Cabin Crew Fire Training Needs Analysis

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June 2017

Final Report

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Technical Report Documentation Page

1. Report No. DOT/FAA/AM-17/11	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Cabin Crew Fire Training Needs Analysis		5. Report Date June 2017
		6. Performing Organization Code
7. Author(s) McLean CL, Weed DB, Paskoff LN, Ruppel DJ, McLean GA		8. Performing Organization Report No.
9. Performing Organization Name and Address FAA Civil Aerospace Medical Institute P.O. Box 25082 Oklahoma City, OK 73125		10. Work Unit No. (TRAIS)
		11. Contract or Grant No.
12. Sponsoring Agency name and Address Office of Aerospace Medicine Federal Aviation Administration 800 Independence Ave., S.W. Washington, DC 20591		13. Type of Report and Period Covered
		14. Sponsoring Agency Code

15. Supplemental Notes

This work was performed under task PRS-12

16. Abstract

The degree to which cabin crew are prepared for firefighting events is a variable in transport aviation, as airlines have different firefighting training programs for their crews. The expertise provided by these programs has not been previously studied for U.S. airline cabin crew. A training needs assessment has been developed by RGW Cherry and Associates, Ltd., for the U.K. Civil Aviation Authority, which was intended to identify training program deficiencies and suggest potential improvements to in-flight firefighting competency. The fire training needs analysis has been applied by Cherry to international crew members and replicated here for U.S. cabin crews and training instructors. A questionnaire was used to measure the participants' perceptions of the adequacy, content, and realism of their firefighting training, for which cabin crew training instructors were expected to rate their training programs higher than crew members (flight attendants).

Cabin Crew Training Instructors did indeed rate all aspects of their firefighting training higher than did Cabin Crew with one exception: the effect of training intervals on crews' retention, for which both groups showed an average rating of 0.13 (range -2.0 to +2.0). Overall, the lowest ratings were given to the adequacy of training to prepare crew members for dealing with multiple fires at the same time, and the fidelity of the fire and smoke conditions used during training. The greatest discrepancies in ratings were the perceived adequacy of the firefighting training with regard to passenger management during an in-flight fire and the relevance of scenarios used during training. The highest ratings were given to the procedures taught during training, as well as the adequacy to equip crew members to extinguish visible fires, and the similarity of training equipment to onboard equipment.

17. Key Words Cabin Crew, In-flight Fires, Training, Human factors	18. Distribution Statement Document is available to the public through the Internet: http://www.faa.gov/go/oamtechreports/		
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 42	22. Price

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

ACKNOWLEDGMENTS

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CABIN CREW FIRE TRAINING NEEDS ANALYSIS

In 1983, a fire was detected on Air Canada Flight 797, en route from Dallas, TX, to Montreal, Quebec, Canada. A passenger noticed a strange odor, a cabin crew member discovered smoke in an aft lavatory, and another crew member noted that the smoke was coming from between the lavatory wall and ceiling panels. Although no flames were seen, one of the cabin crew members discharged a carbon dioxide (CO_2) fire extinguisher toward the panels and the trash bin, and then closed the lavatory door. The first officer went to the back of the passenger cabin to assess the situation, but could not get to the lavatory because of the smoke. By the time he got back to the cockpit, the smoke appeared to be clearing, which he announced to the captain. He returned to the lavatory and found the door to be hot to the touch. He hurried back to the cockpit, telling the captain, "I don't like what's happening, I think we better go down, okay?" During the emergency descent, smoke increased, filled the cabin, and entered the cockpit. After the McDonnell Douglas DC-9 landed at Greater Cincinnati International Airport, the cabin crew initiated an emergency evacuation. Twenty-three of the passengers were not able to get out of the plane before they died when the cabin burst into flames. The airplane was destroyed. The National Transportation Safety Board (NTSB) found that the underestimation of the fire severity, conflicting fire progress updates to the captain, and the flight crew's delay in making the emergency descent all contributed to the accident.

In response, the NTSB noted that the rapid response of flight and cabin crews to fire and smoke was critical to accident survival and recommended proper training to quickly recognize and assess conditions associated with an in-flight fire and to take immediate and aggressive action to locate and extinguish the fire. Its recommendations to the Federal Aviation Administration (FAA), following the accident investigation, were intended to provoke earlier fire detection and improve procedures and equipment for flight and cabin crews to combat cabin fires. Safety Recommendation A-84-076 referred specifically to training programs (NTSB/AAR-84/09):

> Require that Air Carrier Principal Operations Inspectors (POIs) review the training programs of their respective carriers and, if necessary, specify that they be amended to emphasize requirements:
>
> - For flight crews to take immediate and aggressive action to determine the source and severity of any reported cabin fire and to begin an emergency descent for landing or ditching if the source and severity of the fire are not positively and quickly determined or if immediate extinction is not assured.
> - For cabin crews to recognize the urgency of informing flight crews of the location, source, and severity of any fire or smoke within the cabin.
> - For both flight and cabin crews to be knowledgeable of the proper methods of aggressively attacking a cabin fire by including hands-on-training in the donning of protective breathing equipment, the use of the fire ax to gain access to the source of

the fire through aircraft interior panels which can be penetrated without risk to essential aircraft components, and the discharge of an appropriate handheld fire extinguisher on an actual fire.

Blake (1999) conducted tests to evaluate the ability of cabin crew to extinguish cargo fires in small Class B cargo (cabin-level) compartments, defined in Title 14 Code of Federal Regulations Part 25.857 (14 CFR 25.587) as a cargo/baggage compartment in which (1) there is sufficient access in flight to enable a crew member to effectively reach any part of the compartment with the contents of a hand fire extinguisher; (2) when the access provisions are being used, no hazardous quantity of smoke, flames, or extinguishing agent will enter any compartment occupied by the crew or passengers; and (3) there is a separate approved smoke detector or fire detector system to give warning at the pilot or flight engineer station. Blake found that it took *trained* cabin crew participants an average of 50.5 seconds (range 30 – 89 s) to don protective breathing equipment (PBE), and they were unable to successfully extinguish a fire in a typical Class B compartment with two 2.5-lb. Halon 1211 extinguishers. Furthermore, opening the compartment access door allowed products of combustion into the occupied areas of the cabin, especially when the door was left open during retrieval of the second extinguisher from the front of the airplane. The study participants remarked that more realistic firefighting training would be very valuable as their training had not prepared them to do what they were asked during the study. Blake concluded that improved training procedures would help prepare crew members to more effectively fight in-flight cargo compartment fires.

In a later review of commercial aviation accidents involving in-flight fires that occurred between 1983 and 2000, the NTSB (2002) again identified safety issues involving crew training, which often lacked instruction in how to identify the location of hidden fires and how to gain access to areas behind the interior wall/ceiling panels; also, recurrent training lacked drills fighting actual or simulated fires. Consequently, the NTSB made further Safety Recommendations to the FAA regarding crew member training:

- Issue an advisory circular (AC) that describes the need for crew members to take immediate and aggressive action in response to signs of an in-flight fire. The AC should stress that fires are often hidden behind interior panels and, therefore, may require a crew member to remove or otherwise gain access to the area behind interior panels in order to effectively apply extinguishing agents to the source of the fire. (A-01-083)
- Require POIs to ensure that the contents of the AC (recommended in A-01-83) are incorporated into crew member training programs. (A-01-084)
- Amend 14 CFR 121.417 to require participation in firefighting drills that involve actual or simulated fires during crew member recurrent training and to require that those drills include realistic scenarios on recognizing potential signs of, locating, and fighting hidden fires. (A-01-085)

- Issue a flight standards handbook bulletin to POIs to ensure that air carrier training programs explain the properties of Halon and emphasize that the potential harmful effects on passengers and crew are negligible compared to the safety benefits achieved by fighting in-flight fires aggressively. (A-01-087)

In response, the FAA developed AC 120-80 (2004) "In-flight Fires," which addressed a number of concerns and specifically discussed knowledge- and skill-based objectives for training programs. The importance of crew members taking "immediate and aggressive action" to locate and extinguish in-flight fires was stressed in numerous paragraphs within the AC. A revision to 14 CFR 121.417 requiring firefighting drills during recurrent training was not made, however.

On July 12, 2013, crossed battery wires under the battery cover plate of an emergency locator transmitter (ELT) on board an Ethiopian Airlines Boeing 787 Dreamliner initiated thermal runaway of the five lithium-metal battery cells. The resulting slow-burning fire damaged a section of the rear fuselage crown skin, fuselage stringers, and thermo-acoustic insulation blankets. Fortunately, at the time of the fire, the aircraft was parked, unpowered, and unoccupied at London Heathrow Airport.

