



Safety Versus Passenger Service: The Flight Attendants' Dilemma

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After 9/11, new security duties were instituted at many U.S. air carriers and existing safety and security duties received increased emphasis. Concurrently, in-flight services were changed and in many cases, cabin crews were reduced. This article examines the post-9/11 conflict between passenger service and the timely performance of safety and security duties at 1 major U.S. air carrier. In-flight data were obtained on both international and domestic flights. The data suggest that the prompt performance of the safety and security duties is adversely affected by the number of service duties occurring in the later part of both international and domestic flights.

A significant amount of research has been conducted on flight attendants over approximately the last 20 years. Much of this research has been concerned with work-related factors that might adversely affect the flight attendants' health. Among the factors investigated are circadian dysrhythmia, recycled air, fatigue, shifting work schedules, radiation exposure, and the lifting and handling of heavy objects (Ballard, Lagorio, De Angelis, & Verdecchia, 2000; Dresel & Boutros, 2001; Griffiths & Powell, 2012; Lauria, Ballard, Caldora, Mazzani, & Verdecchia, 2006; Schaub et al., 2007; Sharam, 2007; Suvanto, Partinen, Harma, & Ilmarinen, 1990). Other research has examined how aspects of the job—extended time away from home, irregular work schedules, long hours, and difficult passengers—contribute to work-related stress, psychological well-being, and job dissatisfaction (Avers, King, Nesthus, Thomas, & Banks, 2009; Avers et al., 2011; Gunnarsdottir, Sveinsdottir, Bernburg, Fridriksdottir, & Tomasson, 2006; Liang & Hsieh, 2005; Salinger, Jesilow, Pontell, & Geis, 1985). A few studies address organizational

factors—the lack of a clear career path, limited job resources, and lack of immediate supervision—that contribute to stress and turnover (Chen & Chen, 2012; Liang & Hsieh, 2005). Surprisingly, little research has been concerned with the job itself, identifying the activities a flight attendant performs and the factors affecting that performance. This article begins to address this gap by focusing on in-flight duties and factors that affect their performance.

The in-flight duties of cabin crew can be grouped into three major categories: safety, security, and passenger service. The safety duties are concerned with ensuring that no one is injured during a flight. Flight attendants must ensure that passengers are seated with their seat belts fastened during turbulence so that they cannot be injured by being thrown about the cabin. Similarly, service items and trash must be stowed properly to prevent these items from flying about the cabin during turbulence or during takeoff and landing. If there are injuries or illnesses, the flight attendants must deal with these according to the air carrier's procedures. Additionally, the aisles must be kept clear to minimize tripping hazards. Security duties are primarily concerned with ensuring that no foreign objects are on board and that no activities occur that would interfere with the normal progress of the flight. Passenger service duties include such activities as serving meals and beverages and responding to passenger requests.

High-quality passenger service can provide a competitive advantage for an air carrier, distinguishing it from its competitors and generating customer loyalty (Morgan & Nickson, 2001). To ensure that their in-flight service is attentive and prompt, some air carriers have established performance standards for the cabin crew and evaluate crews based on these standards. The standards typically are deadlines that specify a time by which a specific activity must be completed. Passenger service managers periodically fly as passengers on regularly scheduled flights and record the crew's performance. These individuals are not identified to the crew as management, and the crew does not know that their performance is being evaluated. Flight attendants who fail to meet the performance standards might receive a letter of reprimand, have disciplinary hearings, or in cases of repeated failures to meet the standards, lose their jobs.

After 9/11, demand for air travel decreased and many U.S. air carriers were forced to reduce their operating costs, which they accomplished in part by eliminating some on-board amenities, such as hot meals in the main cabin on domestic flights. Fewer amenities required fewer flight attendants. Consequently, the cabin crew was reduced on some aircraft. However, after 9/11, new security procedures began to be developed and implemented, and existing safety and security procedures were modified and received increased emphasis. The introduction of the new procedures with the revision of the existing procedures meant that flight attendants had to devote more in-flight time to safety and security procedures. The combination of reduced crew size and more time-consuming safety and security duties resulted in flight attendants spending a higher percentage of their time performing safety and security duties.

