown	

Event Name	Event Description	Parameters and Basic Event Definition	Notes
Landing in a Crab	An event to detect failure to align aircraft with the runway at touchdown.	Heading, CAS Δ Heading at Touchdown vs. Average Heading until CAS = 60 knots	
Hard Landing	An event that measures excessive G-force at touchdown, indicating a hard landing.	Air/Ground Switch, Vertical Acceleration Air/Ground = Ground, Vertical Acceleration > x G	
Bounced Landing	An event that measures excessive G-force at touchdown followed by a second excessive G-force, indicating a bounced, hard landing.	Air Ground Switch, Vertical Acceleration Air/Ground = Ground, Vertical Acceleration > x G, followed by second Vertical Acceleration > x G within 20 seconds of first touchdown	
Excessive Brake Usage	An event to detect higher-than-normal brake application.	Brake Pressure Sum of Brake Pressure readings (one per second) from Touchdown to Runway Turnoff/1000. Resulting index number > x	A routine operational measurement (ROM) would be helpful to determine normal braking at a given airport.
Thrust Reverser Stowed	An event that measures the speed at which the thrust reverser is stowed during landing rollout.	CAS, Thrust Reverser Deploy Thrust Reverser = On for 5 seconds before Thrust Reverser = Off, CAS > x knots	
Overweight Landing	An event to detect landings made in excess of the maximum gross landing weight.	Air/Ground Switch, Gross Weight Air/Ground from Air to Ground + 20 seconds, Gross weight > x pounds	

Event Name	Event Description	Parameters and Basic Event Definition	Notes
Abnormal/ Incorrect Landing Flaps	An event to detect that the aircraft touched down with flaps in a position less than the minimum expected landing flap setting.	Air/Ground Switch, Flap Position, Air/Ground from Air to Ground + 5 seconds, Flaps < x degrees	Will need to be customized for the recommendations in the flight manual.
Runway/Taxiway Rough	An event that measures excessive G-force on the ground, indicating defects in runway/taxiway surfaces.	Air/Ground Switch, Vertical Acceleration, CAS Air/Ground = Ground, CAS < 100 knots, Vertical Acceleration >1.3 g	
Stick Shaker Operation	An event to detect stick shaker operation.	Stick Shaker Stick Shaker + On (L or R)	
GPWS Warning	An event to detect when a GPWS warning is triggered.	GPWS GPWS = On	This event should be subdivided for each of the different warning modes of the GPWS.
Engine Failure	An event to detect in-flight engine failure/shutdown.	Air/Ground Switch, Fuel Flow, Oil Pressure, EGT Air/Ground = Air, Oil Pressure < x psi, Fuel Flow < x pph, EGT < x degrees	
TCAS Advisory	An event to detect any TCAS advisory triggered.	TCAS Advisory (Up or Down) TCAS Advisory = On	This event should be separated for TCAS Traffic Advisories (TAs) and Resolution Advisories (RAs).
Engine Reverse at Low Speed	An event to detect use of engine reverse at low speed that can result in engine overtemps and/or FOD ingestion.	Thrust Reverser, N_1, CAS Thrust Reverser = On, CAS < x knots, N_1 > x% for x seconds	

APPENDIX III. GLOSSARY

GLOSSARY	
Term	**Definition**
ACARS	Aircraft Communications Addressing and Reporting System. ACARS is a VHF air/ground data link that uses nearly 600 VHF frequency locations throughout North and Central America, Hawaii, the Caribbean, and several U.S. territories. It relays Aircraft Operational Control (AOC), Airline Administrative Control (AAC), and Air Traffic Control (ATC) messages between ground-based organizations and the cockpit.
ACMS	Aircraft Condition Monitoring System. An airborne unit that can create reports such as long-term trend data and aircraft/engine monitoring. ACMS is mainly used for maintenance applications.
Aggregate Data	Detailed data grouped according to some criterion and combined using mathematical or statistical methods (e.g., sum, count, average, standard deviation).
Air Carrier	An organization that undertakes -- either directly or by lease or some other arrangement -- to engage in air transportation.
ARINC	Aeronautical Radio Incorporated. The ARINC organization is the technical, publishing, and administrative support arm of the Airlines Electronic Engineering Committee (AEEC) groups. AEEC standards define avionics form, fit, function, and interfaces.
ATC	Air Traffic Control. A service operated by appropriate authority to promote the safe, orderly, and expeditious flow of air traffic.
COTS	Commercial-Off-the-Shelf. Products, components, or software that are readily available through normal commercial channels, as opposed to custom-built units that would achieve the same functionality.
DAR	Digital ACMS Recorder. See ACMS.
Data Frame	A data map. See LFL.
De-identified Data	Data from which any identifying element that could be used to associate them with a particular flight, date, or flightcrew has been removed.