About 25 minutes after entering the aircraft cabin, the airport Rescue and Fire Fighting Service (RFFS) firefighters were able to extinguish the fire, the location of which was difficult to identify and access. The ELT was installed in the attic area above the passenger cabin ceiling, mounted on a bracket between two fuselage frames, surrounded by insulation blankets. The firefighters moved into dense smoke in the aft cabin and observed "indications" of a fire in a gap between two overhead bins, then discharged a handheld Halon extinguisher into the gap. They removed ceiling panels to expose flames in the area and extinguished them with water from a hose-reel.

The United Kingdom Department for Transport Air Accidents Investigation Branch (AAIB) concluded that, should that type of fire ignite during flight, it would be difficult for the cabin crew to locate the source of the "non-visible" fire because the aircraft's environmental control system (ECS) would distribute the smoke and fumes away from the hidden fire. Once identified, the crew would have to remove a ceiling panel and stand on a seat or arm-rest in order to fight the fire at its source. Without specific training, it would be challenging for a crew member to fight an ELT fire on an aircraft configured like the Ethiopian Airlines B-787 aircraft. (See AAIB Aircraft Accident Report 2/2015.) The manufacturer's Flight Attendant Manual (FAM) incorporated a section on "Lithium Battery Fires" after the incident. Except for describing potential difficulties in the report, the AAIB safety recommendations did not address crew member in-flight firefighting training.

The December 2014 revision of AC 120-80 (Rev. A) occurred in response to the NTSB recommendations following the investigation of United Parcel Service Flight 6 accident on September 3, 2010, in the United Arab Emirates. A cargo fire on the main cargo deck severely damaged the flight control systems, filling the upper deck and cockpit with smoke, impairing the ability of the crew to operate the aircraft. The supplemental oxygen supply ceased without

warning, incapacitating the Captain. Both flight crew members were fatally injured and the airplane was destroyed by impact and post-crash fire. Recommendations to the FAA (NTSB, 2011), and subsequent modifications to the AC, focused on safety issues related to flight crew training, the use of oxygen masks, maintaining communications with crew members wearing oxygen masks, oxygen mask stowage, lithium battery fires, and hidden fires.

Aviation safety experts and accident investigators tend to agree that the occurrence of a fire while in flight is one of the most "horrific" experiences one can encounter, mostly because there is no escape from the threat of disaster except to fight the fire. Fortunately, the incidence of in-flight fires in the last decade has decreased, and survivability when fire accidents do occur has increased, due, in part, to the aircraft improvements "implemented through the regulatory process resulting from research conducted by the Federal Aviation Administration" (FAA, Sarkos, 2011). In-flight-fire threats still linger; however, as some of the more subtle causes of in-flight fires are wiring failures, electrical component failures, lightning strikes, bleed air leaks, and faulty circuit protection. These problems may be associated with aging aircraft, although new aircraft are loaded with more on-board high-tech systems that require an abundance of wiring, often the source of smoke and fire behind wall panels and above ceiling panels. Potentially explosive lithium and lithium-ion batteries also have a strong new presence onboard aircraft, both as cargo and for powering aircraft systems and electronic equipment carried by passengers and crew, including tablets used in lieu of seat back monitors and credit card readers.

The FAA Office of Security and Hazardous Materials Safety reported that, as of January 15, 2016, there had been approximately 171 air cargo or passenger baggage incidents recorded since March 20, 1991, involving smoke, fire, extreme heat, or explosion from batteries or battery-powered devices. The FAA Flight Standards Service continues to issue Safety Alerts for Operators (SAFOs) to inform operators about the dangers associated with lithium batteries (e.g., SAFO 16001, SAFO 10017). The FAA further prohibits the transport of loose lithium batteries and battery-operated e-cigarettes in passenger checked baggage. Several airlines have also banned hoverboards or drones as carry-on or checked baggage (i.e., portable electronic devices [PEDs] with lithium ion batteries) due to the volatile nature of the batteries even when installed in the equipment. As recently as March 16, 2016, an electronic cigarette ignited in a passenger's carry-on backpack during boarding, delaying the flight out of Hartsfield-Jackson Atlanta International Airport. The fire was extinguished and there was no damage to the airplane. The airline's policy is to permit electronic cigarettes onboard, "Battery-powered portable electronic smoking devices (e.g., e-cigarettes, e-cigs, e-cigars, e-pipes, e-hookahs, personal vaporizers, electronic nicotine delivery systems), when carried by passengers or crew members for personal use, must be carried on one's person or in carry-on baggage only. Recharging of the devices and/or the batteries on board the aircraft is not permitted" (ABC News, 2016).

The actions of the flight and cabin crew members are the first and main lines of defense when in-flight fires occur. As such, it is essential that the crew members are fully prepared with

the appropriate skills to handle any in-flight fire threat. Moreover, the flight and cabin crew must act together as rapidly as possible to deal with emergency situations.

The degree to which cabin crew are prepared for firefighting events is a variable in transport aviation, as airlines have different firefighting training programs for their crews. Instruction in handling in-flight fires is required as part of crew member training (14 CFR 417(b)(3)(ii) Crew member Emergency Training). Additional guidance regarding the hazards and risks of in-flight fires and training is provided in Air Carrier Operations Bulletin 230 (ACOB; No. 01-94-29), AC 120-80A (2014) In-flight Fires, and Flight Standards Information Management System (FSIMS, Order 8900.1) Volume 3 General Technical Administration Chapter 23 Flight Attendant and Qualification Programs.

In 2007, the United Kingdom Civil Aviation Authority (UK CAA, 2009) commissioned a study to identify crew training program deficiencies and to suggest potential improvements to in-flight firefighting competency, to "ensure that cabin crew have the most appropriate skills to fully match current and future fire threats." RGW Cherry and Associates, Limited, conducted an assessment of the views and experiences of flight and cabin crew members through an online survey, which invited cabin crew, flight crew, safety trainers, and other interested parties, to comment on perceived deficiencies in fire training and make suggestions for improvement. Survey questions were "intended to gauge participants' perception of their firefighting training and record any problems that might have been encountered by those who had been involved in fighting an in-flight fire." The survey consisted of (a) 5 background information questions; (b) 13 rating-scale-type items, which asked respondents the degree to which they agreed with statements (Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree): 5 related to adequacy and content of fire training, 5 related to realism of practical fire training, and 3 related to procedures taught in fire training; and (c) 4 opinion/experience questions (2008).

Although 2,164 responses were received from 66 countries across Europe, Asia Pacific, Africa, North and South America, the detailed analysis by Cherry was limited to responses from the UK (76%). Respondents were asked if they had witnessed an in-flight fire, been involved in fighting an in-flight fire, or had no experience with in-flight fires. Nine percent of the UK respondents had some kind of in-flight fire experience (i.e., witnessed or been involved in fighting an in-flight fire). The experience information was then used to group the remaining responses. In general, respondents without in-flight fire experience rated their training higher than respondents with in-flight fire experience. Some respondents without experience stated that it was difficult for them to assess the adequacy of their training since they had no knowledge of actual in-flight fire conditions. Respondent comments also emphasized concerns about a) the lack of criteria by which to measure crew member proficiency in firefighting skills, b) insufficient emphasis on urgency of response to in-flight fire and smoke during both theoretical and practical training, c) the lack of an established standard for fire training instructors resulting in a high degree of variability in instructors' training skills, and d) a lack of in-flight firefighting procedures for single cabin crew operation.

This study replicated the RGW Cherry and Associates study, but focused on Cabin Crews and Cabin Crew Training Instructors (Occupation) from Major, Regional, and Corporate U.S. operators (Operator Type) rather than Fire Experience. Operators were categorized into Major, Regional, or Corporate, according to the number and location of routes flown and the types of aircraft within the fleet. Instructors were expected to rate training higher than Cabin Crew.

METHOD

Participants

Attendees of workshop activities at the FAA Civil Aerospace Medical Institute (CAMI) were asked to voluntarily complete the research questionnaire. Of the 248 participants, 174 were crew members or instructors (pilots and maintenance crew not included). Of those, 43% were Cabin Crew, 57% were Cabin Crew Training Instructors (N = 74, 100, respectively). Eighty-eight percent (N = 65) of the Cabin Crew participants had no experience with in-flight fires; 12% (N = 9) had at least some experience whether they had witnessed a fire or had been involved in fighting the fire. Similarly, 92% (N = 92) of the Instructors had no experience with in-flight fires; 8% (N = 8) had some experience. The frequency distribution among operators is shown in Table 1.

Table 1. Frequency Distribution of Respondents				
Operator Type	**Occupation**	**No In-flight Fire Experience (N)**	**Some In-flight Fire Experience (N)**	**Total**
Major	Cabin Crew	24	5	29
	Instructor	35	4	39
Regional	Cabin Crew	29	3	32
	Instructor	52	3	55
Corporate	Cabin Crew	12	1	13
	Instructor	5	1	6
Total		157	17	174

Materials

Individual's Consent to Voluntarily Participate in a Research Project (Appendix A) was used to describe the study and to collect informed consent from participants prior to distribution of the questionnaire.