The primary goal of this study was to examine the potential conflict between achieving airline-specified performance standards and the prompt and complete execution of safety and security duties. Two secondary goals concerned determining the effect of available service time and atmospheric turbulence on the cabin crew's ability to achieve the performance standards and on the timely execution of safety and security duties.

The data presented in this article were part of a larger effort examining cabin crew staffing on three different aircraft at a major U.S. carrier. The Federal Aviation Administration (FAA) specifies a minimum cabin crew size for each aircraft type flown by a passenger-carrying U.S. airline. The minimum crew size is seen by the FAA as a safety issue and it is determined by the number of seats on the aircraft and the results of evacuation demonstrations (Code of Federal Air Regulations, 2012). U.S. air carriers can staff their aircraft with any number of cabin crew provided that the number of flight attendants meets or exceeds the FAA-specified minimum staffing level.

Two aircraft from the carrier's fleet were selected for study because the staffing had been reduced after 9/11. One of these aircraft, the MD-80, had been flown with five flight attendants for many years after its initial introduction. The staffing was then reduced to four. Beginning in the early 1990s, the staffing had been further reduced to three cabin crew, with "variable manning" to allow for an augmented crew of four. Variable manning allows the air carrier to add cabin crew to a flight with complex or time-limited cabin service. After 9/11, the variable manning option was eliminated on the MD-80, and all flights were flown with the FAA-mandated minimum crew of three.

The second aircraft, the B-737, had been introduced after the MD-80 and had always been flown by this air carrier with three flight attendants, variably manned to four. After 9/11 the variable manning option on this aircraft was eliminated, and all flights were flown with the FAA-mandated minimum crew of three.

The third aircraft, a new configuration of the B-777, was certified by the FAA for a minimum of six flight attendants. At the time this study was conducted (after 9/11), the air carrier staffed this aircraft with 11 flight attendants, variably manned to 12. Despite frequent complaints from the flight attendants about the workload, the cabin staff was to be reduced to 10 flight attendants, variably manned to 11, within a few months after the beginning of this study.

METHODS

Observation Trips

Data were obtained from one major U.S. air carrier. Information on the staffing levels and service on the MD-80, the B-737, and the B-777 are given in Tables 1 and 2. Table 1 shows that the B-737 was a slightly larger aircraft than the MD-80

TABLE 1
Capacity and Staffing for the MD-80, B-737, and B-777 Aircraft

<i>Parameter</i>	<i>Aircraft</i>		
	<i>MD-80</i>	<i>B-737</i>	<i>B-777</i>
Passenger seating			
First class	14	16	18
Business class			42
Main cabin	115	126	194
Federal Aviation Administration required minimum staffing level	3	3	6
Air carrier's staffing level	3	3	11 or 12 ^a

^a Staffing level dependent on the number of passengers in the main cabin.

TABLE 2
Staffing and Service Levels for Transatlantic Flights

<i>Parameter</i>	<i>Route</i>		
	<i>New York-Paris</i>	<i>New York-London</i>	<i>London-Chicago</i>
Flight date	March 2002	March 2002	April 2002
Number of flight attendants			
Main cabin	5	5	4
Business class	4	4	4
First class	3	3	3
Federal Aviation Administration required minimum staffing	6	6	6
Number of observers			
Main cabin	2	2	2
Business class	3	3	3
First class	3	3	3
Meals	Dinner, breakfast	Lunch, dinner	Lunch, dinner
Available service time	5:40	5:38	7:36

in terms of seating capacity. However, the service on the two aircraft was identical in both first class and the main cabin.

As part of the larger study, data were collected on two Los Angeles-Dallas MD-80 flights. For the B-737, data were obtained on flights between Toronto-Dallas and Philadelphia-Dallas and on a round-trip between Chicago and Miami. Three round-trips were observed on the B-777: New York-Paris, New York-London, and Chicago-London.

Subject Matter Experts

Subject matter experts (SMEs) helped develop the task analyses and collected in-flight data. All SMEs were required to have a minimum of 10 years of experience as an active flight attendant; time spent on maternity leave or as a ground-based manager was not counted. All SMEs were required to have both international and domestic experience and have worked on at least two different aircraft. Additionally, all SMEs were required to have a minimum of 1 year of experience performing each of two different flight attendant positions (a main cabin flight attendant vs. a first-class flight attendant).