GLOSSARY	
Term	**Definition**
DFDAU	Digital Flight Data Acquisition Unit. A device that acquires aircraft data via a digital data bus and analog inputs, and formats that information for output to the flight data recorder in accordance with requirements of regulatory agencies. In addition to the mandatory functions, many DFDAUs have a second processor and memory module that enables them to perform additional Aircraft Condition Monitoring System (ACMS) functions/reports. The DFDAU can provide data and pre-defined reports to the cockpit printer, or a display for the flightcrew, or directly to Aircraft Communications Addressing and Reporting System (ACARS) for transmittal to a ground station, or to a Quick Access Recorder (QAR) for recording/storage of raw flight data.
DFDMU	Digital Flight Data Management Unit. A unit that performs the same data conversion functions as the DFDAU and has the added capability to process data onboard the aircraft. Additionally, this unit has a powerful data processor designed to perform in-flight airframe/engine and flight performance monitoring and analysis. Some DFDMUs have ground data link and ground collision avoidance systems incorporated into the units.
DFDR	Digital Flight Data Recorder. A digital device that records pertinent parameters and technical information about a flight. At a minimum, it records those parameters required by the governing regulatory agency, but may record a much higher number of parameters. A DFDR is designed to withstand the forces of a crash so that information recorded by it may be used to reconstruct the circumstances leading up to the accident.
DMU	Data Management Unit. A unit that performs the same data conversion functions as a Flight Data Acquisition Unit (FDAU) with the added capability to process data onboard the aircraft. Additionally, this unit has a powerful data processor designed to perform in-flight airframe/engine and flight performance monitoring and analysis. Some DMUs have ground data link and ground collision avoidance systems incorporated into the unit.
EGT	Exceedance Guidance Team. See FMT.
EMT	Event Monitoring Team. See FMT.
Event	An occurrence or condition in which pre-determined limits of aircraft parameters have been exceeded. Events represent the conditions to be tracked and monitored during various phases of flight and are based on sensory data parameters available on a specific aircraft fleet. Events may be categorized at different severity levels based on the degree to which the associated limits were exceeded. Most FOQA trend analysis is based on event monitoring and tracking.

GLOSSARY	
Term	**Definition**
Event Set	A collection of events designed to measure all aspects of normal flight operations for a particular aircraft type at a particular air carrier. Individual events within the event set would be customized to the approved limitations for the aircraft type and in accordance with the air carrier's operational procedures. The event set for a particular fleet may be limited by the available parameters on the aircraft.
FAR	Federal Aviation Regulations. Federal rules that govern airworthiness and the conduct of flight operations by certificate holders, among other safety matters.
FDAU	Flight data acquisition unit. See DFDAU.
FDR	Flight data recorder. A required device that records pertinent parameters and technical information about a flight. At a minimum, it records those parameters required by the governing regulatory agency, but may record a much higher number of parameters. An FDR is designed to withstand the forces of a crash so that information recorded by it may be used to reconstruct the circumstances leading up to the accident. See DFDR.
FMT	FMT. A group comprised of representatives from the pilot association, if applicable, and the air carrier. This group, sometimes referred to as the Exceedance Guidance Team (EGT) or Event Monitoring Team (EMT), is responsible for reviewing and analyzing flight and event data, and determining and monitoring corrective actions.
FOQA	Flight Operational Quality Assurance. A voluntary program for the routine collection and analysis of flight operational data to provide more information about, and greater insight into, the total flight operations environment. A FOQA program combines these data with other sources and operational experience to develop objective information to enhance safety, training effectiveness, operational procedures, maintenance and engineering procedures, and air traffic control procedures.
Gatekeeper	The FOQA team member who is primarily responsible for the security of identified data. The gatekeeper is the only individual who can link FOQA data to an individual flight or crewmember. The gatekeeper is normally a member of the pilot association.
GDL	Ground Data Link. See WDL.
GDRAS	Ground Data Replay and Analysis System. A software application designed to: transform airborne recorded data into a usable form for analysis; process and scan selected flight data parameters; compare recorded or calculated values to predetermined norms using event algorithms; and generate exceedance reports for review or trending when exceedances are found.