Research participants used a paper-form questionnaire, "Cabin Crew Fire Training Information" (Appendix B), to record their opinions and comments about the adequacy, content,

and realism of their in-flight firefighting training. The questionnaire consisted of: (a) 3 background questions (Items 1, 2, and 3); (b) 13 five-point Likert-scale items, which asked respondents the degree to which they agreed with positive statements (Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree): 5 related to adequacy and content of fire training (Block 7), 5 related to realism of practical fire training (Block 8), 3 related to procedures taught in fire training (Block 11); and (c) 5 opinion/experience questions (Items 4, 5, 6, 9, 10, and 12). Spaces for additional comments were distributed throughout the questionnaire.

Procedure

After an introductory presentation was made in a classroom setting, the study was described to the workshop attendees and consent form was reviewed by a researcher. Those who volunteered to participate in the study exchanged the signed consent form for the questionnaire, which took about 10 minutes to complete. Discussion among the participants was discouraged. Questionnaires were collected and workshop activities continued.

RESULTS

Data were obtained regarding the duration, adequacy, realism, and procedures related to in-flight firefighting training. Some participants also provided additional comments related to perceived problems with training, equipment, actual firefighting, etc.

All data screening and statistical analyses were performed using IBM SPSS® Statistics Version 21. Prior to analysis, the questionnaire data were examined for accuracy of data entry. "Not Applicable" responses and missing data cases were not included in the analysis.

The chi-square (χ^2) test was used to assess relationships between categorical variables (e.g., Occupation v Degree of Agreement [Opinion] with statements). Cramér's Phi (Φ_C) coefficient was calculated to assess the strength of relationship (measure of association) between the variables (range 0 to +1.00).

For the Likert-scale items regarding training adequacy, realism, and procedures taught (Blocks 7, 8 and 11), rating averages were calculated as the weighted average of the responses (for a group) using Cherry's procedure. Values were assigned to each point on the response scale as follows, creating an interval scale better suited for further analysis:

Strongly Disagree = -2

Disagree = -1

Neutral = 0

Agree = 1

Strongly Agree = 2

The rating average of group responses (e.g., Cabin Crew v Instructors, Major v Regional v Corporate) provided an overall indication of the group's attitude or opinion about each item. The

rating values were also used in analysis of variance (ANOVA). While these data do not strictly meet the assumptions for ANOVA, this is an acceptable practice among survey researchers (Labovitz, 1970; SPSS, 2001).

Level of Fire Experience

The degree to which participants agreed with the training statements for all items was shown to be independent of their level of fire experience (no experience/some experience). Because of the low number of participants with real fire experience (and the likelihood of violating the assumption of normality for small expected frequencies for chi-square analysis), the results for Level of Fire Experience will only be shown for the Duration of Fire Training items to provide a direct comparison with Cherry's findings.

Duration of Fire Training

Duration of theoretical training. Although more participants without fire experience reported that the duration of theoretical fire training (Item 4) was sufficient (69.4%), compared with those having some amount of fire experience (52.9%), the lack of fire experience was not shown to be statistically associated with participants' opinion about time spent on theoretical training (Figure 1). There was a substantial percentage of participants in each group who reported that they thought the duration of theoretical training was too short. No one considered theoretical training to be too long. In addition, no relationship was found between Operator Type or Occupation and participant responses to the theoretical training question. "I don't know" responses were only reported by participants without fire experience.

From the comments received on the subject, those who considered theoretical training to be too short thought that there was too much material covered without adequate time being given to it. While some participants reported that their fire training has become more scenario-based, others commented that they wanted more varied scenarios and role-playing included in their training. Those who outsourced their training were generally satisfied with theoretical fire training that they received. Some participants reported the content of their training:

> *"We outsource our initial fire training…and it is very thorough. (Corporate Instructor)*

> *"It is mostly reading accident scenarios and using extinguishers to simulate extinguishing a fire." (Regional Instructor)*

> *"We spend 2 hours in the classroom and 1 hour hands-on." (Regional Instructor)*

Duration of practical training. Similarly, fire experience was not shown to be associated with participants' opinion about the duration of practical training (Item 5), but more participants in both groups reported that they thought practical training time was too short (Figure 2). Again, "I don't know" responses were only reported by cabin crew participants without fire experience. No one considered practical training to be too long. As with the theoretical training, no relationship was found between Operator Type and participant responses to the practical training item. However, a greater percentage of Cabin Crew reported that they considered practical

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training to be too short (64.7%) compared with Instructors (49%), shown in Figure 3, resulting in a statistically significant association between Occupation and responses about the duration of practical training, $\chi^2(2, N = 174) = 9.87$, $p < .01$ (Cramér's $\Phi_C = .24$).

The comments received show a general dissatisfaction in the content of practical training. The following are some comments made by participants who rated the duration of practical training as too short:

> *"None in recurrent. Addressed in initial. Recurrent is pretend." (Regional Cabin Crew, No experience)*

> *"Process you in and out. Don't really check to make sure you are comfortable." (Major Cabin Crew, no experience)*

> *"We put out one fire, in a controlled environment without stress factors, during initial only." (Major Cabin Crew, no experience)*

> *"There is NO practical. It is all mock." (Regional Cabin Crew)*

> *"We don't have capabilities for practical training, i.e., cabin trainer." (Regional Instructor)*
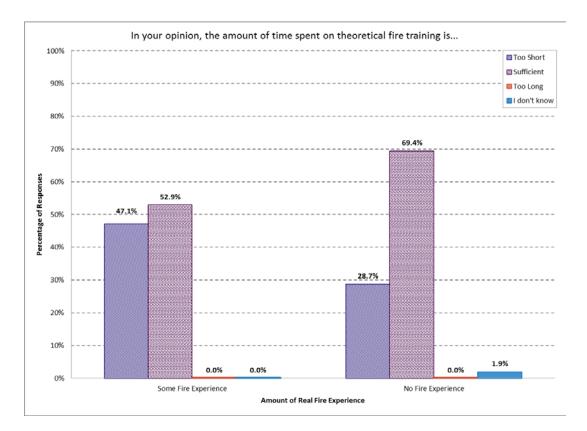

Figure 1. Participant responses about duration of theoretical fire training according to real fire experience.
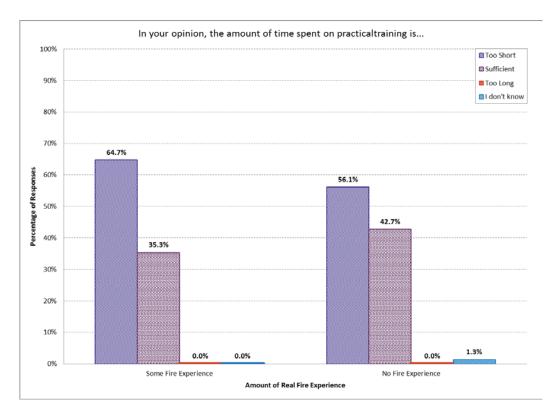
Figure 2. Participant responses about duration of practical fire training according to real fire experience.
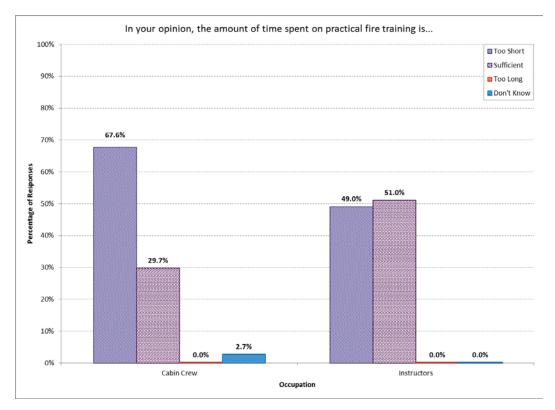

Figure 3. Participant responses about duration of practical fire training according to Occupation.

Adequacy of Training

Participant responses to all Adequacy of Training items (Block 7) were shown to be independent of the Operator Type for which they worked. Cabin Crew and Instructor rating averages for each Adequacy of Training statement are shown in Table 2. In general, the average ratings were higher from Instructors than from Cabin Crew, with one exception, i.e., effect of training intervals on crews' retention, where the average ratings were equal. The lowest ratings were given to the adequacy of the training to prepare crew members for dealing with multiple fires at the same time. The greatest discrepancy in ratings between Cabin Crew and Instructors was the perceived adequacy of the firefighting training with regard to passenger management during an in-flight fire. The adequacy of fire training to equip crew members to extinguish visible fires was rated highest, overall.

