

**FOQA/Flight Data Monitoring Program
2002 Survey Findings**

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1. Overview

As part of the U.S. Federal Aviation Administration's Flight Operational Quality Assurance (FOQA) Demonstration Project (DemoProj), a confidential research survey was conducted in third quarter 2002 to elicit information from airlines worldwide to determine the status and characteristics of current and planned Flight Data Monitoring (FDM), Flight Data Analysis (FDA), FOQA, and other similar programs. The intended learning from this survey is a better understanding of how these types of programs are progressing in the airline industry. Its findings attempt to fathom the status, scale, scope, architecture, usage, and benefits of current FOQA programs. This information will provide value to any airline interested in implementing a FOQA, FDA, or FDM program.

A 28% survey response rate was achieved, and this document shares its de-identified findings. Although these programs are operated under a variety of names or acronyms they are essentially the same. For the purposes of document consistency the term, "FOQA program," will be used to encompass all of them.

2. Executive Summary

Each of the 35 survey respondents represented a different airline which either have, or are planning to have, a FOQA program. Attributes of the responding airlines include:

- Scheduled passenger airline (83%)
- Based in North America or Europe (79%)
- Classified as a major or national airline (75%)
- Currently has a FOQA program (80%)
- FOQA programs begun in or since 2000 (50%)

Over half of the airlines reporting FOQA programs characterized them as being productive to highly successful. Another third described their airlines' programs as adequate.

As might be expected, airlines reported that information derived from FOQA programs is regularly used by a number of different user groups within their organizations. The vast majority (93%) reported that their airline safety professionals regularly use it. Also cited were operations (71%), maintenance/engineering (57%), and training (54%).

Almost half of the responding airlines generate FOQA reports quarterly, and 39% generate them monthly. Of the airlines that generate FOQA reports, half required two days or less to produce their reports and half require more than two days.

At the time of the survey (08/02), the cumulative fleet size of the responding airlines was 3,805 and 47% were FOQA equipped. Seventy-seven percent of these airlines acquired their aircraft FOQA-equipped, and 60% planned to retrofit non-FOQA-equipped aircraft. In addition, they projected (with some qualifications) that by December 2003, 63% of their fleets would be FOQA equipped.

Fifty-seven percent of responding airlines took 12 months or more to implement their FOQA program after the decision was made to initiate it. In addition, they reported that a major challenge is the selection of vendors for the various technology required.

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There are a number of ways to equip a FOQA program, and the survey findings indicate that carriers are using a variety of approaches. The following chart summarizes product use and satisfaction:

FOQA Program Product	Most-Cited Method Used for FOQA Program	Most-Cited Vendor Used for FOQA Program	Responding Airlines' Vendor Satisfaction Level
Airborne Data Collection	Not applicable	<ul style="list-style-type: none"> ➤ Teledyne 68% ➤ Penny and Giles 46% ➤ Honeywell 36% ➤ SFIM 36% 	<ul style="list-style-type: none"> ➤ 68% good to excellent ➤ 16% average
Data Retrieval Products	<ul style="list-style-type: none"> ➤ Manual download 56% ➤ Handheld download 28% ➤ Wireless data link 8% 	<ul style="list-style-type: none"> ➤ Austin Digital RDS 20% ➤ Avionica RSU 20% 	<ul style="list-style-type: none"> ➤ 56% good to excellent ➤ 32% average
Flight Data Analysis Software	83% use Commercial Off-The-Shelf (COTS) software products	<ul style="list-style-type: none"> ➤ SFIM's Airborne Ground System (AGS) 38% ➤ Austin Digital's Exceedance Measurement System (EMS) 25% ➤ Spirent's Ground Replay and Analysis Facility (GRAF) 25% 	<ul style="list-style-type: none"> ➤ 79% good to excellent ➤ 31% average
Flight Animation Software	95% use COTS software products	<ul style="list-style-type: none"> ➤ SimAuthor's FlightViz 42% ➤ Spirent's GRAF Vision 26% 	<ul style="list-style-type: none"> ➤ 88% good to excellent ➤ 12% average

In terms of staffing, the two key positions included in most of the respondents' FOQA programs are FOQA Managers (82%) and FOQA Analysts (75%).

- Of the 23 airlines that have FOQA Managers, 78% employ one full-time manager.
- Of the 21 airlines that have FOQA Analysts, 62% employ one full-time analyst.
- Eighteen airlines include Line Pilots in their FOQA program staffing; and 72% employ between one and seven part-time pilots.

Over three-quarters of respondents neither know nor attempt to calculate the potential cost savings associated with their organizations' FOQA programs; and almost one-third either do not calculate or do not know their respective annual program cost.

Of those airlines that reported the calculations of FOQA program investments:

- 25% spent less than \$100K
- 25% spent more than \$100k, but less than \$500k
- 22% spent more than \$750K
- 11% spent more than \$1M

The survey findings indicate that airlines use a wide variety of methods to communicate with employees about their FOQA programs. Three specific communications vehicles were deemed *most effective*:

- Recurrent training presentations (63%)
- Video/flight animation distribution (51%)
- Direct contact with pilots (44%)

Finally, respondents were given the opportunity to write open-ended responses to two questions:

- What would “significantly improve” FOQA programs? Twenty-three percent cited simplification and automation of data retrieval logistics, and the availability of wireless technology to facilitate this process.
- What are the key challenges to creating effective FOQA programs? Thirty-three percent cited organizational challenges and 27% cited pilot involvement challenges.

3. Survey Methodology

The survey was emailed to 102 airlines worldwide and garnered a 28% response rate for a total of 35 responses. It is possible that the only airline representatives who chose to respond to this survey already have an active interest in, or a positive pre-disposition to, FOQA programs. This rate of return, however, compares favorably with response rates commonly obtained in business research. As would be expected with a sample pool of this size, the information presented in this document is deemed directional rather than conclusive.

Two versions of the questionnaire were used. The non-U.S. carrier version had 28 questions. The U.S.-carrier version did not include questions regarding "FOQA and Regulators" because FOQA in the U.S. is guided by the FOQA Rule (14 CFR Part 13) effective 30 November 2001 (available at <http://www1.faa.gov/avr/arm/foqa.htm>).

Strict adherence to respondent anonymity was both promised and kept. The questionnaire was pre-tested among several representative airline flight safety office representatives; and where necessary, questions were clarified based on pre-testing feedback prior to distributing the finalized questionnaire.

Flight safety professionals from 126 airlines worldwide received questionnaires via email. Only one individual per airline was invited to participate. The invited individuals held the titles of:

- FOQA Manager (or the equivalent title) for participants in the FOQA Demonstration Project;
- FDA or FDM Managers for non-U.S. carriers; or
- Airline Safety Directors who have attended various aviation safety conferences.

Of the 126 individuals receiving the survey, 102 represented non-U.S. carriers, and 24 represented U.S. carriers.

In total, 35 airline representatives (28%) responded to the survey. Of these:

- 16 non-U.S. airline representatives responded. (16% of the 102 non-U.S. air carriers surveyed.)
- 19 U.S. airline representatives responded. (79% of the 24 U.S. carriers surveyed.)

The higher response rate for the U.S. carriers most likely reflects U.S. carriers pre-disposition regarding FOQA as a result of DemoProj.

4. About this Document

Preceding the graphed response to each survey question is a brief summary of how each question was received. For example, not all respondents supplied answers to every question and where appropriate, a "No Answer Given" category of response is graphed. For select questions, e.g., FOQA equipment, the number of users who supplied a response is indicated. Additionally, the reader should also be aware of the following:

- When questions asked the respondent to “select all answers that apply,” the number of responses received for those questions were, of course, higher than total number of survey respondents.
- Where respondents provided written answers to questions, verbatim was edited for both clarity and de-identification.
- Where pie charts are presented to illustrate responses, the number after the data label (shown in parenthesis) is the number of airline representatives who provided that particular response.

The survey findings are available only in Adobe® Portable Document Format (PDF). All survey respondents will receive a copy of this document by email. Additionally, this document will be available through the FOQA Demonstration Project Library of www.aqp-foqa.com.

5. Respondent Airline Characteristics

Survey respondents represented air carriers featuring a broad array of services, revenue and fleet size from 15 different countries. Figure 1 graphs this geographic composition. The majority of the responses (79%) were from North America (Canada, United States, and Mexico) and Canada.

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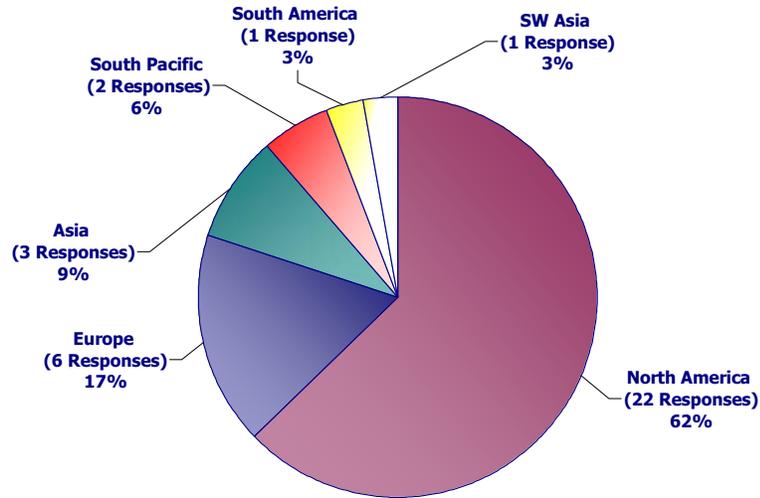


Figure 1. Survey Responses by Geography

Figure 2 graphs the "Type of Service" primary-business composition of the airlines represented by the 35 respondents. Eighty-three percent of the respondents were affiliated with scheduled passenger carriers.

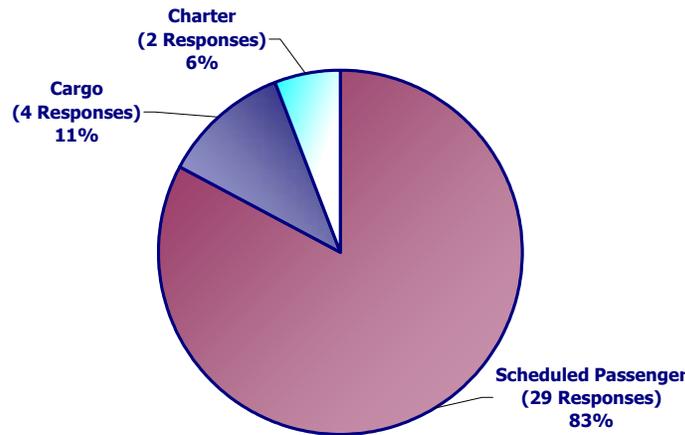


Figure 2. Survey Responses by Type of Service

Figure 3 graphs the "Airline Revenue" composition as reported by the 35 survey respondents. Annual operating revenue for airlines is characterized by the U.S. Department of Transportation (DOT) as follows:

- Major = >USD \$1 billion
- National = <USD \$1 billion and >USD \$100 million
- Regional = <USD \$100 million

Cargo carriers are shown as "N/A" because their revenue is characterized in a different manner than it is for passenger airlines. Slightly more than half of the respondents were representatives of major carriers.

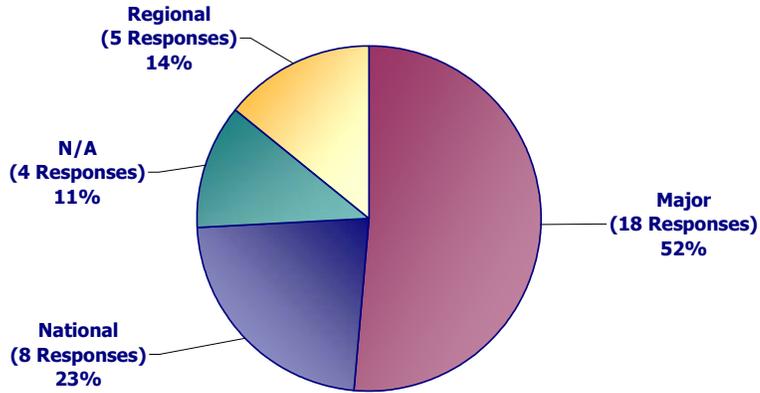


Figure 3. Survey Responses by Revenue

Figure 4 graphs the fleet size composition reported by the 35 respondents categorized as:

- A: >250 aircraft
- B: >100 and <=250 aircraft
- C: >50 and <=100 aircraft
- D: >20 and <= 50 aircraft
- E: <20 aircraft

Respondents represented airlines across all fleet size categories, however, almost half reported fleet sizes greater than 100 aircraft. An additional 43% reported fleet sizes smaller than 100, but more than 20 aircraft.