GLOSSARY	
Term	**Definition**
I&O Plan	Implementation and Operations Plan. A detailed specification of key aspects of a FOQA program to be implemented by an air carrier, including a description of the operator's plan for collecting and analyzing the data, procedures for taking corrective action that analysis of the data indicates is necessary in the interest of safety, procedures for providing the FAA with de-identified aggregate FOQA information, and procedures for informing the FAA as to any corrective actions being undertaken.
LAN	Local Area Network. A communications network that serves users within a confined geographical area, typically linked together by cable.
LFL	Logical Frame Layout. A data map that describes the format in which parameter data are transcribed to a recording device. This document details where each bit of data is stored.
LRU	Line Replaceable Unit. A unit that can be replaced by line maintenance personnel without removing the aircraft from service for an extended period.
Mapping	See LFL.
MEL	Minimum Equipment List. A list of required equipment that, under certain conditions, might be inoperative.
MTBF	Mean Time Between Failure. The life expectancy of a component or part, expressed in flight hours.
OQAR	Optical Quick Access Recorder. See QAR. A QAR that stores data on an optical disk.
PAI	Principal Avionics Inspector. The FAA employee responsible for oversight and inspection of avionics at a specific air carrier.
Parameters	Measurable variables that supply information about the status of an aircraft system or subsystem, position, or operating environment. Parameters are collected by a data acquisition unit installed on the aircraft and then sent to analysis and reporting systems.
PCMCIA card	Personal Computer Memory Card International Association card. A credit card-sized data storage and transfer device that was originally developed for portable computers and may be used on some QARs. The Personal Computer Memory Card International Association was organized in 1989 to promote standards for these memory or input/output (I/O) devices.
PMI	Principal Maintenance Inspector. The FAA employee responsible for oversight and inspection of aircraft maintenance functions at a specific air carrier.
POI	Principal Operations Inspector. The FAA employee responsible for operational oversight of a specific air carrier.

GLOSSARY	
Term	**Definition**
QAR	Quick Access Recorder. A recording unit onboard the aircraft that stores flight-recorded data. These units are designed to provide quick and easy access to a removable medium, such as an optical disk or PCMCIA card, on which flight information is recorded. QARs may also store data in solid-state memory that is accessed through a download reader. QARs have now been developed to record an expanded data frame, sometimes supporting 2,000 plus parameters at much higher sample rates than the FDR. The expanded data frame greatly increases the resolution and accuracy of the ground analysis programs.
SRU	Shop Replaceable Unit. A unit that must normally be replaced in a maintenance facility during heavy maintenance checks.
SSFDR	Solid State DFDR. A DFDR that utilizes solid-state memory for recording flight data. See DFDR.
STC	Supplemental Type Certificate. An addendum to the Type Certificate. An STC is required for any new equipment installed on a model of aircraft after that model of airplane has been issued a Type Certificate. See TC.
TC	Type Certificate. The initial certificate issued for every new model of aircraft. The TC lists components and equipment installed on that model of aircraft.
WAN	Wide Area Network. A communications network in which computers are connected to each other over a long distance, using telephone lines, cable connections, or satellite links.
WDL	Wireless Data Link. A system allowing the high-speed transfer of onboard aircraft data to ground facilities using various wireless technologies. It may also allow for upload of data to the aircraft. Sometimes referred to as Ground Data Link (GDL).

APPENDIX IV. REFERENCES

CFR Part 193, Protection of Voluntarily Submitted Information
CFR Part 13, Section 13.401, Flight Operational Quality Assurance Program
AC 00-46, as amended, Aviation Safety Reporting System (ASRS)
AC 00-58, as amended, Voluntary Disclosure Reporting Program
AC 120-59, as amended, Air Carrier Internal Evaluation Programs: Air Carrier Internal Evaluation-Model Program Guide
AC 120-66, as amended, Aviation Safety Action Program
Flight Safety Foundation, FAA Contract Report, Air Carrier Voluntary Flight Operational Quality Assurance (FOQA) Program, 1992
General Accounting Office, GAO/RCED-98-10, Aviation Safety—Efforts to Implement Flight Operational Quality Assurance Programs, December 1997

APPENDIX B. FOQA I&O PLAN CHECKLIST

The following checklist should be used by certificate holders to prepare their I&O Plans and verify that all required materials are included. The FAA will review this checklist to determine that the items required in a FOQA program have been specified in the I&O Plan. This checklist identifies the minimum requirements of an I&O Plan. An air carrier's I&O Plan may contain additional information in excess of these minimum requirements. When the I&O Plan is submitted for FAA approval, a completed copy of this checklist should accompany it.
The "Response" column must be completed for each question. Appropriate responses are "Yes," "No," or "NA" (not applicable). All "No" and "NA" responses should include, in the "Comment" column, a brief explanation of each such response.

The "Reference" column is to be completed for each question to which the air carrier provides a "Yes" response. The information provided in the "Reference" column must identify the specific location of the subject item in the I&O Plan (e.g., Section 2.1).