Table 2. Adequacy of Fire Training			
	Mean Rating		
Block 7 Statements	**Cabin Crew**	**Instructors**	**Difference**
The fire training equips crew members to extinguish a fire behind the cabin panels.	-0.38	0.15	0.53
The fire training equips crew members to extinguish any fire visible in the cabin.	1.00	1.34	0.34
The training for the management of passengers in the event of in-flight fire is adequate.	-0.07	0.56	0.63
The fire training equips crew members to deal with multiple fires occurring at the same time.	-1.07	-0.80	0.27
The time between practical fire training sessions is such that crew members remember everything taught in the training within that period.	0.13	0.13	0.00

Training for fire behind cabin panels. There was no significant relationship between participants' Occupation or Operator Type and their responses regarding the training to extinguish a fire behind cabin panels (i.e., hidden fires). Figure 4 shows the distribution of responses, categorized by Operator Type and Occupation. Major and Regional Operator Cabin Crew expressed the strongest disagreement, with Cabin Crew ratings ($M = -0.38$) lower than Instructor ratings ($M = 0.15$), in general. Participants in Cherry's study rated hidden fire training higher, with a rating average of 0.40 overall, compared to -0.16 overall rating average from participants in this study.

Some of the comments provided by participants who answered "Strongly Disagree" or "Disagree" reinforce their responses:

"Practical training on hidden fires is insufficient and significantly lacking!" (Cabin Crew)

"I have never received proper training for fighting fires behind cabin panels." (Cabin Crew)

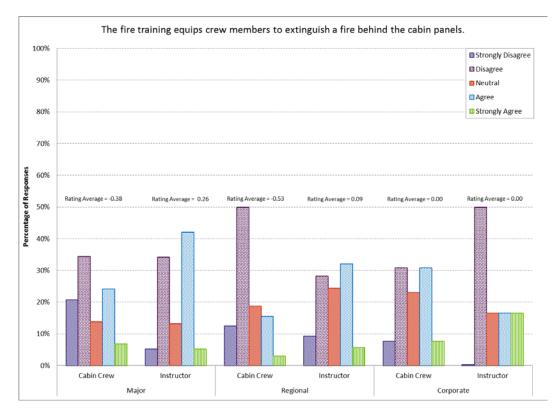*"Never shown how to pull off panels on A/C."* (Cabin Crew)

"I have never tried a behind panels fire as an exercise." (Instructor)
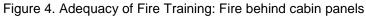
"We cover behind panels only in theory or role-play. No actual requirement to remove the panel." (Instructor)

"Practical training on hidden fires is significantly lacking. Training in identifying hidden fires is very poor." (Cabin Crew)

Training for any fire visible in the cabin. Participant responses were strongly positive regarding the adequacy of training for fires visible within the cabin, especially among the Instructors (Figure 5). Participants' responses were significantly associated with their Occupation, χ^2(4, N = 174) = 14.07, p < .01 (Cramér's Φ_C = .28). Rating values were examined with a 3 x 2 (Operator Type x Occupation) ANOVA, confirming a significant main effect of Occupation, F(1, 168) = 12.79, p < .01. Cabin Crew ratings (M = 1.00) were lower than Instructors (M = 1.34), overall.

Training for management of passengers. Participant responses were generally positive about the adequacy of training for managing passengers during an in-flight fire, except among Major and Regional Cabin Crew who disagreed more with the statement and had the lowest average ratings than the other groups (Figure 6). Participants' responses were significantly associated with their Occupation, χ^2(4, N = 173) = 15.34, p < .01 (Cramér's Φ_C = .30). Rating values were examined with a 3 x 2 (Operator Type x Occupation) ANOVA, confirming a significant main effect of Occupation, F(1, 167) = 4.51, p < .05. Cabin Crew (M = -0.07) ratings were lower than Instructors (M = 0.56), in general.

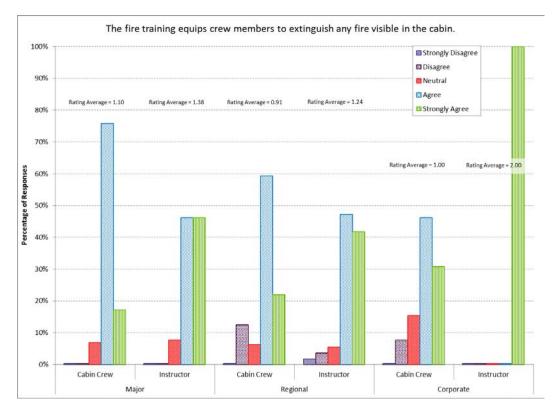Figure 4. Adequacy of Fire Training: Fire behind cabin panels

Figure 5. Adequacy of Fire Training: Visible fire in cabin

Comments from Cabin Crew who disagreed most about the adequacy of training for managing passengers showed that this is a topic that may not be included in training programs:

"I have never received proper training for passenger management."

"We don't emphasize moving pax when fighting fires."

"We have no scenarios that involve passengers. We are told what to do to help them in case of an onboard fire." (Major Instructor)

However, single crew members are common among corporate and regional operators, making management of passengers essential:

"I'm training single crew members and pilots (sometimes without cabin crew member) and stress the management of passengers because there are no other crew members to help with this." (Corporate Instructor)
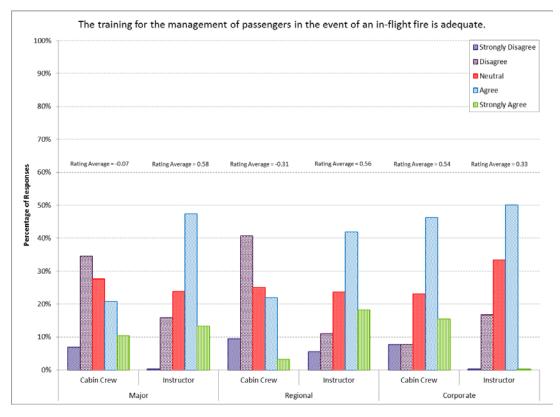

Figure 6. Adequacy of Fire Training: Management of passengers

Training for simultaneous, multiple fires. Cabin Crew and Instructors expressed overall negative responses regarding the adequacy of training for simultaneous, multiple fires with Major and Regional Cabin Crew having the lowest rating averages (Figure 7), but there were no significant associations shown between participant responses and their Occupation or Operator

Type. Overall, however, Cabin Crew (*M* = -1.07) ratings were lower than Instructor (*M* = -0.80) ratings.

This statement did generate the most comments:

> *"Never thought of two fires at the same time." (Instructor)*

> *"Training to fight multiple fires at the same time would be helpful." (Cabin Crew)*

> *"Some of our aircraft have only one FA, so we may not be able to handle multiple fires without help from ABPs." (Instructor)*

> *"Multiple fires is an overlooked yet highly probable scenario that isn't often covered." (Instructor)*

Adequacy of the frequency of practical fire training. When asked about the frequency of practical fire training (Item 6), more than half of all participants (52.3%) reported annual practical fire training and 20.1% reported training every 2 years. A few received practical training every 3 years. Interestingly, 21.3% selected "Other" and accompanying comments indicated that their practical fire training occurred only during initial training. (The response distributions for each Operator Type are shown in Figure 8.) This information was used in conjunction with their responses to adequacy of training frequency.
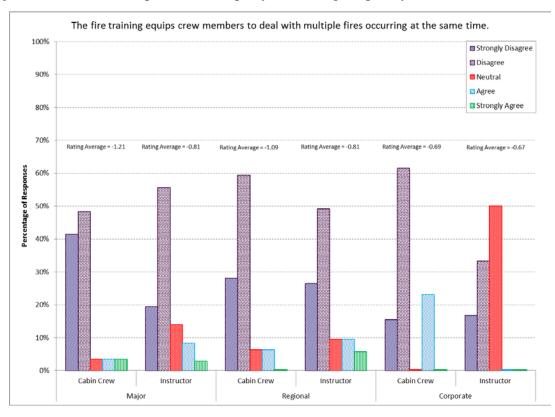

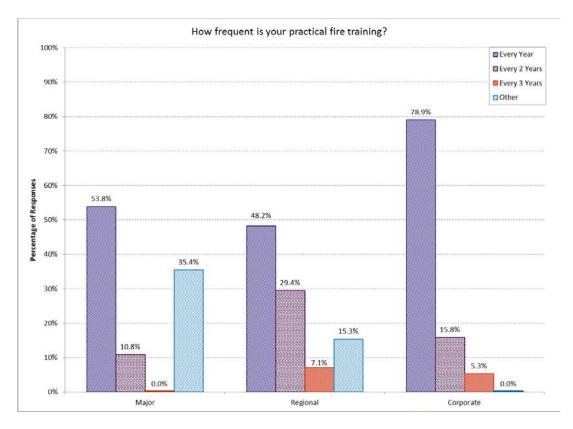Figure 7. Adequacy of Training: Simultaneous, multiple fires