For the 777 data collection effort, SMEs were nominated by the flight attendants' union to act as in-flight observers (data collectors). For the MD-80 and B-737 collection efforts, both the in-flight service division of the air carrier and the flight attendants' union identified SMEs to act as in-flight observers. All of the SMEs for the MD-80 and B-737 studies received the same training as the B-777 observers. Observer teams on the MD-80 and the B-737 were composed of SMEs nominated by both the air carrier and the union.

Task Analyses

At the time the larger study was begun (Spring 2001), no detailed descriptions of flight attendant duties were available in the open literature (but see Hagihara, Tarumi, & Nobutomo, 2001, for an overview of some aspects of their duties; and Nesthus & Schroeder, 2007, for a task analysis and discussion of flight attendants' major duties). Requests for task analyses and job descriptions from the air carrier's training department were unproductive. The first step, therefore, was to create a task analysis for each unique flight attendant position on each aircraft that was to be observed.

The development of the task analyses began with the first author constructing a short, general task analysis for the B-777 using flight attendant manuals and handbooks. Five SMEs used the general task analysis to create a specific task analysis for each of the 10 unique flight attendant positions on the B-777. These 10 task analyses were circulated among the SMEs and revised until every SME agreed with every task analysis. Subsequently, a new group of SMEs developed the stop-start behaviors for every task in the task analyses. Finally, a third group of SMEs took printed copies of the task analyses on actual flights to ensure that nothing was omitted and that the sequence of tasks agreed with actual practice. All omissions or sequence changes were submitted to the original group of SMEs for approval.

The B-777 task analyses reflected the service performed on a transatlantic flight, which included two meals, entertainment, and other amenities not found on domestic flights. Consequently, the task analyses for the B-737 and the MD-80

were developed by having two new SMEs identify the three positions on the B-777 that were most similar to those on the B-737 and MD-80. They then eliminated tasks from the B-777 task analyses and modified the remaining tasks to reflect the appropriate level of service. These SMEs also verified the sequence of tasks and the assignment of tasks to the appropriate flight attendant. A new group of SMEs reviewed the start–stop behaviors for appropriateness. The task analyses then were verified on flights using the procedure already described.

Safety and Security Duties

The task analyses identified six safety and security duties. The first five duties were required only by the air carrier. The sixth duty was required both by the FAA and the air carrier.

Safety compliance check (turbulence). When an aircraft encounters turbulence in flight, the captain might require the passengers to return to their seats and fasten their seat belts. The captain signals this decision by turning on the “Fasten seat belt” sign. Immediately after this sign is illuminated, one flight attendant in each cabin must walk through the cabin and verify that all passengers are seated with their seat belts fastened. This walk through the cabin is called the *safety compliance check*. This is a coordinated responsibility among the cabin crew; that is, the flight attendants in each cabin designate the crew member responsible for performing this activity. The time from the illumination of the sign to the beginning of the safety compliance check was recorded. Because turbulence can cause anyone standing or walking to lose his or her balance, the designated flight attendant needs to perform this check promptly. Any safety compliance checks that were begun more than 1 min after the illumination of the seat belt sign were scored as late.

Lavatory inspections. Flight attendants were required to check every lavatory at least once every 2 hr for smoke, foreign objects, and adequate supplies. This activity is a coordinated responsibility among the flight attendants in each cabin. Observers recorded the time at which the lavatories were checked.

15-min inspections. Each cabin must be inspected at least once every 15 min except during the meal, beverage, and duty-free services when carts are in the aisles. During this inspection, flight attendants ensure that no objects block the aisle or pose falling hazards and that no unsafe activities are occurring. This activity is a coordinated responsibility among the flight attendants in each cabin. Observers recorded when the inspections occurred. Inspections that began more than 1 min after the scheduled time were scored as late. During descent, these inspections are replaced by the safety compliance checks described later.