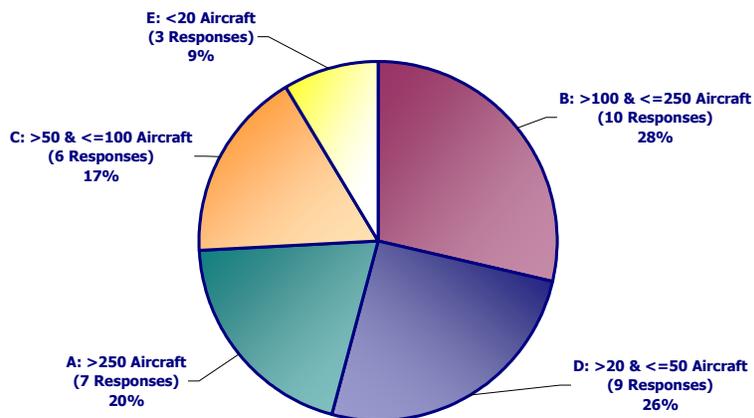


Figure 4. Survey Responses by Fleet Size

6. Current and Projected Status of FOQA Programs

6.1 2002 Program Status

Figure 5 graphs responses to the question, "Which best describes the status of your company's FOQA Program?" All 35 respondents answered this question, and all either currently, or are planning to, have FOQA programs.

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Over half of the respondents have deployed and implemented a fully operational FOQA program. In addition, 29% are in the equipment acquisition and installation phase for initial implementation of their program; and 15% are either investigating or planning a FOQA program. Five respondents reported that their carrier does not currently (but is planning to) have a FOQA program.

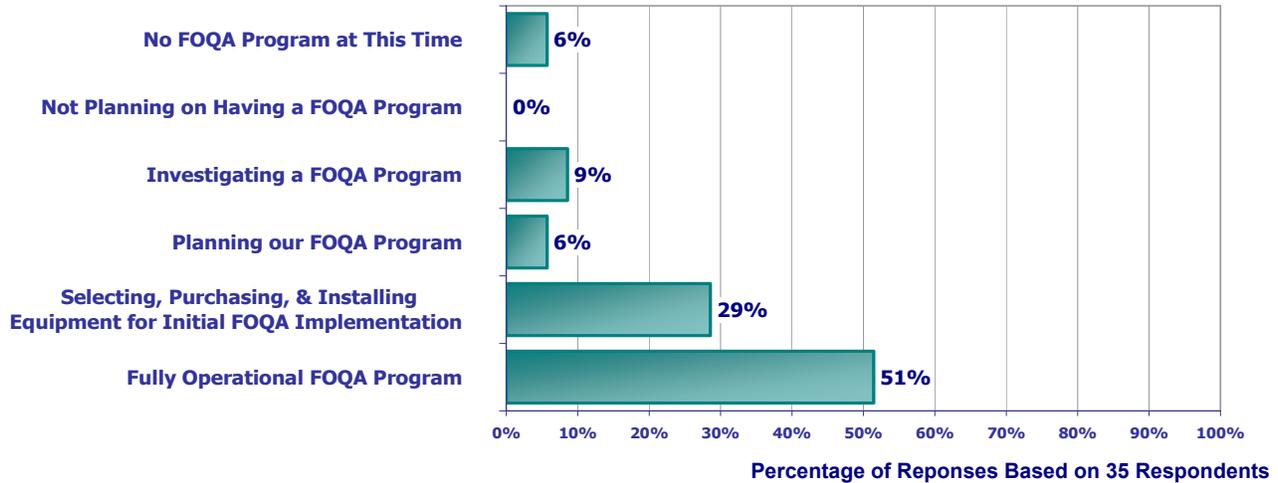


Figure 5. Status of FOQA Program

Figure 6 graphs, by decade, the 24 responses¹ to the question, "If you have a currently operating FOQA program, in what year did it begin?" The earliest year a program was started was 1970. Among the respondents who currently have a FOQA program, 79% were deployed since 1990 (50% were deployed since 2000).

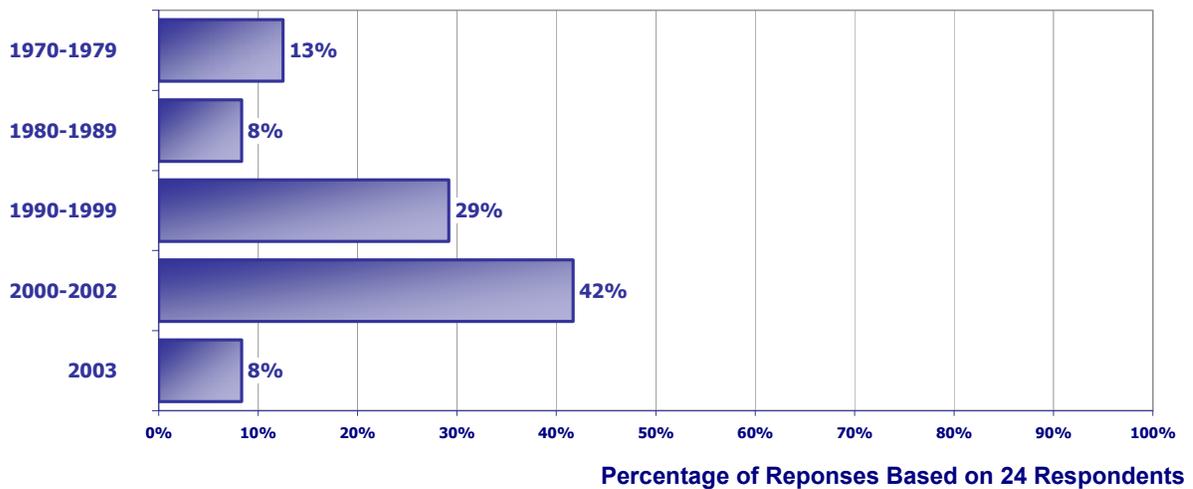


Figure 6. FOQA Program Start Year

Table 1 summarizes responses to the question, "What was the total number of FOQA-equipped and non-FOQA-equipped aircraft in your fleet on 31 August 2002?" Respondents reported a total of 3,805 aircraft, with 47% being FOQA-equipped (1,806). Responses are reported both by aircraft manufacturer and by fleet type.

¹ As noted previously, five survey respondents indicated that their carrier did not have a FOQA program but was investigating having one. It is assumed, therefore, that six additional individuals chose not to respond to this question.

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TABLE 1. AIRCRAFT FLEET SUMMARY AS OF 31 AUGUST 2002						
		FOQA EQUIPPED		NON-FOQA EQUIPPED		
MANUFACTURER	FLEET TYPE	No AIRCRAFT	% AIRCRAFT	No AIRCRAFT	% AIRCRAFT	TOTAL AIRCRAFT
Airbus	A300	41	100%	0	0%	41
	A319	198	75%	66	25%	264
	A320	190	66%	97	34%	287
	A321	69	71%	28	29%	97
	A330	24	59%	17	41%	41
	A340	5	21%	19	79%	24
ATR	ATR 72	8	100%	0	0%	8
Avro	RJ85/100	0	0%	19	100%	19
Boeing	B717	2	6%	32	94%	34
	B727-100	0	0%	61	100%	61
	B737-100/200	0	0%	116	100%	116
	B737-300/400/500	121	21%	468	79%	589
	B737-NG	273	69%	124	31%	397
	B747-100/200	25	27%	69	73%	94
	B747-300/400	126	78%	35	22%	161
	B757	172	64%	97	36%	269
	B767	132	58%	95	42%	227
	B777	36	100%	0	0%	36
Bombardier	CL-65 (CRJ)	0	0%	26	100%	26
	Dash 8 Q400	25	100%	0	0%	25
Embraer	EMB-135	0	0%	30	100%	30
	EMB-145	108	77%	33	23%	141
	ERJ-145	6	21%	23	79%	29
	EMB-XRJ	0	0%	18	100%	18
	RJ 145	0	0%	25	100%	25
Fokker	F50	4	100%	0	0%	4
	F100	1	5%	20	95%	21
McDonnell-Douglas	DC-10	9	19%	38	81%	47
	DC-8	0	0%	69	100%	69
	DC-9	0	0%	174	100%	174
	MD-11	71	100%	0	0%	71
	MD-80	160	48%	171	52%	331
Saab	S 2000	0	0%	29	100%	29
TOTAL		1,806	47%	1,999	53%	3,805

Figure 7 graphs the distribution of FOQA-equipped and non-FOQA-equipped aircraft by key manufacturers. The "Other" manufacturers category includes ATR, Avro, Bombardier, Fokker, and Saab.

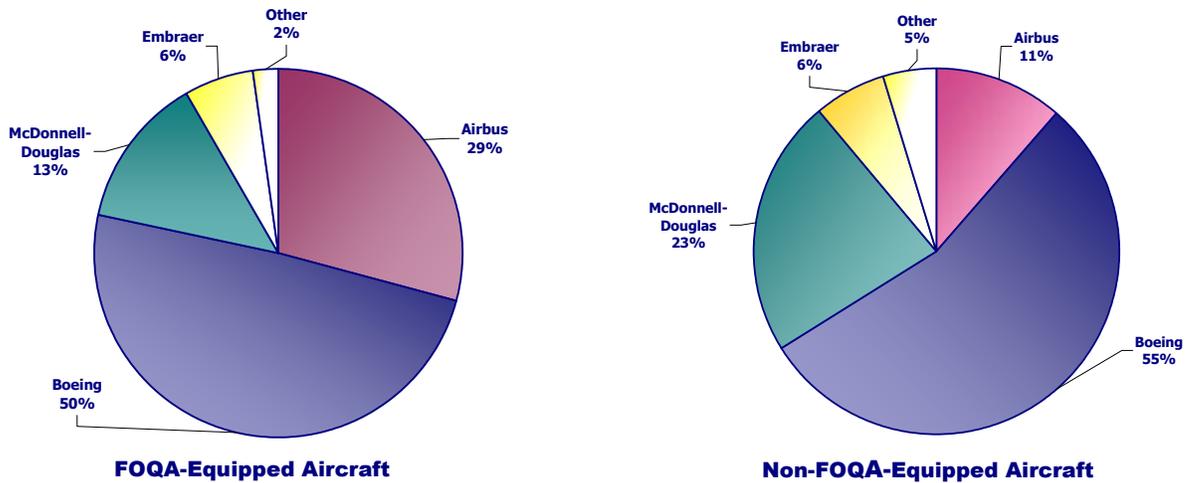


Figure 7. FOQA Equipped and Non-Equipped Aircraft by Fleet Type

6.2 2003 FOQA-Equipped Aircraft Projections

Responses to, "How many FOQA-equipped aircraft are projected to be in your fleet on 31 December 2003?" revealed a projected year-end number of FOQA-equipped aircraft of 2,411.

Figure 8 graphs various FOQA-equipped aircraft fleet sizes reported by the 30 respondents² to this question. Some respondents indicated that it was impossible to forecast the number of FOQA-equipped aircraft that will be in their fleet at the end of 2003 due to uncertainties regarding:

- Which current aircraft will be retained longer than had been previously planned; or
- Financial ability of their carriers to upgrade to FOQA-equipped aircraft direct from the factory.

Reported fleet size projections can be roughly split into thirds:

- Less than 51 aircraft
- Between 51 and 100 aircraft
- More than 100 aircraft

² As noted previously, five survey respondents indicated that their carrier did not have a FOQA program but was investigating having one.