Figure 8. Frequency of Practical Fire Training

Effect of training intervals on crews' retention. Cabin Crew and Instructors did not differ significantly in their responses. Figure 9 shows that those who had annual practical training believed they retained what they were taught better between training events. The lowest rating was seen in the "Other" category, the majority of those cases having practical training only during initial training. There were only 7 reports of practical training every 3 years, the majority from the Regional operators. The overall rating averages were the same for Cabin Crew and Instructors, $M = 0.13$.
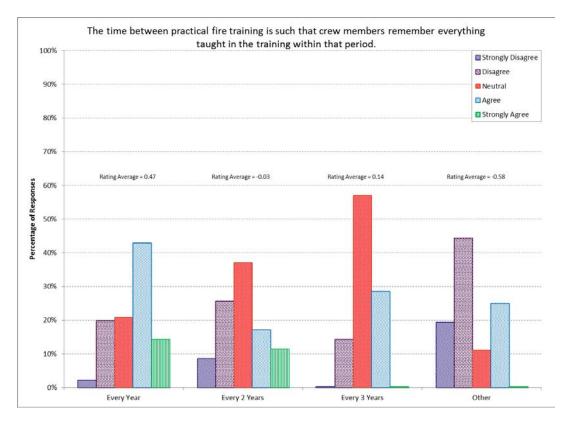
Figure 9. Adequacy of Training: Intervals between practical training sessions

Realism of Practical Fire Training

Cabin Crew and Instructor rating averages for each Realism of Practical Fire Training statement are shown in Table 3. Instructor ratings for agreement with each statement averaged higher than Cabin Crew ratings. Overall, the lowest ratings were given to the fidelity of smoke and fire conditions experienced during training. The greatest discrepancy in ratings between Cabin Crew and Instructors was for the relevance of firefighting scenarios used during training. The similarity of the equipment used during training compared to equipment onboard was rated highest.

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Table 3. Realism of Practical Fire Training			
	Mean Rating		
Block 8 Statements	**Cabin Crew**	**Instructors**	**Difference**
The fire conditions experienced during training are realistic.	-0.58	-0.01	0.57
The equipment used in fire training is similar to the equipment on board the actual aircraft.	1.20	1.46	0.26
Firefighting scenarios carried out during training are relevant to aircraft operation.	0.21	0.86	0.65
The smoke conditions experienced during training are realistic.	-0.49	-0.36	0.13
Fire training is carried out in a facility sufficiently representative of an aircraft cabin.	-0.49	-0.09	0.40

Realism of fire conditions during training. Both Operator Type and Occupation were significantly associated with the participant responses, $\chi^2(8, N = 173) = 16.20$, $p < .05$ (Cramér's $\Phi_C = .31$) and $\chi^2(4, N = 173) = 10.22$, $p < .05$ (Cramér's $\Phi_C = .24$); see Figure 10. Rating values were examined with a 3 x 2 (Operator Type x Occupation) ANOVA, confirming significant main effects for Operator Type and Occupation, but no interaction effects, $F(2, 167) = 6.39$, $p < .01$. and $F(1, 167) = 11.54$, $p < .01$. The Major ($M = -0.26$) and Regional ($M = -0.50$) employee ratings both differed significantly from the Corporate employee ratings ($M = 0.58$). Cabin Crew ratings ($M = -0.58$) were significantly lower than the Instructor ratings ($M = -0.01$).

Comments from several Corporate Operator Instructors indicated that their initial fire training was contracted to an outside training organization. Comments from operators that conduct their own training include:

"The fire was little red lights outside the plane." (Major Operator Cabin Crew)

"Mockups are amazing however, red lights and theatrical smoke without heat confuse FAs." (Major Operator Instructor)

"Fire training done in classroom." (Major Operator Instructor)

"We use a rug with ribbons on it and use a Halon extinguisher to put out "fire." (Regional Operator Instructor)

"There are a lot of restrictions in training because of location. No actual fire." (Corporate Operator Cabin Crew)

"Fire training is a small controlled gas flame." (Major Operator Cabin Crew)

"Is an orange extension cord sufficient to simulate a fire? It is at our airline." (Major Cabin Crew)

"Done outside of classroom door, done without real fire." (Regional Cabin Crew)

"Water is discharged into a bucket – no actual fire." (Major Instructor)

<u>*Similarity of training and aircraft equipment.*</u> Participants generally agreed that equipment they used for training was similar to equipment on the aircraft. Occupation was significantly associated with the participant responses, $\chi^2(4, N = 174) = 15.08, p < .01$ (Cramér's $\Phi_C = .29$). Rating values were examined with a 3 x 2 (Operator Type x Occupation) ANOVA, confirming significant main effect of Occupation, $F(1, 168) = 5.67, p < .05$ (Figure 11). Even though both were strongly positive, Cabin Crew ratings ($M = 1.20$) were significantly lower than the Instructor ratings ($M = 1.46$).

Protective Breathing Equipment. Although PBEs were not specifically identified in the statement about equipment, there were several comments made about them similar to the following:

"We don't use the PBE at the same time as the fire extinguisher. We only did this with an actual fire during initial training." (Regional Cabin Crew)

"No drill that we use the PBE and the fire extinguisher at the same time." (Major Cabin Crew)

"Not enough hands-on training with PBE and extinguisher other than initial training." (Major Cabin Crew)

"We do a drill yearly of spraying the water extinguisher into a trash can outside. We have to don the PBE before using the extinguisher." (Major Cabin Crew)

"During the 5 yrs. I've been flying, have donned a PBE only 2x including training. Actually only put out 1 fire with the PBE and that was during the 21 day training." (Regional Cabin Crew)
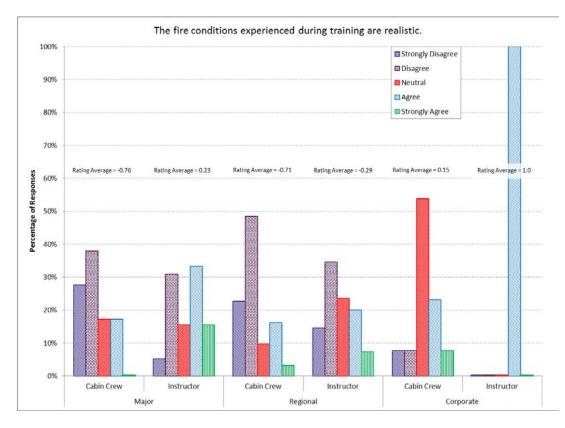
Figure 10. Realism of Practical Fire Training: Fire conditions

Relevancy of training scenarios to aircraft operation. Occupation was significantly associated with the participant responses, $\chi^2(4, N = 170) =16.69$, $p < .01$ (Cramér's $\Phi_C = .31$). Rating values were examined with a 3 x 2 (Operator Type x Occupation) ANOVA, confirming a significant main effect for Occupation, $F(1, 164) = 14.82$, $p < .01$ and Operator Type, $F(2, 164) = 4.15$, $p < .05$, but there were no interaction effects (Figure 12). Regional employee ratings ($M = 0.36$) differed significantly from the Corporate employee ratings ($M = 1.18$), but not the Major employee ratings ($M = 0.60$). Cabin Crew ratings ($M = 0.21$) were significantly lower than the Instructor ratings ($M = 0.86$).

Comments from respondents generally agreed that realistic training scenarios were lacking in fire training, even to the point of revising training:

"More realistic training is needed in a more real life scenario." (Major Cabin Crew)

"Measures are being taken to provide more realistic scenarios in training sessions due to new facility and new manager of training." (Regional Instructor)

"Not realistic. No true scenarios in training. Basically we 'touch' the extinguishers then move on to other subjects." (Regional Cabin Crew)

"Scenarios are too short. Not enough time to initiate crew communication procedures, back-up (assisting pax, etc.). (Corporate Instructor)

Realism of smoke conditions during training. Operator Type was significantly associated with the participant responses, $\chi^2(8, N = 153) = 32.03$, $p < .01$ (Cramér's $\Phi_C = .46$), Figure 13. Rating values were examined with a 3 x 2 (Operator Type x Occupation) ANOVA, confirming a significant main effect for Operator Type, $F(2, 147) = 18.35$, $p < .01$. Pairwise comparisons of employee ratings showed that the training of each of the Operator Types produced different perceptions of realism: Major ($M = -0.11$), Regional ($M = -1.03$) and Corporate ($M = 0.81$) ratings. Overall, Cabin Crew ratings ($M = -0.49$) were lower than Instructor ratings ($M = -0.36$).