Attended cabin. At least one flight attendant must be in a position to observe the activity occurring in each cabin at all times. Determining a flight attendant's field of view from any given position is problematic. Consequently, a simplifying assumption was adopted: If the flight attendant was inside his or her assigned cabin, he or she could observe the activity in the cabin. Each observer recorded the time at which the flight attendant left his or her assigned cabin and the time at which he or she returned. The data were analyzed to identify any periods in which all of the flight attendants assigned to a given cabin were absent from that cabin. For analysis purposes, the cabin was considered unattended if no flight attendant was present for more than 1 min.

Cockpit guard. Shortly after 9/11, U.S. airlines began developing procedures for protecting access to the cockpit when a pilot leaves the cockpit for any reason. At the time the B-777 data were collected, no procedure was in operational use. Seventeen months later, when the domestic flights were observed, a procedure requiring two flight attendants, usually those working in first class, had been adopted for use. This procedure had designated positions for the flight attendants performing the duty. Both flight attendants were required to remain at their designated positions while the pilot was out of the cockpit. The observers recorded the beginning and end of this activity for both flight attendants. Any activities that interrupted this duty were also recorded.

Safety compliance checks on descent and final approach. The pilots provide the cabin crew with three warnings that the aircraft is approaching landing. The first of these is the illumination of the "Fasten seat belt" sign during descent. When the sign is illuminated, a flight attendant moves through the cabin ensuring that the passengers' seat belts are fastened (safety compliance check), collecting trash, and picking up service items. This is a coordinated responsibility. All of these activities will be referred to as DSCC1.

The second warning is a chime indicating that the aircraft is passing through 10,000 ft. After this chime, a flight attendant moves through the cabin repeating the activities performed previously. These activities (DSCC2) are also a coordinated responsibility.

On final approach, the captain makes a "prepare for landing" announcement. Each flight attendant must perform the final safety compliance check (FSCC). After completing this check, the flight attendants should not pick up trash or service items. The flight attendant should be seated as quickly as possible after completing the FSCC because, in this phase of flight, the aircraft might have to descend or ascend quickly. This type of maneuvering could cause a flight attendant to lose his or her balance, potentially injuring himself or herself and passengers. The time to begin FSCC was recorded to determine if the flight attendant began the check promptly (less than 1 min) after the announcement.

Cabin Crew Performance Standards

The service performance of flight attendants is assessed periodically by their airline using performance standards. Some of the standards require the crew to begin a specific activity, such as the meal service, by a specific time; others to end an activity by a specific time. Standards are either measured from the 10,000 ft chime during climb or from the estimated touchdown time. That is, either an activity must begin no later than a specific number of minutes after the chime or it must be completed by a specific number of minutes before estimated touchdown.

Performance standards are set and assessed on a cabin-by-cabin basis (first class, business class, main cabin). For standards that require an activity to begin by a certain time, the entire crew assigned to the cabin has met the standard if one of the flight attendants in that cabin has met the standard. Similarly, if the standard requires an activity to be completed by a certain time, the entire crew assigned to the cabin fails the standard if one flight attendant in the cabin is still performing the activity past the deadline. Because not all flight attendants were observed in business class and in the main cabin on transatlantic flights, a cabin crew's success in meeting a standard could not always be determined unambiguously on these flights.

Observation Issues

All B-777 data were recorded on Tungsten E Palm Pilot personal digital assistants. Hewlett-Packard Pocket PCs were used on the B-737 and the MD-80 flights. Timer Pro Professional software (Applied Computer Services, Inc.) was used on both devices to collect the data. The Timer Pro software presented the observer with a list of task names. The observer scrolled through the task list to find the task currently being performed and highlighted the task name to begin recording. Observers could enter notes concerning the performance of a task or other events, such as turbulence, that could affect task performance. Different task lists were used for domestic versus transatlantic flights reflecting differences in the meal services and the presence of business class on the B-777. Before the first data collection flight, the observers identified positions in the aircraft where they would stand or sit to observe their flight attendant once data recording began. Because of post-9/11 security rules, the observers could not move between cabins to record data nor could they follow the flight attendant to observe his or her activities.

As shown in Table 1, the FAA specified a minimum number of flight attendants for each aircraft: six for the B-777, three for the MD-80, and three for the B-737. All three flight attendants were observed on all domestic flights. Resource limitations prohibited the observation of all 11 or 12 flight attendants on the transatlantic flights. Consequently, the eight flight attendants with unique safety duties were selected for observation.