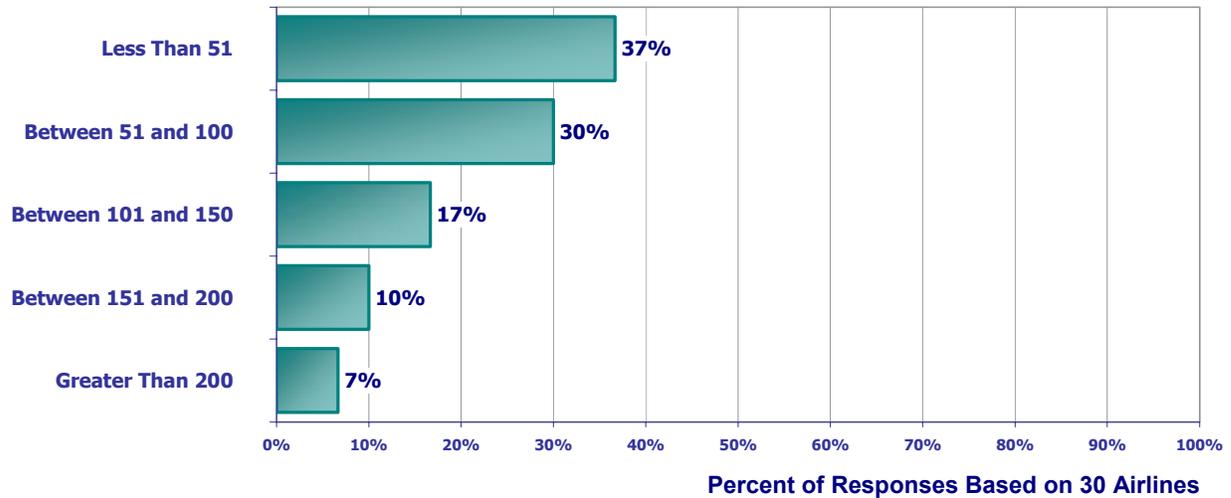


Figure 8. Projected Number of FOQA-Equipped Aircraft by December 31, 2003

7. FOQA-Equipped Aircraft Acquisition and Retrofit Plans

Figure 9 graphs the responses to the question, "If your company is acquiring new aircraft directly from a manufacturer, are they delivered FOQA-equipped?" Over three quarters of respondents said they are acquiring FOQA-equipped aircraft directly from the aircraft manufacturer.

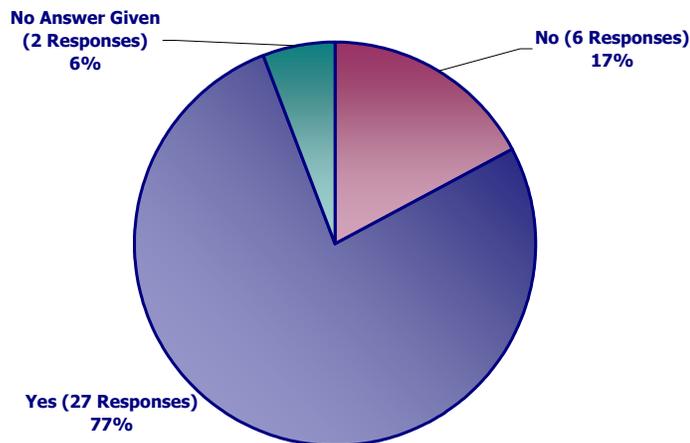


Figure 9. FOQA-Equipped at Aircraft Acquisition

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Figure 10 graphs responses to the question, "Are there any plans to retrofit aircraft that are not now FOQA-equipped?" Sixty percent of the respondents indicate that their airlines are planning to retrofit fleets that are not currently included in their FOQA programs.

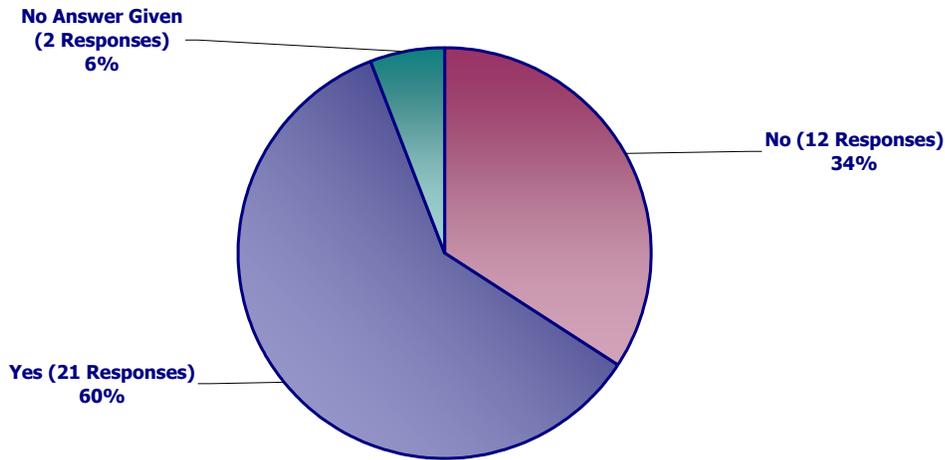


Figure 10. Aircraft Retrofit

Using the same fleet types employed previously in Table 1, Table 2 summarizes the responses to, "Please name the types/models that you plan to retrofit." Respondents were not asked to provide the number of each aircraft under retrofit-planning consideration.

TABLE 2. RETROFIT AIRCRAFT INFORMATION	
MANUFACTURER	FLEET TYPE
Airbus	A300
	A310
	A320
	A330
	A340
Avro	RJ85/100
Boeing	B717
	B727
	B737-300/400/500
	B747-100/200
	B747-300/400
	B757
	B767
Embraer	EMB-120
	ERJ-135
	ERJ-145
Fokker	F100

TABLE 2. RETROFIT AIRCRAFT INFORMATION	
MANUFACTURER	FLEET TYPE
McDonnell-Douglas	DC-10
	MD-10
	MD-80
Saab	S 2000

8. Your FOQA Program

This section focuses on FOQA program implementation at various carriers including time to deploy it and technology employed.

Figure 11 graphs the 30 responses³ to the question, "From the time a decision was made to have a FOQA program, how long did it take your company to implement it?" More than half of responding airlines took 12 months or more to implement their programs once the decision was made to initiate them; and 40% required more than two years to implement them. Almost one quarter of respondents cited that their airlines did not track the time from FOQA program conception to implementation.

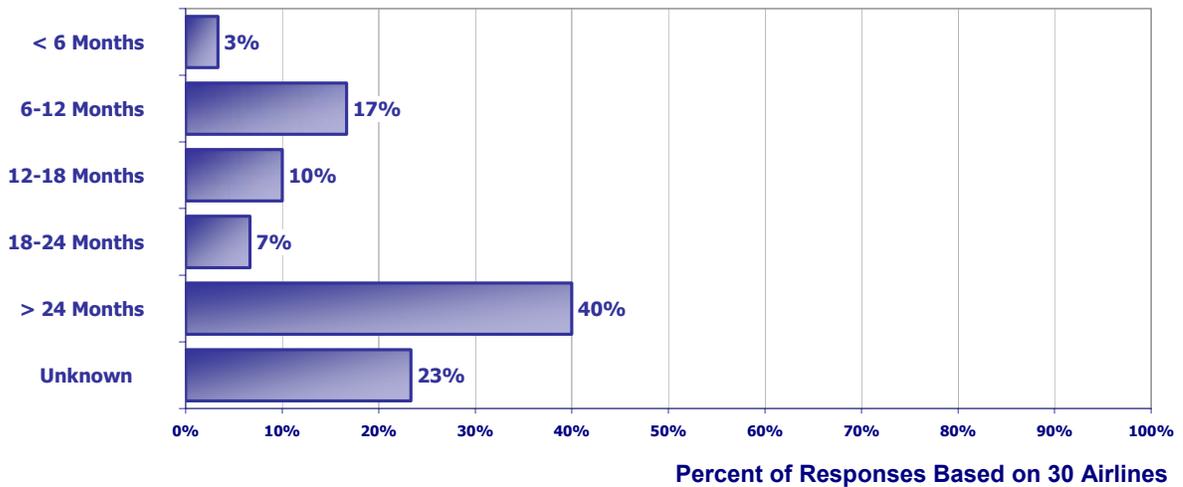


Figure 11. FOQA Program Implementation Time

Figure 12 graphs responses to the question, "How is data moved from the aircraft to your safety office?" Respondents could provide more than one answer.

³ As noted previously, five survey respondents indicated that their carrier did not have a FOQA program but was investigating having one.

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Of the 37 responses from 32 respondents⁴, 75% reported that their carriers are physically moving the media from the aircraft's data collection point to the FOQA-processing facilities. The second most reported technique was handheld download units at 31%. Although the technology is relatively new, 6% of responses cited wireless data links via ground transmissions.

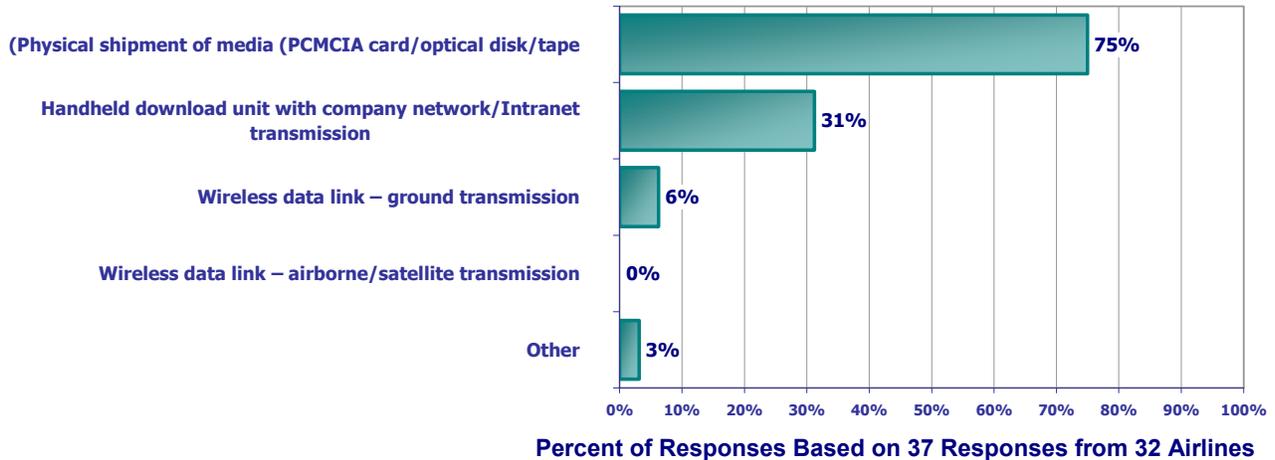


Figure 12. FOQA Logistics

One respondent further clarified his/her response by writing, "a PCMCIA card is used to transfer the data from the aircraft to a Maintenance Download Station (MDS) and once there, the data is transferred to our FOQA Server via an internal T-1 line."

One respondent cited "Other" and wrote "Media removed from aircraft and carried to ground station for transmittal over company network/intranet using a vendor's remote data station."⁵

Figure 13 graphs the 59 multiple responses from 28 respondents⁶ to the question, "What airborne data collection products are used in your FOQA program?" Two individuals either chose not to answer, or responded with, "To Be Determined." The airborne data collection products cited represent a wide range of vendors. Most cited were:

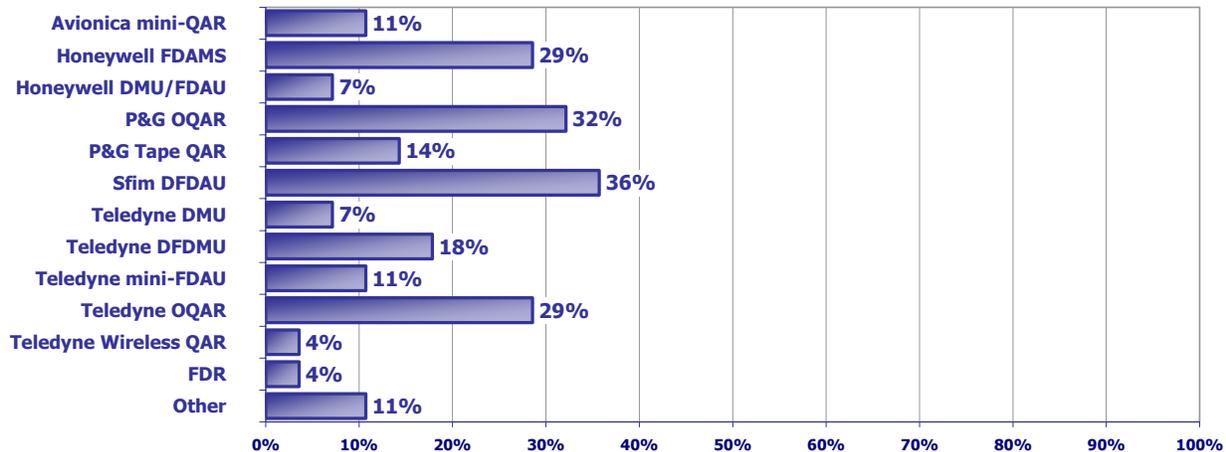
- Teledyne (68%)
- Penny and Giles (46%)
- Honeywell (36%)
- SFIM (36%)

⁴ Three individuals chose not to answer this question.