I&O Plan Checklist			
	Response	**Reference**	**Comment**
General			
1. Has approval of the I&O Plan been requested by the certificate holder in a cover letter addressed to the POI, accompanying submittal of the plan?	❑ Yes ❑ No ❑ NA		
2. Has a copy of the cover letter and plan been forwarded to HQ FAA/AFS-230?	❑ Yes ❑ No ❑ NA		
3. Does the I&O Plan identify the personnel, system equipment, and resources that have been committed to support of the FOQA program?	❑ Yes ❑ No ❑ NA		
4. Does the I&O Plan acknowledge that revisions will be documented in accordance with standard revision control methodology?	❑ Yes ❑ No ❑ NA		
5. Does the I&O Plan acknowledge that, following initial FAA approval, subsequent modifications to the FOQA program must be documented in revisions submitted to the POI and AFS-230?	❑ Yes ❑ No ❑ NA		

I&O Plan Checklist			
	Response	**Reference**	**Comment**
I&O Plan			
1. Have the goals and objectives of the FOQA program been clearly specified?	❑ Yes ❑ No ❑ NA		
2. Have the major stakeholders within the air carrier been clearly identified?	❑ Yes ❑ No ❑ NA		
3. Has a copy of an agreement with the pilot association (if applicable) for FOQA data usage been included as an appendix?	❑ Yes ❑ No ❑ NA		
4. Are air carrier data safeguard and protection mechanisms described?	❑ Yes ❑ No ❑ NA		
5. Are the air carrier fleets (make, model, series) that are targeted for participation in the FOQA program identified?	❑ Yes ❑ No ❑ NA		
6. Are the capabilities of the planned airborne equipment for FOQA described?	❑ Yes ❑ No ❑ NA		
7. Does the plan identify provisions for airborne equipment maintenance and support?	❑ Yes ❑ No ❑ NA		

I&O Plan Checklist			
	Response	**Reference**	**Comment**
8. Is a fleet installation plan specified?	❑ Yes ❑ No ❑ NA		
9. Are the capabilities of the proposed ground data replay and analysis system (GDRAS) described?	❑ Yes ❑ No ❑ NA		
10. Does the plan identify provisions for maintenance of the GDRAS hardware and software?	❑ Yes ❑ No ❑ NA		
11. Does the plan describe other key technology components of the air carrier's FOQA program?	❑ Yes ❑ No ❑ NA		
12. Has a single point of contact been designated to oversee the FOQA program?	❑ Yes ❑ No ❑ NA		
13. Does the plan define the air carrier's organizational structure for oversight and operation of the FOQA program?	❑ Yes ❑ No ❑ NA		
14. Does the plan describe the roles and responsibilities of key air carrier personnel and teams?	❑ Yes ❑ No ❑ NA		

I&O Plan Checklist			
	Response	**Reference**	**Comment**
15. Does the plan specify the schedule and timeline for implementing the FOQA program?	❑ Yes ❑ No ❑ NA		
16. Are FOQA program start-up criteria specified?	❑ Yes ❑ No ❑ NA		
17. Does the plan describe how key FOQA team members will be trained?	❑ Yes ❑ No ❑ NA		
18. Does the plan describe how the air carrier will educate its pilots about the FOQA program?	❑ Yes ❑ No ❑ NA		
19. Is a plan for educating senior management and stakeholders described?	❑ Yes ❑ No NA		
20. Does the I&O Plan specify procedures for implementing and auditing security mechanisms?	❑ Yes ❑ No ❑ NA		
21. Is a data storage and retention policy specified?	❑ Yes ❑ No ❑ NA		
22. Are flight data collection and retrieval procedures specified?	❑ Yes ❑ No ❑ NA		
23. Are the procedures for defining fleet-specific events and associated parameters described?	❑ Yes ❑ No ❑ NA		

I&O Plan Checklist			
	Response	**Reference**	**Comment**
24. Are the fleet-specific event definitions, including trigger limits for each event's severity classification, provided as Appendix 2 to the plan?	❑ Yes ❑ No ❑ NA		
25. Are the procedures for validating, refining, and tracking event definitions described?	❑ Yes ❑ No ❑ NA		
26. Does the plan acknowledge that updates to FOQA event definitions must be included in I&O Plan revisions submitted to the FAA?	❑ Yes ❑ No ❑ NA		
27. Are procedures for data review and evaluation specified?	❑ Yes ❑ No ❑ NA		
28. Does the plan provide for notifying appropriate air carrier departments of adverse trends revealed by FOQA data flightcrew training?	❑ Yes ❑ No ❑ NA		
29. Are procedures for taking, tracking, and following up on corrective actions specified?	❑ Yes ❑ No ❑ NA		

I&O Plan Checklist			
	Response	**Reference**	**Comment**
30. Are guidelines for crewmember contact and follow-up described?	❑ Yes ❑ No ❑ NA		
31. Is a description included of how FOQA system procedures will be documented?	❑ Yes ❑ No ❑ NA		
32. Does the plan describe the process for joint FAA/air carrier periodic reviews of the FOQA program and associated aggregate data?	❑ Yes ❑ No ❑ NA		