The use of the recording devices was at the discretion of the captain. On all flights, data collection began at the 10,000 ft chime on climb, which was the start of the flight attendants' service period. Observations were terminated on all B-777 flights at touchdown. At the captain's request, the recording devices were turned off on domestic flights after the 10,000 ft chime on descent, which was the end of the flight attendants' service time.

Observer Training

Before training began, each observer was assigned to a specific flight attendant position and was expected to become familiar with the task analysis for that position, including the start–stop behaviors for each activity, and the task list instantiated in the software. Group training was designed to allow the observers to practice using the recording device and to ensure high interrater reliability. During this training, observers practiced recording realistic scenarios. After each scenario, the instructor compared the recorded task sequence. Any differences were discussed and resolved. The observers practiced until 100% agreement was reached on the recorded tasks. After the formal training was completed, each observer practiced recording data on several flights on which he or she was a passenger.

RESULTS AND DISCUSSION

Two secondary goals of this article were to determine how the length of the service period (10,000 ft chime during climb to 10,000 ft chime during descent) and the occurrence of turbulence affected the crew's ability to achieve the performance standards. Therefore, for the purposes of this article, the domestic and the transatlantic flights with the longest service times and those with the shortest service times are presented. Additionally, the domestic and transatlantic flights that experienced the most turbulence are presented because turbulence often slows down or stops the in-flight service, putting the cabin crew behind schedule.

Overviews concerning the achievement of performance standards and the timely performance of safety and security duties are given for the transatlantic flights and the domestic flights. Following the overviews are summaries of each flight. These summaries give a more detailed picture of the relation between the activities required to meet the performance standards and the timely performance of the safety and security duties.

The reader should note that, at the time these data were collected, the FAA had no regulations pertaining to in-flight rest for flight attendants. The rest periods described for the transatlantic flights reflect contractual agreements between labor and management at the airline.

Transatlantic Flights

The three transatlantic flights selected for analysis were the New York–London (shortest service time), London–Chicago (longest service time), and New York–Paris (most turbulence). Staffing and service information for these three flights is given in Table 2. For transatlantic flights the performance standards were divided into three groups corresponding to the early, middle, and late portion of the service period (see Table 3). The early group was concerned with the initiation of the in-flight entertainment, the initiation of the meal service, and the completion of the meal service in all three cabins. All these standards were assessed from the 10,000 ft chime on climb. The middle group consisted of two standards that pertained to the duty-free service and the beginning of the second meal service.

TABLE 3
Achievement of Performance Standards for Transatlantic Flights

<i>Performance Standard</i>	<i>Route</i>								
	<i>New York–London</i>			<i>London–Chicago</i>			<i>New York–Paris</i>		
	<i>First Class</i>	<i>Business Class</i>	<i>Main Cabin</i>	<i>First Class</i>	<i>Business Class</i>	<i>Main Cabin</i>	<i>First Class</i>	<i>Business Class</i>	<i>Main Cabin</i>
<i>Early</i>									
Distribution of premium-class entertainment systems	Y	Y		Y	Y		Y	N?	
Beginning of first meal service	Y	Y	N?	Y	N?	N?	Y	N?	N?
End of first meal service	Y	Y?	Y?	Y	N	N	Y	N	Y?
<i>Middle</i>									
End of duty-free service	Y	Y?	Y?	Y	Y?	Y?	N	Y?	Y?
Beginning of second meal service	N	N	N	Y	Y?	Y?	N	N	N
<i>Late</i>									
Collection of premium-class entertainment systems	N	N		N	Y		Y	N	
Completion of all entertainment	Y	N	N	Y	N	Y?	Y	N	Y?
Completion of paperwork	N	N	N	N	N	N	N	N	N
All galleys and cabins secure	N	N	N	N	N	N	N	N	N

Note. N = the standard was failed; Y = the standard was achieved; N? = no observed crew member made the standard; Y? = all observed crew members made the standard.

These were assessed from the estimated touchdown time. The late standards pertained to completing the in-flight entertainment service, securing the cabin and galleys before touchdown, and completing paperwork. These standards also were assessed from estimated touchdown time.