For those training programs that did include smoke, it was usually theatrical smoke. Most of the comments came from those whose training did not include any smoke:

> *"Smoke is not used due to risk of injury on-duty. Many are allergic to simulated smoke products." (Major Instructor)*

> *"We don't experience any smoke." (Regional Cabin Crew)*

> *"We don't have any training with smoke or in an aircraft." (Regional Cabin Crew)*

> *"My company uses obscured-lens glasses to simulate smoke." (Regional Instructor)*

Adequacy of fire training facility. Operator Type was significantly associated with the participant responses, $\chi^2(8, N = 166) = 24.74$, $p < .01$ (Cramér's $\Phi_C = .39$), Figure 14. Rating values were examined with a 3 x 2 (Operator Type x Occupation) ANOVA, confirming a significant main effect for Operator Type, $F(2, 160) = 17.65$, $p < .01$. Pairwise comparisons of rating values showed that ratings of Regional employees ($M = -0.75$) were significantly lower than those of both Major ($M = -0.05$), and Corporate ($M = 0.68$) employees ratings. Cabin crew ($M = -0.49$) ratings were lower than Instructor ($M = -0.09$) ratings, overall.

Comments regarding fire training facilities indicated that fire training facilities are not usually representative of an aircraft cabin:

> *"Training is conducted in an open warehouse. Environment is not even close to representing the tight quarters of a regional jet. (Major Cabin Crew)*

> *"We don't have any training with smoke or in an aircraft." (Regional Cabin Crew)*

> *"Realism is lacking in firefighting training – usually due to lack of realistic mock-ups/lack of funds for realistic mock-ups." (Major Instructor)*

> *"No realistic environment for training." (Regional Instructor)*

> *"Fire module is 1 hour long in recurrent. Practice involves discharging Halon into hole in covered trash can. However, my company is buying a new 'virtual video.'" (Regional Cabin Crew)*
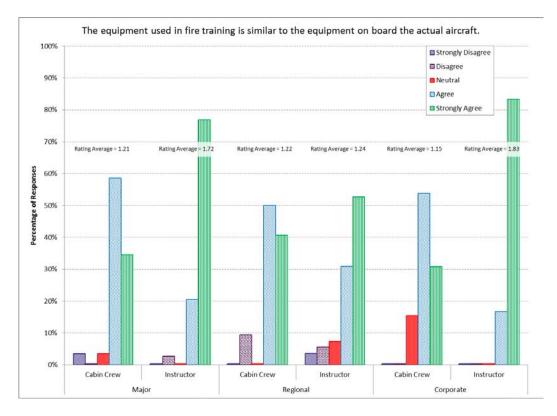
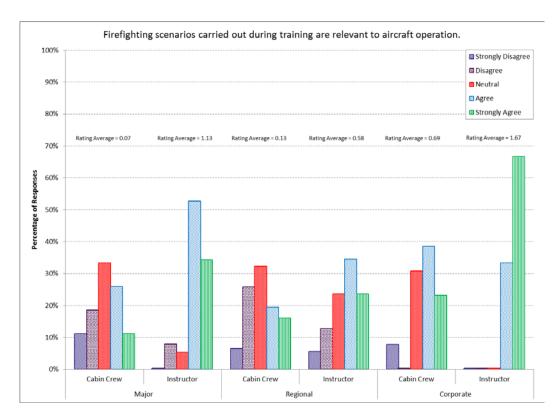Figure 11. Realism of Fire Training: Equipment
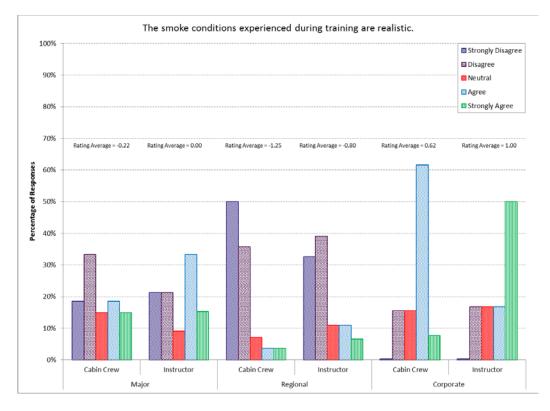

Figure 12. Realism of Fire Training: Scenarios
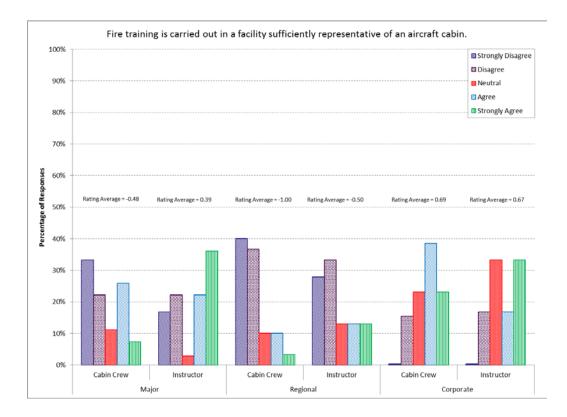
Figure 13. Realism of Fire Training: Smoke conditions

Figure 14. Realism of Fire Training: Facility

Procedures in Training

Cabin Crew and Instructor rating averages for each Procedures in Training statement are shown in Table 4. Instructor ratings for agreement with each statement averaged higher than Cabin Crew ratings and the ratings overall were among the highest for all of the training areas.

Table 4. Procedures in Training			
	Mean Rating		
Block 11 Statements	**Cabin Crew**	**Instructors**	**Difference**
The procedures taught in fire training correspond to procedures in crew operating manuals.	1.00	1.49	0.49
Procedures for communication and coordination between flight crew and cabin crew in the event of an in-flight fire are appropriate.	0.72	1.28	0.56
Procedures for communication and coordination between cabin crew in the event of an in-flight fire are appropriate.	0.77	1.18	0.41

Relationship between procedures in training and crew operating manuals. Occupation was significantly associated with the participant responses, $\chi^2(4, N = 173) = 28.16$, $p < .01$ (Cramér's $\Phi_C = .14$). Rating values were examined with a 3 x 2 (Operator Type x Occupation) ANOVA, confirming a significant main effect of Occupation, $F(1, 167) = 8.58$, $p < .01$ (Figure 15). Even though both were positive, Cabin Crew ($M = 1.00$) ratings were significantly lower than the Instructor ($M = 1.49$) ratings.

Comments on this subject varied, the most significant submitted from Regional operators:

"There is no reference to hidden fires in the flight attendant manual." (Regional Cabin Crew)

"We read the procedures for our training." (Regional Instructor)

"Our manual stresses contacting Flight Deck. Flight attendants get confused about procedures, i.e., fight fire first. (Regional Instructor)

"Manual procedures are inconsistent. Therefore, difficult to instruct." (Regional Instructor)

Procedures for communication and coordination between flight crew and cabin crew. Occupation was significantly associated with the participant responses, $\chi^2(4, N = 173) = 20.96$, $p < .01$ (Cramér's $\Phi_C = .35$). Rating values were examined with a 3 x 2 (Operator Type x Occupation) ANOVA, confirming a significant main effect of Occupation, $F(1, 167) = 15.16$, p

< .01 (Figure 16).   Even though both were positive, Cabin Crew (M = 0.72) ratings were significantly lower than the Instructor (M = 1.28) ratings.

Procedures for communication and coordination between cabin crew. Occupation was significantly associated with the participant responses, $\chi^2(4, N = 171) = 17.72$, $p < .01$ (Cramér's $\Phi_C = .32$). Rating values were examined with a 3 x 2 (Operator Type x Occupation) ANOVA, confirming a significant main effect of Occupation, $F(1, 165) = 5.24$, $p < .01$ (Figure 17). Even though both were positive, Cabin Crew (M = 0.77) ratings were significantly lower than the Instructor (M = 1.18) ratings, and reinforced by Cabin Crew comments:

> *"During training, there are no "crew" communication techniques used." (Major Cabin Crew)*

> *"More emphasis should be placed on crew communication. Training should consist of evaluated scenarios where team dynamics are graded as well as firefighting techniques." (Major Cabin Crew)*

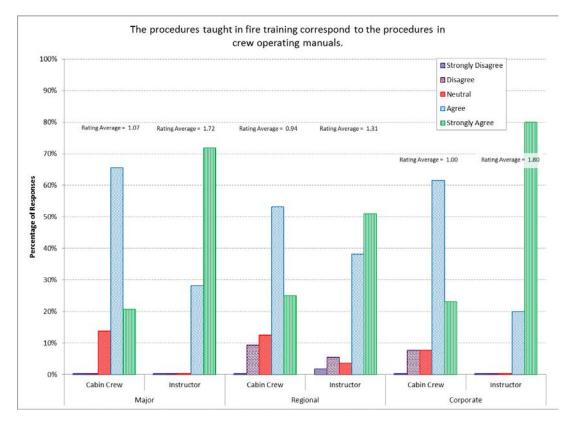> *"More emphasis on cabin crew coordination may be necessary." (Regional Instructor)*