⁵ All respondent verbatim was paraphrased for purposes of de-identification and clarity.

⁶ As noted previously, five survey respondents indicated that their carrier did not have a FOQA program but was investigating having one.

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Percent of Responses Based on 59 Responses from 28 Airlines

Figure 13. Airborne Data Collection Products Survey Responses

Three responses, categorized as "Other," include those who indicated that they were using Dassault EQAR, Sundstrand QAR (Tape), and TALAS EQAR equipment⁷.

Figure 14 graphs the 44 satisfaction ratings that 20 respondents⁸ reported regarding their various airborne data collection equipment. The majority (84%) rated their satisfaction as average or better, indicating their overall satisfaction with airborne equipment. Only 14% reported satisfaction ratings of fair or poor.

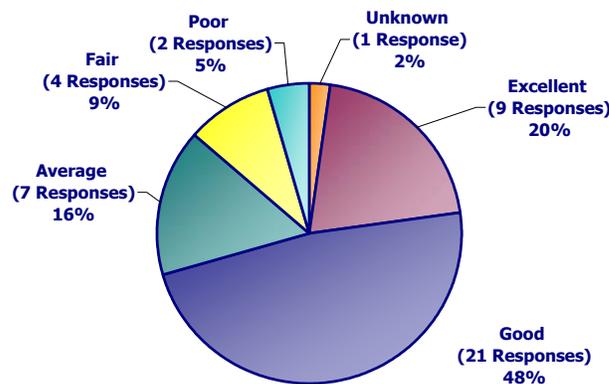


Figure 14. Airborne Data Collection Equipment User Satisfaction

Figure 15 graphs the 28 answers from 25 respondents⁹ to the question, "What data retrieval products are used in your FOQA program?"

⁷ Most of these are legacy systems and the lineage is difficult to trace. For example, for the Dassault EQAR, Dassault Electronique was sold to Thomson-CSF and became Thomson-CSF Detexis. It later became Thales Airborne Systems.

⁸ As noted previously, five survey respondents indicated that their carrier did not have a FOQA program but was investigating having one. This means that ten survey respondents chose not to provide information on airborne data collection products.

⁹ As noted previously, five survey respondents indicated that their carrier did not have a FOQA program but was investigating having one. This means that five survey respondents chose not to provide data retrieval product information.

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Over half of the responses cite manual methods to remove the data from aircraft, and 28% use handheld download units (this included Avionica RSU plus the other hand-held units). Although a relatively new technology, wireless data link methods were cited by 8% of responses.

Two respondents chose “Other” and specified the following hand-held units:

- L3 Communications Portable Interface Unit
- A hand-held unit (did not specify the vendor)

One respondent indicated that the carrier is still determining which product to acquire.

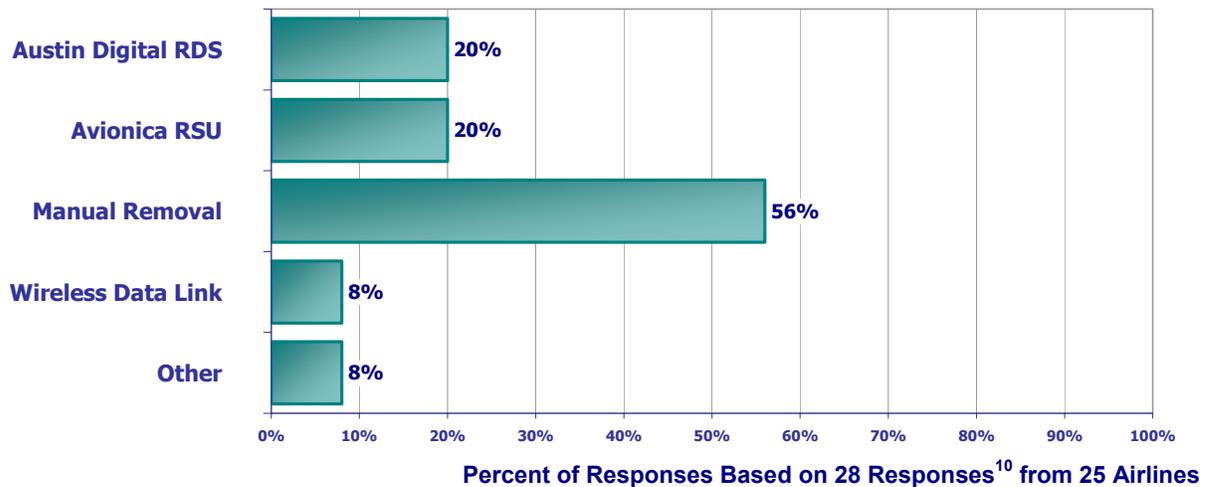


Figure 15. Data Retrieval Products Survey Responses

Figure 16 graphs the satisfaction ratings for the data retrieval equipment from 25 respondents. Over half rated their airline’s chosen equipment as good or excellent. Almost one-third rated their chosen equipment as average, and 16% rated their equipment satisfaction as poor or fair.

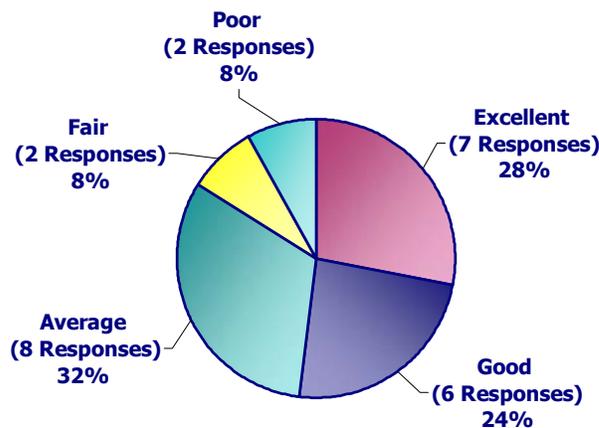


Figure 16. Data Retrieval Equipment User Satisfaction Rating

¹⁰ Percentage total exceeds 100% due to multiple responses.

Figure 17 graphs the 33 multiple answers from 24 respondents¹¹ to the question, "What flight data analysis software products are used in your FOQA program?" The three most cited products cited were:

- SFIM’s Airborne Ground System (38%)
- Austin Digital's Exceedance Measurement System (25%)
- Spirent's Ground Replay and Analysis Facility (25%)

The majority (83%) use Commercial Off-The-Shelf (COTS) software products. Seventeen percent of the responses report in-house-developed flight data analysis software (shown in the "Other-Airline-Developed" category). Four responses cite "Other" products are used, including:

- Avionica's AvScan
- British Airways Safety Information System (BASIS)
- Honeywell software

One respondent reported that their carrier’s flight data analysis product was still being determined. No respondent reported that his/her airline is sending its data to a service provider for analysis.

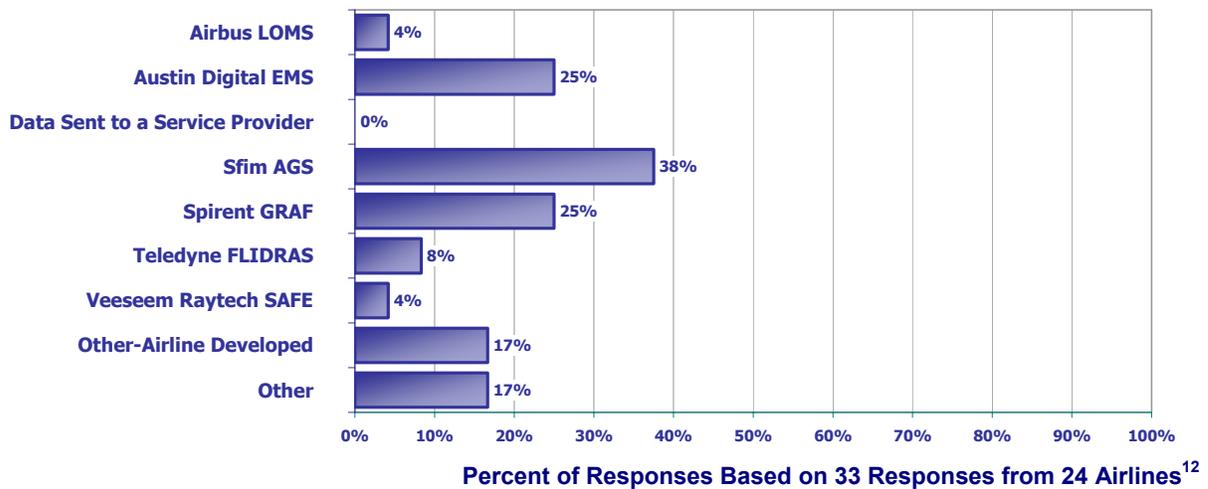


Figure 17. Flight Data Analysis Software Retrieval Products Survey Responses

Figure 18 graphs the 29 flight data analysis software satisfaction ratings from the 24 respondents. Seventy-nine percent rated their software as good to excellent. No one reported dissatisfaction.

¹¹ As noted previously, five survey respondents indicated that their carrier did not have a FOQA program but was investigating having one. This means that six individuals chose not to answer this question.

¹² Percentages exceed 100% due to multiple responses.

FOQA/Flight Data Monitoring Program Survey

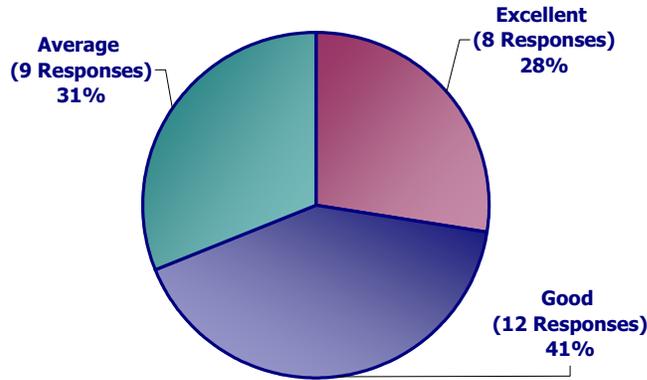


Figure 18. Flight Data Analysis Software User Satisfaction Rating

Figure 19 graphs the 19 responses from 16 respondents¹³ to the question, "What flight animation software products are used in your FOQA program?" Only one flight animation product was reported by each respondent. The most cited products were:

- SimAuthor's FlightViz (42%)
- Spirent's GRAF Vision (26%)

An overwhelming majority of responses (95%) cite COTS products. Five percent use in-house-developed flight animation software (included in the "Other-Airline Developed" category). The three "Other" responses include:

- Airbus' LOMS
- British Airways' BASIS
- An "experiment with Microsoft software"

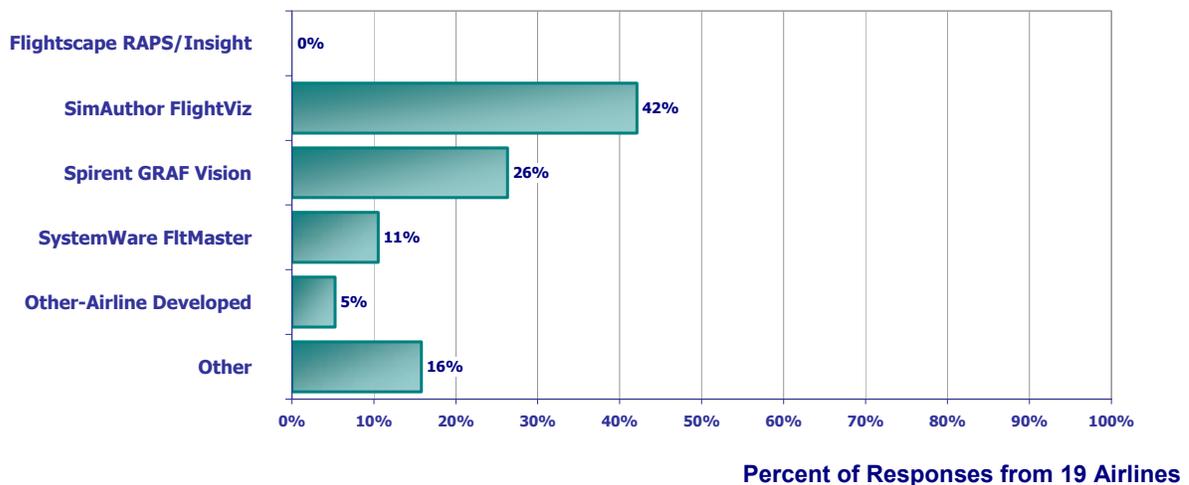


Figure 19. Flight Animation Software Products Survey Responses

¹³ As noted previously, five survey respondents indicated that their carrier did not have a FOQA program but was investigating having one. This means that 14 additional survey respondents chose not to provide flight animation information. Some of the individuals reported "unknown" or "to be determined."