Table 3 presents the results for the eight observed flight attendants for the three flights and shows that the first-class cabin crew was slightly more successful in meeting the performance standards than crews in the other two cabins. This success could be attributed to the low ratio of passenger seats to flight attendant ratio (6:1) as compared to business class (10.5:1) and to the main cabin (17.6:1 or 10.7:1 for variable manning). On the three flights listed in Table 3, only the first-class New York–Paris flight was nearly full, with 16 passengers. The other two flights had less than half of their first-class seats occupied.

Table 3 shows a tendency for the crews to fail a higher proportion of the late group performance standards than the early and middle group standards. Indeed, none of these three crews achieved either of the last two standards. This could be explained by noting that the middle of most transatlantic flights has some free time during which there is no meal preparation or service. This period allows the crew to complete any duties that were omitted or delayed during the early phase of the flight. Only two performance standards occur during this period. The first of these pertains to the duty-free service and is relatively easy to achieve. Once the second meal service begins (the late phase), the flight attendants are locked into a strict schedule limited by descent and touchdown. The failure of the crews to achieve the late group performance standards might indicate that the meal service is started too late in the flight or that it is too complex for the current level of staffing.

Table 4 shows data for safety and security activities. At the time these data were collected, the lavatory inspections had not yet been emphasized and were not recorded. Because 15-min inspections are only performed when no service carts are in the aisles, these inspections occurred only during the middle of the transatlantic flights. Table 4 indicates that the flight attendants were careful not to leave the cabin unattended and generally performed the safety compliance check promptly when turbulence was encountered. The cabin crews were less successful in performing the 15-min inspections and the final safety compliance checks. Table 4 shows that the observed cabin crews had difficulty performing DSCC1 and DSCC2 promptly.

The last performance standard shown in Table 3, securing the galleys and cabins, is the only one linked directly to a safety duty, FSCC. When the “prepare for landing” announcement occurs, the flight attendants should perform FSCC promptly and then be seated immediately (Table 4). A comparison of Tables 3 and 4 indicates that although the flight attendants began FSCC promptly, they continued picking up items and performing other duties, such as service requests from passengers.

TABLE 4
Performance of Safety and Security Duties on Transatlantic Flights

Safety/Security Duty	Route								
	New York–London			London–Chicago			New York–Paris		
	First Class	Business Class	Main Cabin	First Class	Business Class	Main Cabin	First Class	Business Class	Main Cabin
Attended	Y	Y	Y	Y	Y	Y	Y	Y	Y
15 min inspections	N	Y	N	N	N?	N?	N	Y	Y
Safety compliance				Y	Y	Y	Y	N?	Y
FSCC1	N	Y	N?	Y	N?	N?			
FSCC2	Y	N?	N?	Y	N?	Y	Y	Y	Y
FSCC3	Y	N	Y?	N	Y?	Y?	Y	Y?	N

Note. N = the duty was not performed in a timely manner or was not performed correctly; Y = the duty was performed correctly and in a timely manner; N? = no observed crew member performed the duty in a timely manner or correctly; Y? = all observed crew members performed the duty correctly and in a timely manner; FSCC = final safety compliance check.

New York–London. Table 3 shows that the three cabin crews had little difficulty achieving the three early group standards. Flight attendants who fly the New York–London route know that making the late performance standards is difficult because of the short service time. Consequently, seven of the eight observed cabin crew elected not to take their rest period; the eighth took a 4-min rest break. The lack of rest periods explains why no cabin was left unattended (see Table 4); the crew worked throughout the flight.

All three cabin crews began their second meal service early, a violation of the air carrier's performance standards, to ensure that their duties were completed before touchdown. Despite beginning the final meal service early and not taking their breaks, the main cabin crew missed three out of three of the performance standards in the late group; the business-class crew missed four out of four performance standards; and the first-class crew missed three out the four standards (see Table 3).

Given the failure to meet the late performance standards, one could assume that many of the safety and security procedures performed late in the flight were omitted or delayed. This was indeed the case. The last 15-min inspection was omitted in first class; one inspection was late in the main cabin. The DSCC1 in first class was never conducted. In business class, no observed flight attendant performed the DSCC2, and one was late performing the FSCC. In the main cabin, both DSCC1 and DSCC2 were performed late by the observed flight attendants.