Figure 15. Procedures in Training: Relationship with crew operating manuals

Problems Encountered During Firefighting

Of the 17 participants who reported some kind of experience with in-flight fires, 15 were actually involved in fighting the fire. They reported a total of 27 problems which are shown in Figure 18. Additional comments regarding problems included:

"AA battery overheated in a woman's purse and began to catch fire. Unsure what caused battery to ignite." (Major Cabin Crew)

"Some fire extinguishers are buried and almost impossible to access. Definitely true with smoke hoods." (Corporate Cabin Crew)

"Biggest problem is varied location of firefighting equipment across very large fleet of aircraft." (Major Cabin Crew)
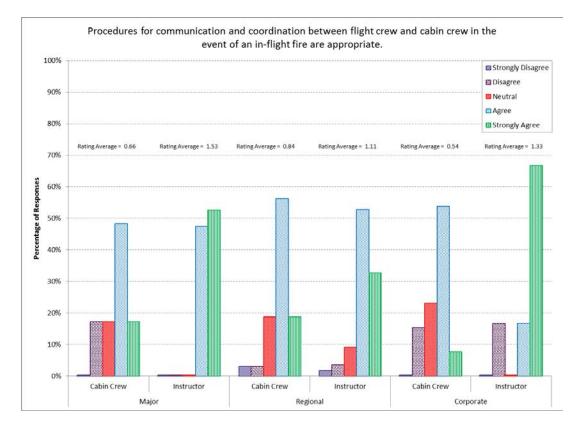

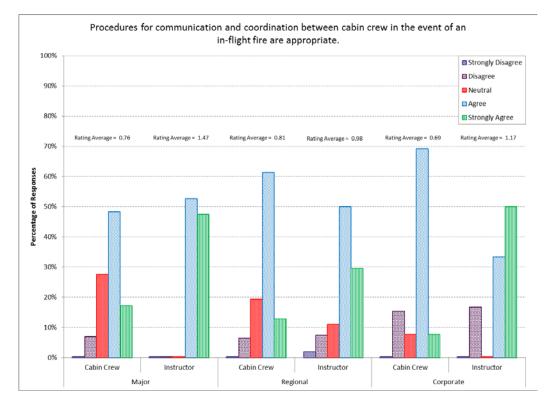Figure 16. Procedures in Training: Communication between flight crew and cabin crew

Figure 17. Procedures in Training: Communication between cabin crew
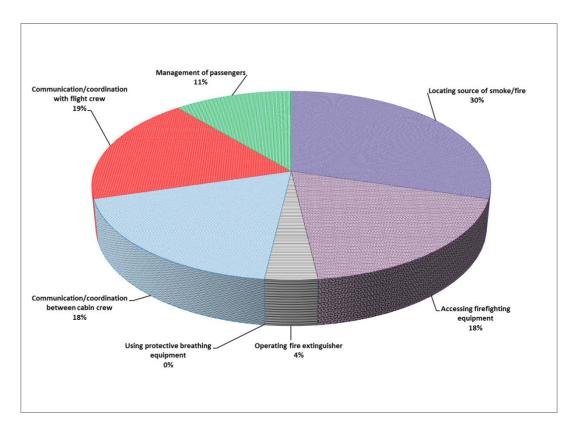

Figure 18. Problems encountered during in-flight firefighting

Comments about deficiencies where improvements might be made

Cabin Crew and Instructors recognized the need for improvements in in-flight firefighting training and their suggestions underscore the importance they place on such training:

"In my initial training, we put out a fire in a wastebasket. In ART, we just show knowledge of operating equipment." (Regional Cabin Crew)

"Hands-on in a real cabin simulator environment would have been good." (Regional Cabin Crew)

"More hands-on or practical training for different fire types and scenarios would be greatly beneficial." (Regional Cabin Crew)

"I truly believe that group role-playing is much more efficient in preparing for an incident as opposed to standing in line and using a piece of equipment on nothing even close to a real situation." (Regional Cabin Crew)

"Stronger recommendations for the 'Team' concept method — 'Communicator, Fire Fighter, Runner' – should be implemented in our industry." (Major Instructor)

"As a [corporate] flight attendant, I've never had training on in-flight emergencies 'with' any of my fellow crew members." (Corporate Cabin Crew)

"More information on handling of new types or categories of fires, e.g., PEDs and batteries." (Regional Instructor)

"All airlines should have a fully-equipped cabin trainer for this and other emergencies." (Regional Instructor)

"Need to train what to do when all extinguishers have been used and more crowd control techniques." (Major Cabin Crew)

"I would like to see more information on what to do when fire is too big and emergency landing is imminent. Do we continue to fight fire or when, if ever, should you stop?" (Regional Instructor)

"With the increase of lithium batters on board and in-flight entertainment systems, the risk seems higher for in-flight fires." (Major Instructor)

"Would like guidance on 'hidden fires' (how to ID, access, etc.) and PEDs (laptop batteries, etc.) fires. Also would like guidance on when (always or as necessary) to don PBEs." (Major Instructor)

"Maybe train on how to utilize passengers as help if needed, especially when only one flight attendant on board." (Major Cabin Crew)

DISCUSSION

The degree to which cabin crew are prepared for firefighting events is a variable in transport aviation, as airlines have different firefighting training programs for their crews. Some programs comply with regulatory requirements by providing the minimum amount of training required with one-time emergency drills that can hardly be considered "realistic." Other programs provide annual theoretical and practical training in the most realistic environments, covering all topics relevant to effective in-flight firefighting. The results of this study show that most crew members would prefer more training, both theoretical and practical, conducted annually in a realistic environment, with adequate time to cover all the topics so they can *demonstrate* proficiency in a variety of in-flight fire scenarios.

Moreover, participant responses suggest that the deficiencies in training that have been identified during actual fire events and reported by the NTSB during the last three decades continue to flourish. The lack of attention to handling hidden fires is especially troublesome considering the fire events that started behind wall or ceiling panels cited in the introduction of this paper.

Cabin Crew rated every training item lower than Instructors, with one exception. Rating averages were equal (0.13) for the effect of training intervals on crews' retention. The consistently lower ratings by Cabin Crew suggest that they do not consider themselves to be adequately trained. Understandably, Instructors would be confident in their training programs and are probably better trained themselves.

Survival psychologist, John Leach (1994) points out that when people are caught in an emergency, they frequently respond by falling back on well-learned behavior patterns. Therefore, when "correct" responses are needed, they must be fully developed so they are automatically activated at the appropriate time. People who have received a substantial amount of realistic training (i.e., consistency and repetition) show a higher degree of effectiveness and group cohesiveness and repeated practice enables the person to function effectively at the automatic level.

CONCLUSIONS

Given what is known about actual fire events and the benefits of a substantial amount of realistic training (i.e., consistent and repetitive), the findings of this study should lead to an advocacy for more comprehensive firefighting training for Cabin Crew. Practical training should include multiple and varied scenarios with "team" training, as appropriate, and "passengers," and conducted in a facility representative of an aircraft cabin with smoke and actual fire capability.

REFERENCES

ABC News. (March, 2016). *Delta flight delayed after e-cigarette ignites in passenger's carry-on*. Available from http://abcnews.go.com/US/delta-flight-delayed-cigarette-ignites-passengers-carry/story?id=37710018

Air Accidents Investigation Branch. (2015). *Report on the serious incident to Boeing B787-8, ET-AOP, London Heathrow Airport on 12 July 2013*. (Aircraft Accident Report 2/2015). Available from https://www.gov.uk/aaib-reports

Blake, D. (1999). *Effectiveness of Flight Attendants Attempting to Extinguish Fires in an Accessible Cargo Compartment.* (DOT/FAA/AR-TN99/29). Washington, DC: FAA. Available from http://www.fire.tc.faa.gov/reports/ reports.asp

Code of Federal Regulations. (2011). Title 14 Part 121.417 Crewmember Emergency Training. Available from the United States Government Printing Office, 732 North Capitol Street, NW, Washington, DC 20401, www.gpoaccess.gov

Federal Aviation Administration. (n.d.). Cabin Safety Air Carrier Operations Bulletin 230 (No. 01-94-29). Available from http://www.faa.gov/about/initiatives/cabin_safety/regs/acob/

Federal Aviation Administration. (2004). Advisory Circular: In-flight Fires (AC No. 120-80): Washington, DC: FAA. Available from: http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgAdvisoryCircular.nsf/MainFrame?OpenFrameset

Federal Aviation Administration. (2014). Advisory Circular: In-flight Fires (AC 120-80A). Washington, DC: FAA. Available from: http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgAdvisoryCircular.nsf/MainFrame?OpenFrameset

Federal Aviation Administration, Office of Security and Hazardous Materials. (1/15/2016). *Batteries and Battery-Powered Devices*. Available from: http://www.faa.gov/about/office_org/headquarters_offices/ash/ash_programs/hazmat/aircarrier_info/media/Battery_incident_chart.pdf

Flight Standards Information Management System, Order 8900.1. (xxxx). Available from http://fsims.faa.gov/PICResults.aspx?mode=EBookContents&restricttocategory=all~menu

General Civil Aviation Authority of the United Arab Emirates Air Accident Investigation Sector. (2012). *Uncontained Cargo Fire Leading to Loss of Control Inflight and Uncontrolled Descent Into Terrain, Boeing 747-44AF, N571UP, Dubai, United Arab Emirates, 03 September 2010* (AAIS Case Reference 13/2010). Available from https://www.gcaa.gov.ae/en/Pages/Default.aspx

Labovitz, S. (1970). The assignment of numbers to rank order categories. *American Sociological Review*, *35*(3).