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Figure 20 graphs the flight animation software satisfaction ratings. An overwhelming 88% rated their airline's flight animation software as good or excellent. No product dissatisfaction was reported.

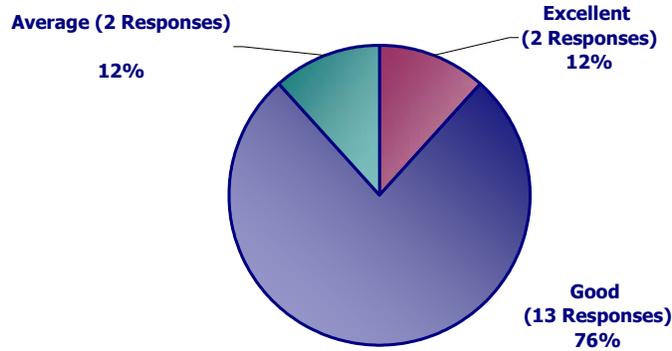


Figure 20. Flight Animation Software User Satisfaction Rating

In response to the question, "What is the number of personnel by function involved in your FOQA program?" 28 respondents¹⁴ placed a number in each category of staffing that applied to their company. Table 3 summarizes this information by both labor category and full/part-time status.

TABLE 3. FOQA PROGRAM STAFFING SURVEY RESPONSES												
FOQA Program Staffing	# of Full-Time Staff						# of Part-Time Staff (< 30 hrs/week)					
Responses	1	2	3	4	5	8	1	2	3	4	5	6
Clerical Personnel (4 responses)		1	1	1			1					
FOQA Analyst (21 responses)	13			2	1	1	1	2		1		
FOQA Manager (23 responses)	18	1					4					
Line Pilot (18 responses)	3		2				2	5	1	3	1	1
Maintenance/Engineering (10 responses)	2	1	1		2		4					
Management/Training Pilot (8 responses)	1						3	2	3			

Eight respondents cited "Other" staffing and provided the following information:

- Two respondents indicated one full-time Intern
- One respondent indicated three full-time Data Systems staff
- One respondent indicated one full-time Programmer
- One respondent indicated one full-time Psychologist
- One respondent indicated two full-time Safety Advisor Specialists
- One respondent indicated two full-time Safety Officers
- One respondent indicated six part-time Event Review Team Pilots & Gatekeeper on a rotating basis

¹⁴ As noted previously, five survey respondents indicated that their carrier did not have a FOQA program but was investigating having one. This means that two survey respondents chose not to answer this question.

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Figure 21 summarizes the percentage of responses citing full and part-time employees by total number of employee staff.

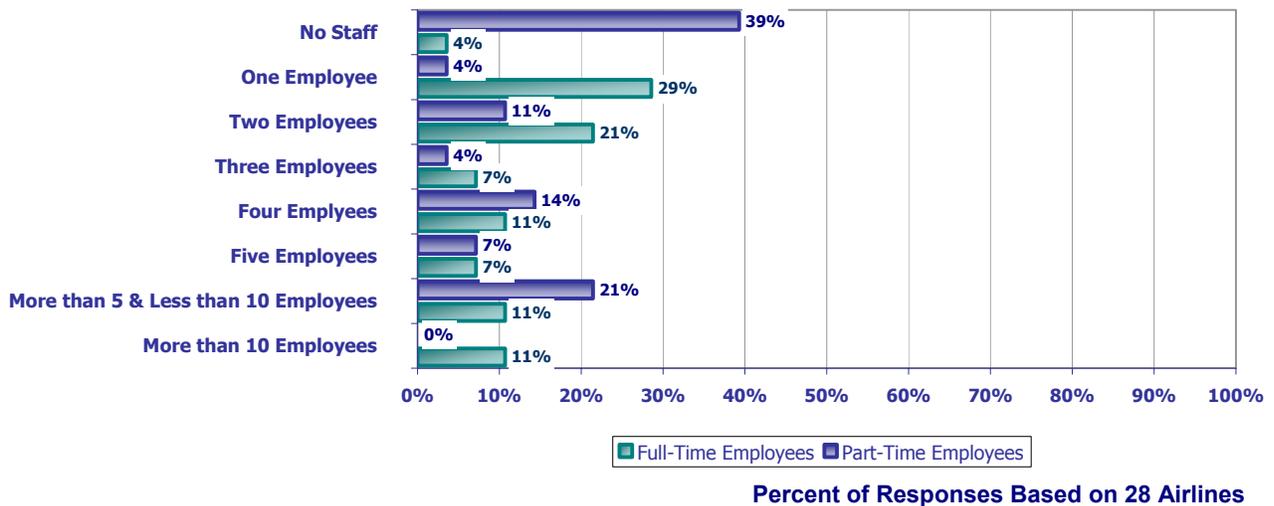


Figure 21. Full and Part-Time Staff Detail

Figure 22 illustrates the breakout of personnel categories for both full- and part-time employees:

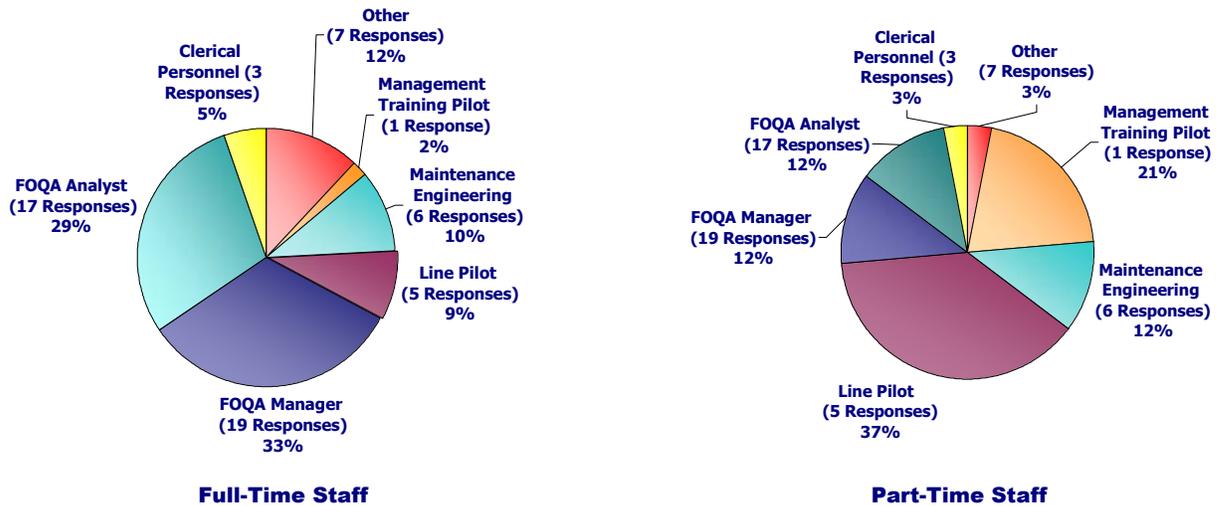


Figure 22. Full- and Part-Time Staff by Personnel Category

With respect to how airlines staff their FOQA program:

- Twenty-three airlines have FOQA Managers, with 78% employing one full-time manager.
- Twenty-one airlines have FOQA Analysts, with 62% employing one full-time analyst.
- Eighteen airlines staff using Line Pilots, with 72% employing one to seven part-time pilots.
- Ten airlines have maintenance/engineering staff for their FOQA programs. Of these, six employ between one and five full-time maintenance/engineering professionals.

- Eight airlines have at least one management/training pilot for their FOQA programs. Of these, seven employ part-time professionals.
- Eight airlines have professional and intern staff (with job titles that vary from those previously mentioned) for their FOQA programs.
- Four airlines have clerical personnel for their FOQA programs. Of these, three employ full-time staff.

Figure 23 graphs the 24 responses¹⁵ to the question, "Which of the following best describes your company's FOQA Program?":

- Over half of the airlines reported their FOQA programs to be productive or highly successful
- One-third described their programs as adequate
- The remainder reported program disappointment or program difficulties

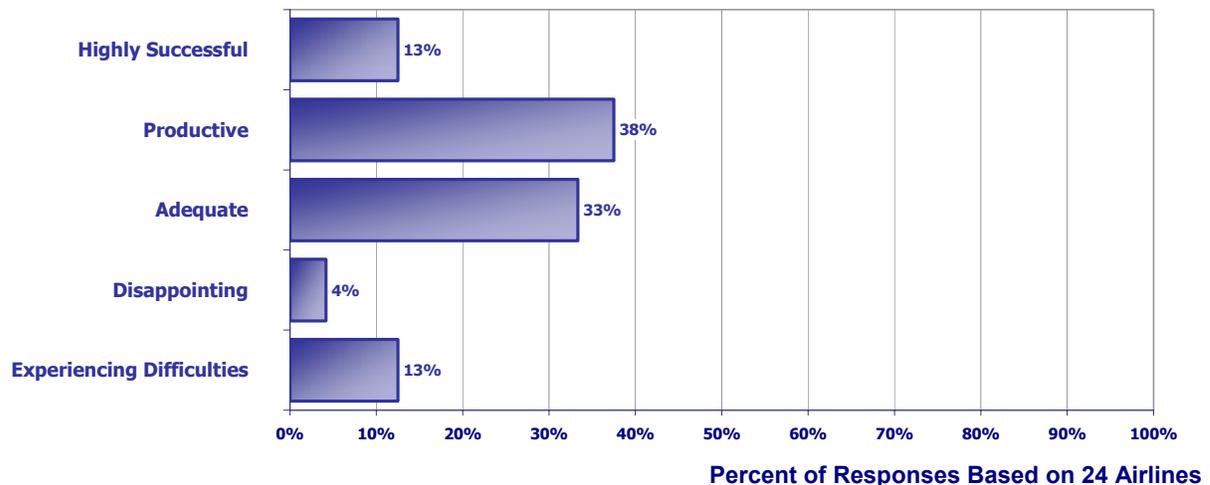


Figure 23. FOQA Program Evaluation

Figure 24 graphs 102 multiple answers from 28 respondents¹⁶ to the question, "Who regularly uses your company's FOQA data in making operational and safety decisions. The results reveal a broad, functional distribution of users of FOQA data:

- Safety (not surprisingly) was the most cited (93%)
- Operations (71%)
- Maintenance/engineering (57%)
- Training (54%)

The three "Other" responses included:

- Schedule & Planning
- A meteorological and hydrologic institute

¹⁵ As noted previously, five survey respondents indicated that their carrier did not have a FOQA program but was investigating having one. This means that six survey respondents chose not to answer this question.

¹⁶ Two survey respondents chose not to answer this question. See footnote 15.

- Weather reports to an academic institute

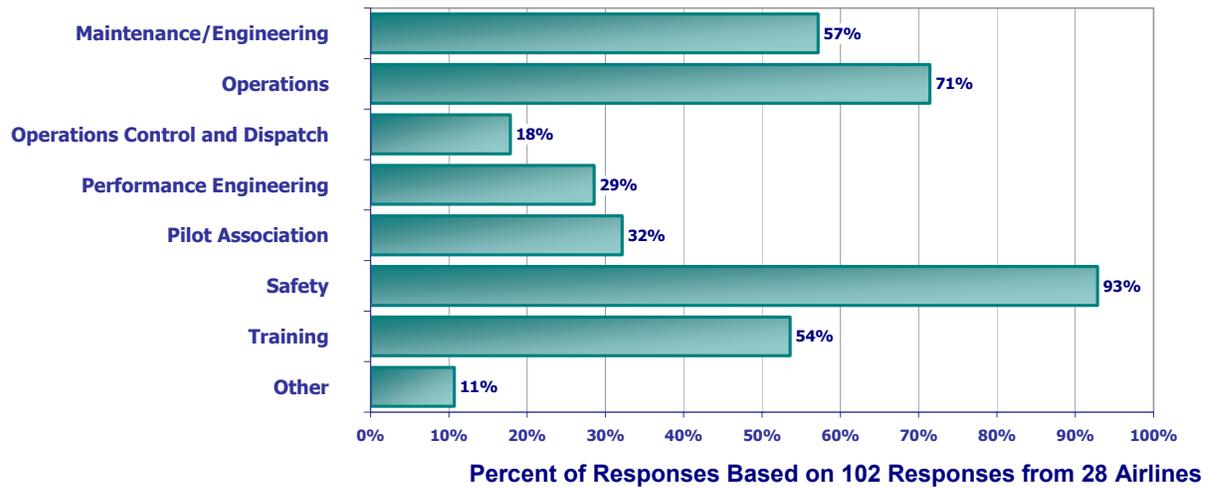


Figure 24. FOQA Data Users

9. FOQA Program Associated Cost & Savings

Figure 25 graphs the 28 responses¹⁷ to the question, "What are your company's annual ongoing FOQA program costs, including equipment and personnel, in U.S. dollars? Key findings include:

- 50% of respondents report an annual budget of less than \$500K, with 25% having an annual budget of less than \$100K.
- 29% of respondents either do not calculate or are unaware of the ongoing costs associated with their airline's FOQA program.
- 22% have annual budgets in excess of \$750K, with 11% exceeding \$1M.