Earlier, it was noted that the last standard in Table 3 (galleys and cabin secure) and FSCC are closely related; the cabin crew should perform FSCC and sit down

promptly. Seven of the eight flight attendants were securing the galley and the cabin after or while they performed FSCC. One flight attendant was so late securing the cabin that she sat down less than 40 s before the aircraft touched down.

London–Chicago. This flight had the longest service time and the fewest number of passengers in the main cabin, 140, which was less than the number needed for variable manning. Consequently, this flight was staffed with 11 rather than 12 flight attendants. All eight observed flight attendants rested on this flight although four received less rest than the contractually required minimum of 45 min. The flight encountered only one instance of turbulence that required the “Fasten seat belt” sign to be illuminated. This turbulence occurred in the middle of the flight and did not affect any meal service. The required safety compliance checks were conducted promptly in all three cabins. At no time during the flight were any of the cabins left unattended.

Despite the relatively small number of main cabin passengers and the lack of turbulence, this crew failed to meet many performance deadlines, especially those for the late portion of the flight (see Table 3). Like the New York–London flight, the failure to achieve the performance deadlines in the late portion of the flight was associated with delayed safety and security activities.

The first-class flight attendants were late beginning four of the 15-min inspections. In business class, two of the 15-min inspections were started late. However, because one flight attendant was not observed, these two inspections might have been conducted on time. In the main cabin, two of the 15-min inspections were omitted by the observed flight attendants. Again, because not all of the main cabin flight attendants were observed, these checks might have been conducted by other flight attendants.

DSCC1 and DSCC2 were performed promptly in first class. FSCC, which must be performed by all flight attendants, was omitted by one member of the first-class cabin crew. In business class, none of the observed flight attendants performed DSCC1 or DSCC2. The two observed main cabin flight attendants failed to perform DSCC1. Additionally, all three cabins failed the last standard (securing the galley and cabins before landing); as they were performing FSCC, they were still picking up and stowing service items. Nevertheless, all of the flight attendants were in their jumpseats at least 2 min before touchdown.

New York–Paris. This flight, like the New York–London flight, a priori had a high workload because of its short service time. Three events occurred in this flight that further increased the workload for the cabin crew. First, this flight encountered the most frequent turbulence of any observed flight. Some of the turbulence was sufficiently severe that the main cabin flight attendants decided to be seated. Second, one of the main cabin flight attendants became ill shortly

after takeoff and could not perform any of her duties. Third, one of the passengers became ill approximately 2.5 hr into the flight and required medical attention from the cabin crew.

The duties of the ill flight attendant were redistributed among the other main cabin flight attendants, with the business-class and first-class flight attendants assisting in the main cabin when their duties permitted. One would assume that the increased duties, the ill passenger, and the turbulence would have resulted in more missed performance deadlines and missed or tardy safety and security duties than the other two crews. An examination of Tables 3 and 4 shows that this is not the case. These flight attendants were able to deal partially with the short staffing and the ill passenger by reducing their rest. By union agreement, flight attendants on this route were entitled to 30 min of rest. Of the eight crew members observed, only one received 30 min of rest. Two received no rest, and the maximum rest for the remaining four crew members was 19 min.

Because of the frequent turbulence, the "Fasten seat belts" sign was illuminated three times. The safety compliance checks were performed promptly in first class and in the main cabin. The three observed business-class flight attendants were either slow to perform the checks or did not perform them.

The turbulence encountered on this flight occurred before and during the second meal service, slowing down the service and making it difficult to achieve the performance deadlines. One 15-min inspection was not performed in first class before the start of the second service. Because the "Fasten seat belt" sign had been illuminated prior to descent and left on, DSCC1 was not performed. FSCC was performed late by both of the observed main cabin flight attendants. On this flight, one of the first-class flight attendants was extremely late in completing his or her duties and finally sat down less than 30 s before touchdown.

Domestic Flights

Table 5 shows data for the domestic flights that are comparable to those shown in Table 2 for transatlantic flights. On domestic flights, all flight attendants were observed. Consequently, the success or failure of a crew to make a performance deadline or perform a safety or security duty was determined unambiguously. As noted previously, the observers on domestic flights did not record any activities after the 10,000 ft chime on descent. Nevertheless, SMEs examined the last 3 to 4 min of each flight attendant's activities to determine if the flight attendant was behind schedule and was performing activities that should have been completed earlier in the flight.