Leach, J. (1994). *Survival Psychology.* London: MacMillan Press

National Transportation Safety Board. (1984). *Aircraft Accident Report Air Canada Flight 797 McDonnell Douglas DC-9-32, C-FTLU Greater Cincinnati International Airport, Covington, Kentucky, June 2, 1983* (Report No. NTSB/AAR-84/09 (PB84-910409)). Washington, DC: NTSB

National Transportation Safety Board. (2002). *Safety Recommendation letter to FAA Administrator January 4, 2002*. Available from http://www.ntsb.gov/safety/safety-recs/recletters/A01_83_87.pdf

National Transportation Safety Board. (2011). *Safety Recommendation letter to FAA Administrator September 20, 2011.* Available from http://www.ntsb.gov/safety/safety-recs/recletters/A-11-087-091.pdf

RGW Cherry and Associates, Limited. (July 2008). *Training Needs Analysis Cabin Crew Fire Training.* (Final Report 0530/R/000425/KK).

Sarkos, C. (2011).*Improvements in Aircraft Fire Safety Derived from FAA Research Over the Last Decade* (DOT/FAA/AR-TN-11/8). Washington, DC: Federal Aviation Administration. Available from http://www.fire.tc.faa.gov/reports/reports.asp

SPSS, Inc. (2001). *Survey Analysis Using SPSS*. SPSS: Chicago.

U.K. Civil Aviation Authority. (2009). *Cabin Crew Fire Training* (CAA Paper 2009/01). London: United Kingdom. Available from www.caa.co.uk.

APPENDIX A

Individual's Consent to Voluntarily Participate in a Research Project

I, _____, understand that this research project, entitled *Cabin Crew Fire Training,* is being sponsored by the Federal Aviation Administration and is being directed by Cynthia L. Corbett, MA, of the Civil Aerospace Medical Institute (CAMI).

PURPOSE / DESCRIPTION OF STUDY: The goal of this questionnaire is to gather information about cabin crew fire training to support activities and exercises conducted during Cabin Safety Workshops at the FAA Civil Aerospace Medical Institute. The information will also be used to identify needed improvements to cabin crew in-flight fire training programs. The results will be published in reports available to the aviation industry.

RISKS: I understand that there are no significant risks associated with my participation in this study. I have been briefed and shown how to complete the questionnaire, and I have had an opportunity to ask any questions I have concerning the research and my participation. All my questions have been answered to my satisfaction.

Participant's Initials _____

PARTICIPANT RESPONSIBILITIES:

I understand that it is important to be accurate and honest with my responses.

Participant's Initials _____

BENEFITS: The major benefit to me will be the satisfaction of participating in a project that can improve cabin safety on commercial airplanes by improving in-flight fire-fighting training that I and other flight attendants may receive.

Participant's Initials _____

PARTICIPANT'S ASSURANCES: I understand that my participation is voluntary.

I have not given up any of my legal rights or released any individual or institution from liability for negligence. I understand that I may refuse to participate and/or withdraw from this study at any point.

Participant's Initials _____

I understand that all records of this study will be kept confidential, and that I will not be identified by name or description in any reports or publication of this study. If I have questions about this study, or need to report any adverse effects from the research procedures, I will contact Cynthia Corbett, MA, at 405-954-7528.

I have read this consent document. I understand its contents, and I freely consent to participate in this study under the conditions described. I understand that I may request a copy of this consent form.

_____   _____

Participant   Date

_____   _____

Investigator   Date

APPENDIX B

Cabin Crew Fire Training Information

I.   Introduction

The goal of this questionnaire is to gather information about cabin crew fire training to support activities and exercises conducted during Cabin Safety Workshops at the FAA Civil Aerospace Medical Institute. The information will also be used to identify needed improvements to cabin crew in-flight fire training programs. The results will be published in reports available to the aviation industry.

Your personal information will not be required. It should take about 10 minutes to complete the questionnaire. Your feedback is really important; please answer questions as completely as possible.

II.   Background Information

      Where do you receive your firefighting training?_____

1.   I am:

    ❑ Cabin Crew   Airline:_____ (for "type" categorization only)

    ❑ Flight Crew

    ❑ Instructor

    ❑ Other (please specify) _____

2.   If you are Flight or Cabin Crew, on what aircraft type(s) do you fly? (List in order of time spent on   board.)

    ❑ Aircraft Type 1   _____

    ❑ Aircraft Type 2   _____

    ❑ Aircraft Type 3   _____

3.   Which country is the primary location of your organization? _____

III. Fire Training Issues

4. In your opinion, the amount of time spent on <u>theoretical</u> fire training is…

    ❒ Too short

    ❒ Sufficient

    ❒ Too long

    ❒ I don't know

    Please include any comment you may have on this subject:

5. In your opinion, the amount of time spent on <u>practical</u> fire training is…

    ❒ Too short

    ❒ Sufficient

    ❒ Too long

    ❒ I don't know

    Please include any comment you may have on this subject:

6. How frequent is your <u>practical</u> fire training?

    ❒ Every year

    ❒ Every 2 years

    ❒ Every 3 years

    ❒ I don't know/Not applicable

    ❒ Other (please specify) _____

7.   Please indicate the degree to which you agree to the following statements about your company's fire training:

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
The fire training equips crew members to extinguish a fire behind the cabin panels.	❍	❍	❍	❍	❍	❍
The fire training equips crew members to extinguish any fire visible in the cabin.	❍	❍	❍	❍	❍	❍
The training for the management of passengers in the event of in-flight fire is adequate.	❍	❍	❍	❍	❍	❍
The time between practical fire training sessions is such that crew members remember everything taught in the training within that period.	❍	❍	❍	❍	❍	❍
The fire training equips crew members to deal with multiple fires occurring at the same time.	❍	❍	❍	❍	❍	❍
Please use this space for any comments you may have on this subject:						

8.　　Please indicate the degree to which you agree to the following statements on the realism of your company's practical fire training:

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
The fire conditions experienced during training are realistic.	○	○	○	○	○	○
The equipment used in fire training is similar to the equipment on board the actual aircraft.	○	○	○	○	○	○
Firefighting scenarios carried out during training are relevant to aircraft operation.	○	○	○	○	○	○
The smoke conditions experienced during training are realistic.	○	○	○	○	○	○
Fire training is carried out in a facility sufficiently representative of an aircraft cabin.	○	○	○	○	○	○
Please use this space for any comments you may have on this subject:						

9. I have:

- ⭘ Witnessed an in-flight fire

- ⭘ Been involved in fighting an in-flight fire

- ⭘ No experience with in-flight fire

If you have witnessed or been involved in fighting an in-flight fire, please briefly describe the fire (e.g., size, type, location, etc.):

10. Please check the appropriate box(es). If you have been involved in an in-flight fire, did you experience any problem with:

- ☐ Locating source of smoke/fire

- ☐ Locating and/or removing the firefighting equipment

- ☐ Breaking the fire extinguisher seals

- ☐ Discharging the fire extinguisher

- ☐ Removing Protective Breathing Equipment from its packaging

- ☐ Using Protective Breathing Equipment

- ☐ Communicating with (other) cabin crew members

- ☐ Communicating with flight crew

- ☐ Management of passengers

If you have experienced any of the above, please briefly describe what you think might have caused the problem:

11. Please indicate the degree to which you agree with the following statements:

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
The procedures taught in fire training correspond to the procedures in crew operating manuals.	○	○	○	○	○	○
Procedures for communication and coordination between flight crew and cabin crew in the event of an in-flight fire are appropriate.	○	○	○	○	○	○
Procedures for communication and coordination between cabin crew in the event of an in-flight fire are appropriate.	○	○	○	○	○	○
Please use this space for any comments you may have on this subject:						

12. Please indicate any deficiencies you believe exist in cabin crew fire training or areas where improvements might be made. Use the back of this page if you require more space.