¹⁷ As noted previously, five survey respondents indicated that their carrier did not have a FOQA program but was investigating having one. This means that two survey respondents chose not to answer this question.

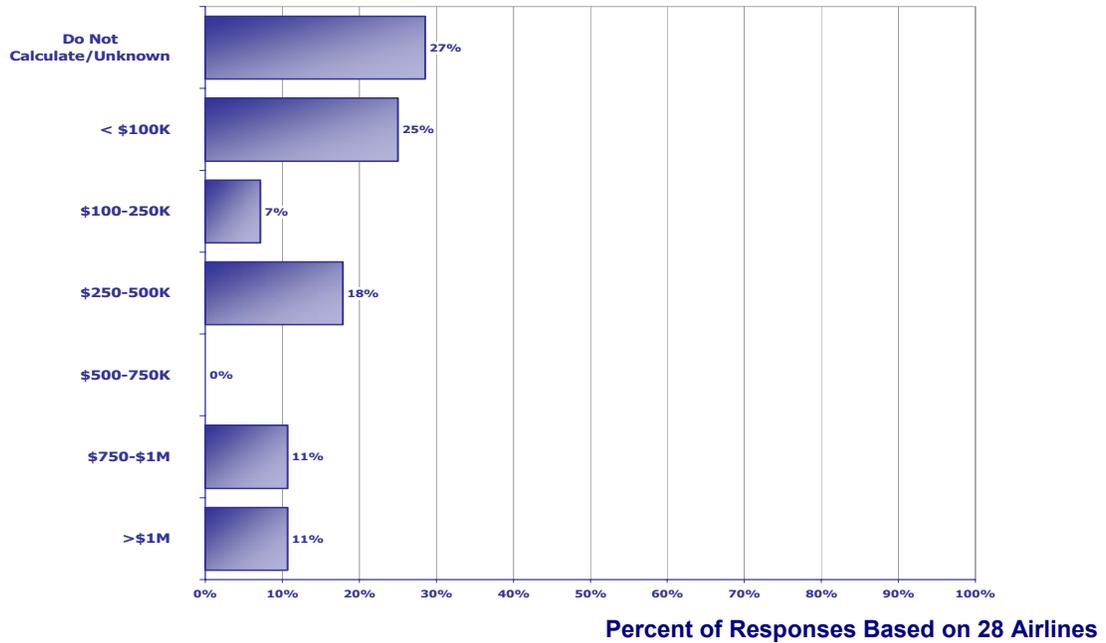


Figure 25. Annual FOQA Program Costs

Figure 26 graphs the 25 responses¹⁸ to the question, "What do you estimate is the annual cost savings/cost avoidance (in U.S. dollars) from safety improvements that are a result of your company's FOQA program?"

Over three-quarters of respondents do not calculate or do not know the safety improvement cost savings achieved by their FOQA program. Of the six respondents who do calculate, 12% have achieved savings greater than \$750K, and another 12% achieved savings in the \$100-500K range.

One respondent noted that his/her annual estimate of cost savings/cost avoidance was assumed for when the airline's FOQA program will be fully up and running. It was extrapolated from the limited program use seen to date by the respondent.

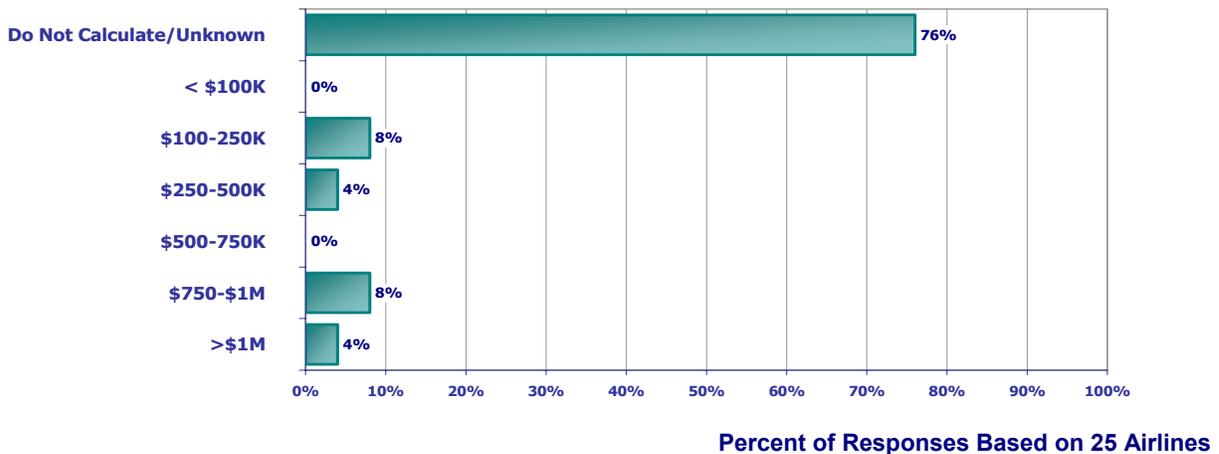


Figure 26. Annual Costs Savings from Safety Improvements

¹⁸ As noted previously, five survey respondents indicated that their carrier did not have a FOQA program but was investigating having one. This means that five survey respondents chose not to answer this question.

Figure 27 graphs the 27 respondents¹⁹ to the question, "What do you estimate is the annual cost savings/cost avoidance (in U.S. dollars) from improvements in operational efficiency (maintenance support, fuel savings, ATC charges, etc.) that are a result of your company's FOQA program?"

Mirroring the findings of the previous question, 74% of respondents do not calculate or do not know the cost savings that are being achieved with their FOQA program as related to operational efficiencies.

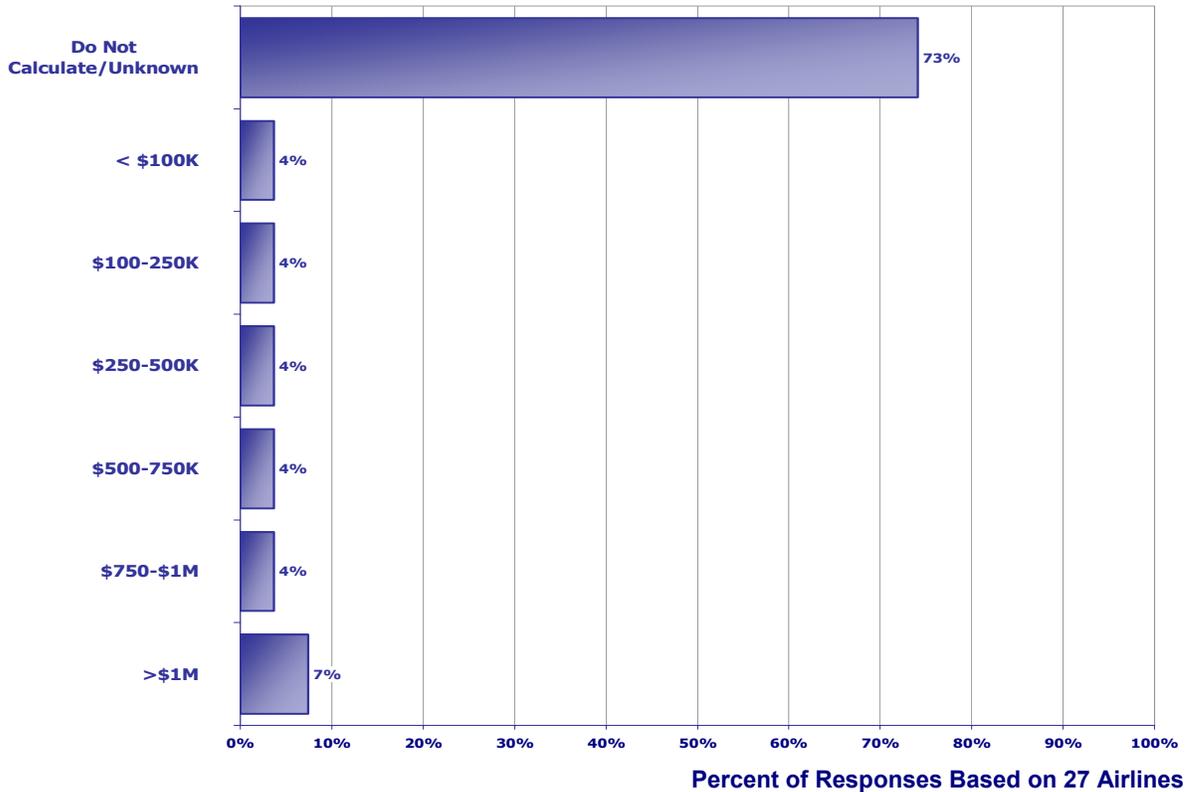


Figure 27. Annual Costs Savings from Operational Efficiencies

10. FOQA and Regulators

The questions in this section were only provided to the international airlines. This is because in the United States, the FOQA Rule (<http://www1.faa.gov/avr/arm/foqa.htm>), per 14 CFR Part 13 and effective 30 November 2001, indicates that FOQA is currently a voluntary program and requires "air carriers participating in approved FOQA programs to submit aggregate FOQA data to the FAA for use in monitoring safety trends." Amendment 26 to ICAO Annex 6 Part 1, paragraph 3.2.3 introduced an international standard that "from 1 January 2005, operators of an aeroplane of a maximum certified take-off mass in excess of 27,000 kg shall establish and maintain a flight data analysis program as part of its accident prevention and flight safety program."

Figure 28 graphs all 16 responses to the question, "Is FOQA currently mandatory in your country?"

¹⁹ Three survey respondents chose not to answer this question. See footnote 18.

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Figure 29 graphs all 16 responses to the question "Will FOQA become mandatory in your country in 2005 because of changes made to ICAO Annex 6?" 87% of the respondents report that currently, FOQA is not mandatory in their country and 49% indicate that it will become mandatory in 2005 based on ICAO Annex 6.

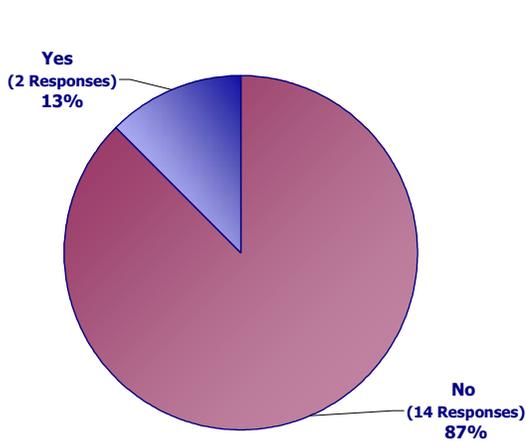


Figure 28. Current Mandatory FOQA Regulation

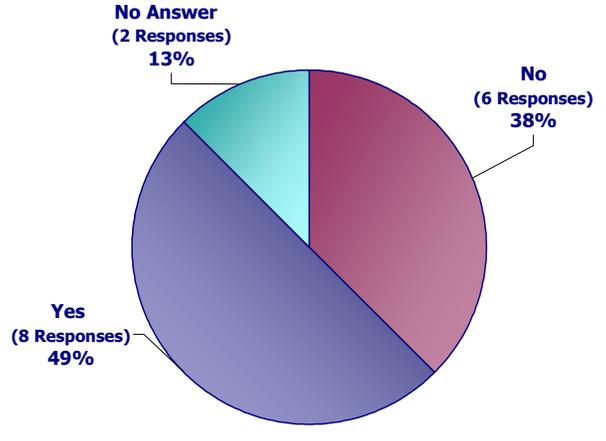


Figure 29. Mandatory FOQA Per ICAO Annex 6

Figure 30 graphs all 16 non-U.S. airline responses to the question, "Are FOQA data provided to civil aviation regulatory authorities (CAA)?" Currently, only one respondent indicated that his/her airline's FOQA data is provided to the regulator.

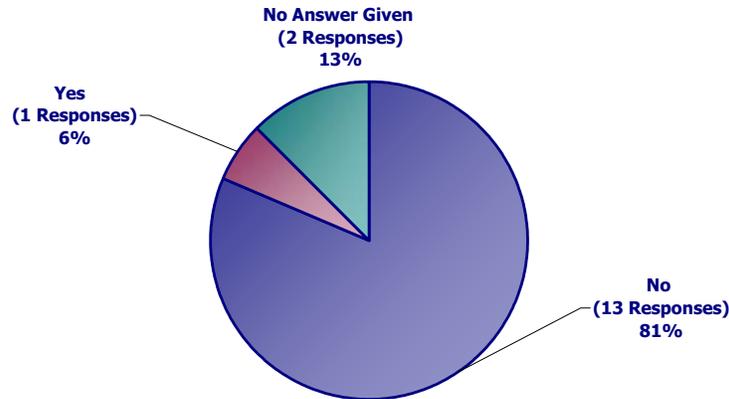


Figure 30. FOQA Data Provided to CAA

11. FOQA Program Communication

This section focuses on how information about an airline's FOQA program is communicated within the airline. While a variety of methods are used to convey information about FOQA methods, not surprisingly the survey found that the most effective methods are those that include sight, sound, and direct employee contact. The following pages provide detailed information about the specific communication methods employed.

Starting on the next page, Figures 31 and 32 graph the 102 multiple responses from 20 respondents²⁰ to the two-phased question, "How does your company educate and communicate FOQA information to your pilots, and how do you rate the effectiveness of these methods?"

Taken individually, the most widely cited communication vehicles were:

- Safety Bulletins (100%)
- Flight Operations Bulletins (85%)
- Direct to Pilots (cited by 80%)

It must be must be pointed out, however, that looked at from an overall communications standpoint, three major categories of responses were cited:

- Printed materials (brochures, newsletters, booklets)
- Posted and recorded materials (on websites, videos, and bulletin boards)
- Personal contact (briefings, trainings, and conversations).

Viewed from this perspective, the three specific communications vehicles deemed most *effective* (this includes extremely and very effective categories) include:

1. Recurrent training presentations (63%)
2. Video/flight animation distribution (51%)
3. Direct contact with pilots (44%)

The "Other" measure (Figure 31) reflects the respondents who checked the communication method but wrote in something other than one of the five standard effectiveness ratings, including:

- "De-identified safety case studies to management," rated as effective.
- Specified that "pilots are encouraged to come and monitor the analysis program" but no effectiveness rating was supplied.
- Specified "inclusion of "FOQA Alerts" in Jeppesen 10-7 pages" and rated this as extremely effective.

²⁰ As noted previously, five survey respondents indicated that their carrier did not have a FOQA program but was investigating having one. This means that ten survey respondents chose not to answer this question.

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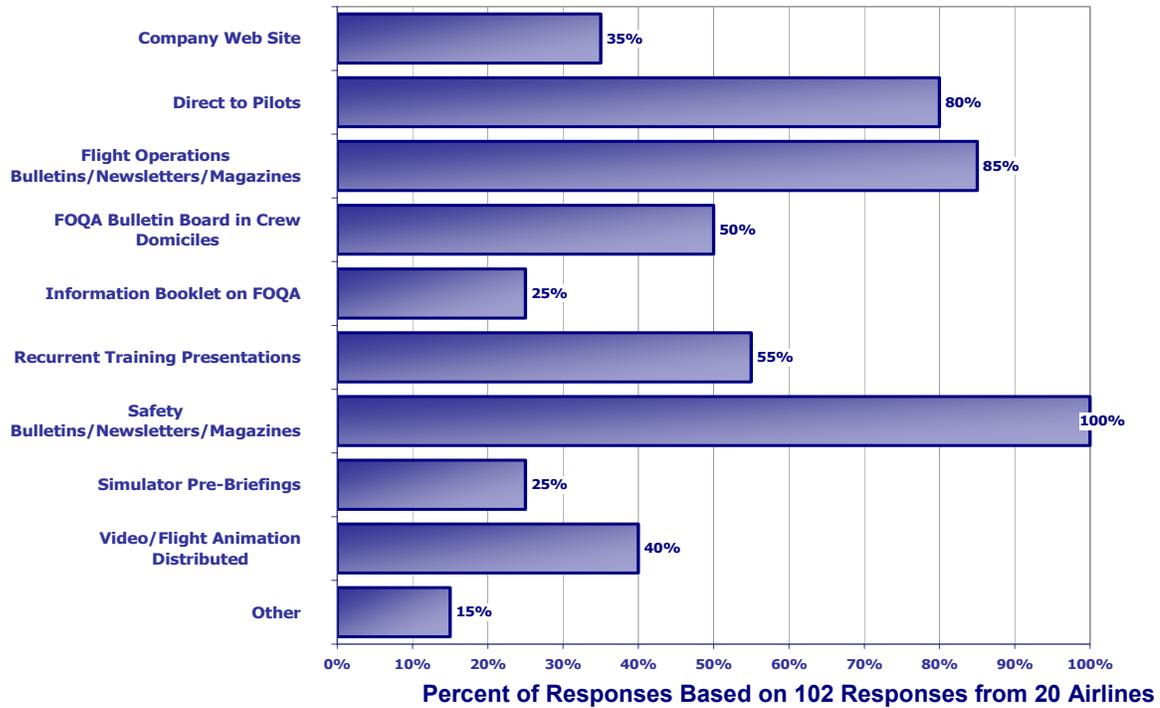


Figure 31. FOQA Education and Communication Methods

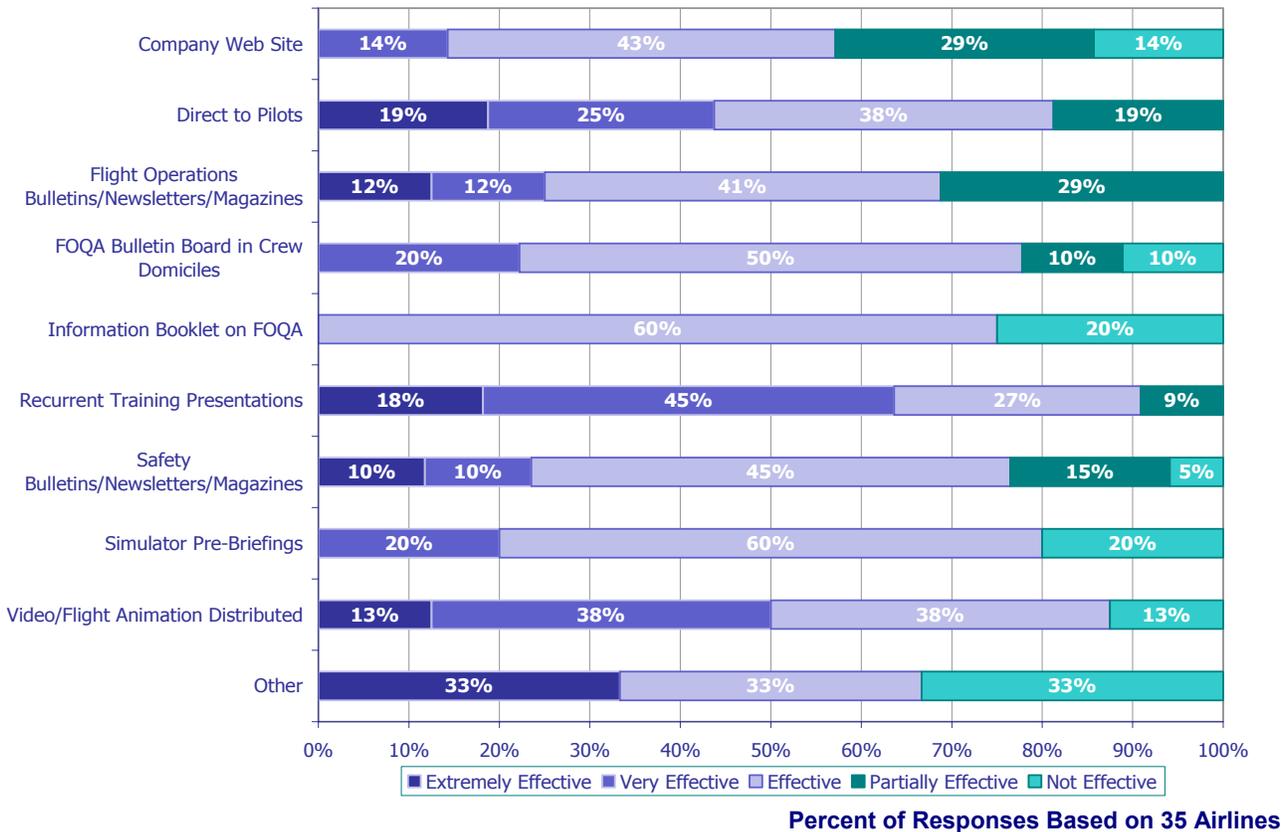
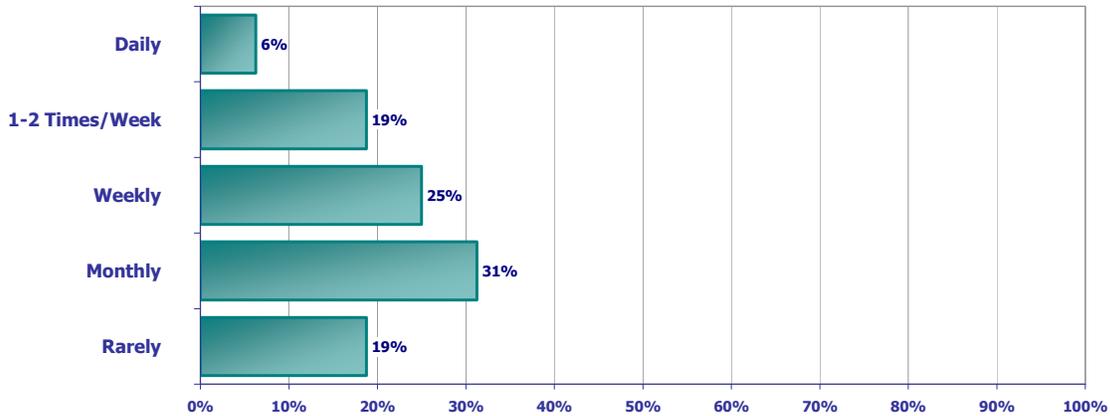


Figure 32. Effectiveness Ratings of FOQA Education and Communication Methods

Figure 33 graphs the 16 responses²¹ to the question, "How often does your company use flight animation?" Of those who regularly use flight animation, more than half use it at least weekly. Two airlines reported that they rarely use their flight animation software.

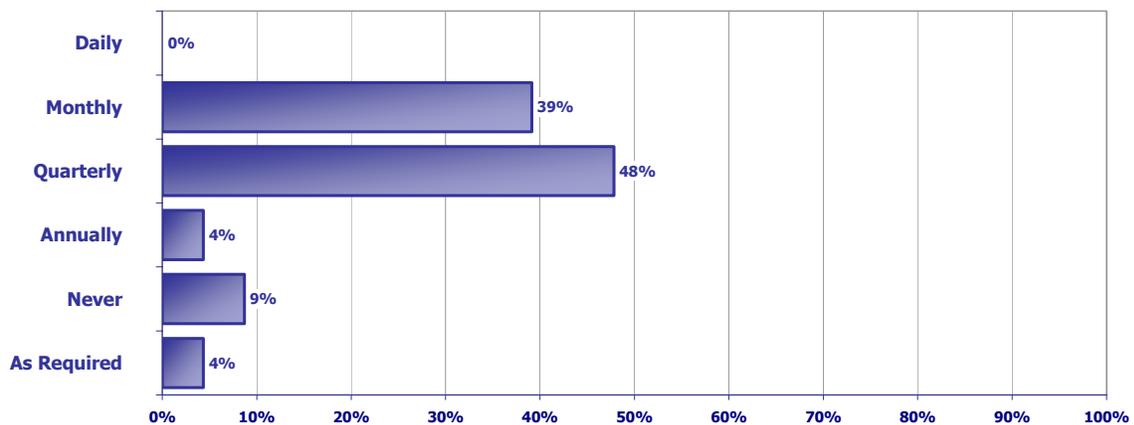


Percent of Responses Based on 16 Respondents

Figure 33. Flight Animation Frequency

Figure 34 graphs the 24 multiple responses from 23 respondents to the question "How frequently does your company produce routine FOQA reports?" The remaining 12 airlines did not supply any information for this question or indicated that the question was not applicable since their program had not yet been implemented. Findings:

- Quarterly reports (49%)
- Monthly reports (39%)
- Never generate routine reports (9%)



Percent of Responses Based on 24 Responses from 23 Respondents

Figure 34. Routine FOQA Report Frequency

²¹ As noted previously, five survey respondents indicated that their carrier did not have a FOQA program but was investigating having one. Twelve airlines responded to this question with "Not Applicable" and did so primarily because flight animation software had not been acquired for their program or because their airline's program was still under development.

Figure 35 graphs the 22 responses received to the question, "How much time is spent producing your routine FOQA reports?"²² Half of the airlines require two days or less to produce their reports with the other half requiring more than two days.

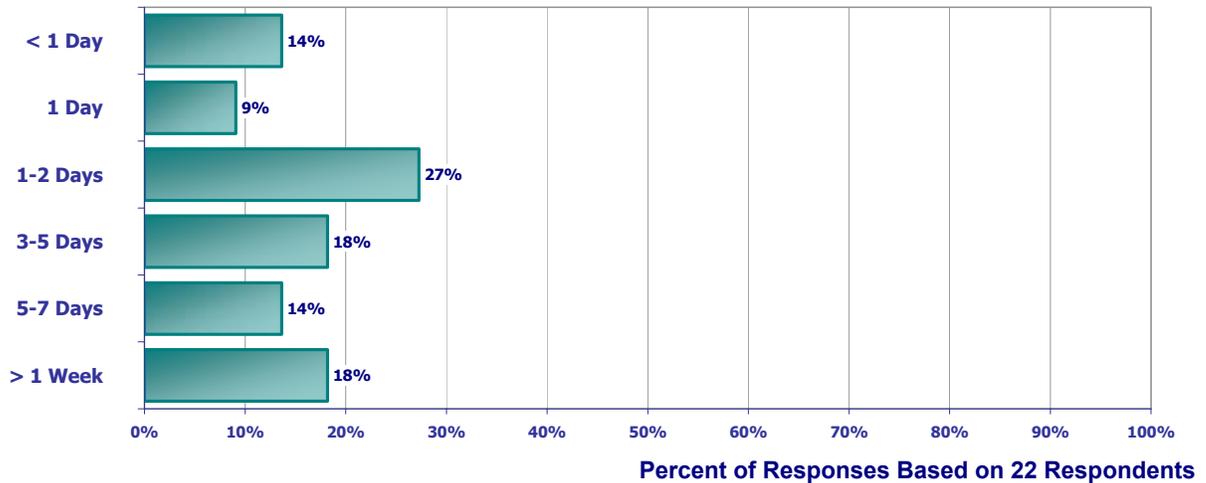


Figure 35. Routine FOQA Report Production Time Requirements

12. Summary Questions

Questions in this section were open-ended so answers would be provided in the actual words of each respondent. Where possible, similar responses have been grouped into major themes. The responses were also edited -- both for clarity and de-identification.

12.1 Suggestions to Improve FOQA Programs

This section summarizes responses to the request, "Please describe one item that you feel would significantly improve FOQA programs." Thirty respondents supplied suggestions regarding areas where they felt that FOQA can be improved. Where numbers appear in parentheses, it indicates the multiple responses paraphrased within the theme. When asked to provide suggestions for improving FOQA programs, the key areas cited provides are summarized in the table below along with the number and percentage of respondents who supplied suggested improvements for each theme.

Verbatim Theme	# of Responses
Simplification and automation of data retrieval logistics, and the availability of wireless technology to facilitate this process.	7 (23%)
➤ A “magic box” and/or better data transmission methods to get the data from the aircraft to the FOQA flight data analysis software [this software is frequently referred to in the U.S. as a Ground Data Replay and Analysis System (GDRAS)] and FOQA processing facility (3).	

²² Eleven respondents chose not to answer this question. Of these, five of their airlines either do not currently have, or are investigating the development of a FOQA program. The two respondents who cited "Not Applicable" indicated that their program was still under development. One respondent indicated that their reports are pre-formatted and that all of the work is in the initial set up.

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Verbatim Theme	# of Responses
<ul style="list-style-type: none"> ➤ Wireless/Cellular transmission of data technology at an affordable rate (< 10 cents (USD) per flight hour) to ease the maintenance burden of downloading data (3). ➤ Remote download and data transfer. 	
Data and information sharing and associated legislative issues, include:	5 (17%)
<ul style="list-style-type: none"> ➤ Stronger legislative protective provisions to enable FOQA data to be exchanged between air carriers worldwide. ➤ Legislation clearly protecting FOQA programs from disclosure from any governmental agency requests and the public. ➤ Elimination of confusion regarding data sharing and access by external agencies. ➤ Effective information sharing between carriers. FAA at a national level only needs limited information that is globally (nationally) significant and is 100% de-identified by carrier and flight. ➤ National and international laws regulating the confidentiality and non-punitive protection. 	
Ground Data Replay and Analysis Systems (GDRAS) features and capabilities.	5 (17%)
<ul style="list-style-type: none"> ➤ Multiple flight track displays. ➤ Establish new FOQA analysis software. ➤ Industry standardized event sets. ➤ Coordinated work regarding parameters and data that can be captured from the aircraft and used in a mature FOQA Program. We have found that many items we wish to explore are not possible as the data is not available or has not been mapped for capture. While much work appears to have gone into picking good quality GDRAS units, not much has been accomplished respecting data maps and sharing of this information. Further, manufacturers are not forthcoming with information leading to the resolution of data capture problems as this is often seen as a source of revenue for them. ➤ Advanced analytical tools. 	
Flight Animation.	4 (13%)
<ul style="list-style-type: none"> ➤ Introduce flight animation in our FOQA program (3). ➤ Simple cost-effective animation module. 	
Miscellaneous Comments:	4 (13%)
<ul style="list-style-type: none"> ➤ Continued increase in management awareness of FOQA's potential value. ➤ Unstable approach. ➤ Improved staffing for data mining/analysis. ➤ Improvement in flight operations. 	
Pilot agreements and their Involvement in the Program.	3 (10%)
<ul style="list-style-type: none"> ➤ An agreement with our pilot association. ➤ The goal of FOQA is to improve flight safety. In achieving it, it is essential to obtain pilot's 	

Verbatim Theme	# of Responses
<p>understanding on FOQA data and FOQA activities. If the pilots understand the importance of FOQA, it becomes possible for them to review their flights with reference to the FOQA information. By incorporating the environmental information, which is voluntarily and positively provided by the pilot, the FOQA information becomes much more meaningful.</p> <ul style="list-style-type: none"> ➤ Contractual agreement with a Pilots’ Union in order to be able to identify and talk to pilots personally at the moment an incident happens. Non-punitive FOQA system. Only FOQA analysts should be allowed to do “identified” data analysis. All these mechanisms are established in our FOQA system. 	
Program costs and the Cost-Justification Process.	2 (7%)
<ul style="list-style-type: none"> ➤ Reduce the cost impact of acquiring data collection and analysis systems...they don’t compete well. ➤ Justification (economic and otherwise) of program: changes made, dollars saved, safety enhancements effected, etc. 	

12.2 Challenges to FOQA Program Effectiveness

This section summarizes the responses to the question, "What do you feel is the key challenge in having an effective FOQA program?" Thirty-three respondents supplied information regarding the challenges to effective FOQA programs that are summarized in the table below.

Verbatim Theme	# of Responses
Organizational challenges	11 (33%)
<ul style="list-style-type: none"> ➤ Setup, including establishing procedures and ensuring everyone within the company is on board with the program. ➤ Creating cooperation among different departments to find joint solutions; communicating across disciplines. ➤ Politics. ➤ Getting around all the red tape and using the data to save lives without fear of micro-management. ➤ To secure the effective use of FOQA information in the company, the organization or a human system is very important as well as the aircraft or the ground computer system. There are two areas. One is a people’s body to feedback the information obtained from the FOQA data bank, and the other is to maintain FOQA. The point is to establish a cooperative work by various people in the company. ➤ Producing useful products and quantifying contribution to safety and efficiency. ➤ Ensuring that the program remains “no blame, safety structured” and not disciplinary by nature. ➤ Getting the trust and cooperation from all parties involved. ➤ Company/crew/union buy in and participation. ➤ In an existing program, keeping the enthusiasm and importance of the program at a high level. For our airline, it has become a routine part of the corporation and has lost some of its emphasis on safety. We have become complacent with our program. 	

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Verbatim Theme	# of Responses
Pilot Involvement Challenges	9 (27%)
<ul style="list-style-type: none"> ➤ Pilot’s acceptance. ➤ An effective agreement with pilot union/association. (2) ➤ Convincing the pilots that it is a non-punitive system. ➤ An effective pilot’s agreement and their Union FOQA program goals and understanding. ➤ The buy-in from the pilot union, and the confidential relationship between union and management. ➤ Talk to the pilots as soon as an incident occurs. Discuss the data together and search for the causes together. ➤ Provide regular feedback to the fleet chiefs in order that common trends can be communicated via bulletins or trends can be taken into consideration for training syllabi. ➤ Good corporate and FAA relationships with the pilots. Mutual trust is the key to getting the most from FOQA. The Europeans seem to be ahead of the United States in FOQA utilization. The European FOQA model voluntarily exercises the requisite tact and discretion that the North American model requires by intricate legal agreements arduously obtained. It’s ironic that Europe is known for traditionally stiffer labor relationships. 	
Analysis Software Challenges	3 (9%)
<ul style="list-style-type: none"> ➤ Establish new FOQA analysis software. ➤ The ability to produce meaningful information in a form that actually helps the intended user to the point where they can implement changes that have an actual impact. ➤ Data presentation. 	
Challenges Related to Acquiring the Requisite Resources	3 (9%)
<ul style="list-style-type: none"> ➤ The key challenge for us has always been, and continues to be, adequate funding. Funding is dependent on showing benefits – but safety benefits are difficult to quantify. ➤ Getting it funded. ➤ Overcoming internal resistance to expend the funds. Technical Services feels they get adequate data from the aircraft and training and standards remain unconvinced of the program’s utility. As such, it remains a struggle to justify the costs to a point where savings and efficiencies can be demonstrated. 	
Communication Challenges	2 (6%)
<ul style="list-style-type: none"> ➤ Communication. ➤ Pilot and stakeholder communication. 	
Miscellaneous Challenge	2 (6%)
<ul style="list-style-type: none"> ➤ Information-sharing with the regulator. ➤ In our case, we are not started as we have long felt “New airplanes are coming. Let’s do it then. We’ll have all the parameters and all the goodies to do it right.” Since this is in slow motion, we started ASAP instead and are now renewing our interest in FOQA. 	

12.3 Other Respondent Verbatim

This section summarizes responses to the question, "Do you have any other comments you would like to add? If so, please state them here." Most of the verbatim supplied by 12 respondents were about FOQA programs in general and its associated technologies.

Some respondents indicated that they were unable to answer all of the questions because they are just beginning to acquire and install the equipment and begin wide-scale collection of flight data, or were beginning trial programs to perform rudimentary data analysis. The responses provided were based on test data and evaluation procedures which have been in-place for some time, and which will be part of their initial program SOPs.

Verbatim Themes (5)

- FOQA has the potential to support a much greater array of applications, such as Maintenance Operational Quality Assurance (MOQA) and Systems Operational Control Quality Assurance (SOCQA). The potential for these applications are limited to the GDRAS capability, which is why it is so critical to acquire the appropriate GDRAS. Specifically, the advent of off-the-shelf software, for a fraction of the cost of current visualization programs, should be able to do the trick.
- Support was expressed for industry meetings and symposia that serve as great sources for information and communications between the air carriers and their regulators concerning FOQA program development. These forums are particularly helpful for those who are in the early stages of their FOQA programs because they facilitate exchanging ideas, discussing problems, and reaching solutions.
- It will take quite some time before the flight crew start accepting this program without suspicion.
- FOQA policies and procedures should always be subject to a formal agreement between the airline and pilot group.
- FOQA is a great idea in theory, however, it is almost impossible to execute as a second-tier carrier.