The observed domestic flights had fewer performance standards than the transatlantic flights because first class received only one meal, no meal was served in the main cabin, no individual entertainment systems were available, and the duty-free service was not performed. The first two service standards shown in

TABLE 5
Staffing and Service Levels for Domestic Flights

Parameter	Aircraft		
	MD-80		B-737
	Los Angeles–Dallas	Philadelphia–Dallas	Toronto–Dallas
Flight date	November 2003	December 2003	December 2003
Passenger seats			
First class	14	16	16
Main cabin	115	126	126
Number of flight attendants			
First class	1	1	1
Main cabin	2	2	2
Federal Aviation Administration required minimum staffing	3	3	3
Meals			
First class	Dinner	Dinner	Dinner
Main cabin	Sandwich snack bag	Sandwich snack bag	Sandwich snack bag
Available service time	2:11	2:48	2:32

TABLE 6
Achievement of Performance Standards for Domestic Flights

Performance Standard	Route					
	Los Angeles–Dallas MD-80		Philadelphia–Dallas B-737		Toronto–Dallas B-737	
	First Class	Main Cabin	First Class	Main Cabin	First Class	Main Cabin
Beginning of service	N	Y	N	N	Y	Y
End of first-class meal	Y		N		Y	
Paperwork completion	Y	Y	Y	Y	Y	Y

Note. N = the standard was failed; Y = the standard was achieved.

Table 6 were measured from the time of the 10,000 ft chime on climb. The third standard concerns the completion of paperwork and is measured from the 10,000 ft chime on descent.

All three flights were scheduled for two beverage services in the main cabin. If a flight is scheduled for two beverage services, both services must be performed unless the captain orders the flight attendants to be seated before they have begun the service. The first-class service included a three-course meal. Unlike the

transatlantic flights, the first-class cabin was completely full on all three of these flights.

Each crew consisted of a dedicated first-class flight attendant and a dedicated main cabin attendant. The third flight attendant began working in the main cabin, finished the first beverage service, moved to first class to assist, and then returned to the main cabin for the second beverage service. This person is referred to as the “floating” flight attendant.

Table 6 shows that, unlike the first-class crews on transatlantic flights, the domestic first-class crews were not more successful at meeting performance standards than the cabin crews. However, like the transatlantic crews, both the first-class and the main cabin domestic crews did not perform many of the safety and security activities correctly. A later section provides more insights into the relation between the timely performance of the safety and security activities and the performance standards for each of the three domestic flights.

Los Angeles–Dallas. Despite having the shortest service time and a full first class, this crew was generally successful in meeting the performance standards (see Table 6). The flight encountered no turbulence and the crew was not required to perform any cockpit guards, allowing them to focus on service. They were less successful in meeting the safety and security duties (see Table 7). In first class, an omitted lavatory inspection was the only safety and security duty not performed appropriately. In the main cabin, one of the 15-min inspections was late and the cabin was left unattended twice for approximately 90 s each time.

No observer recorded the illumination of the “Fasten seat belt” sign during descent. Two explanations for this can be given: The pilots forgot the sign or the sign was left on during the entire flight. In any case, a DSCC1 was not performed

TABLE 7
Achievement of Safety and Security Duties on Domestic Flights

<i>Safety/Security Duty</i>	<i>Route</i>					
	<i>Los Angeles–Dallas</i>		<i>Philadelphia–Dallas</i>		<i>Toronto–Dallas</i>	
	<i>First Class</i>	<i>Main Cabin</i>	<i>First Class</i>	<i>Main Cabin</i>	<i>First Class</i>	<i>Main Cabin</i>
Safety compliance check					N	Y
Lavatory inspections	N	Y	N	N	Y	Y
15-min inspections	Y	N	N	Y	N	Y
Attend cabins	Y	N	Y	N	N	N
Cockpit guard			N	N	N	N

Note. N = duty omitted, performed incorrectly, or not performed to the schedule; Y = duty was performed correctly and in a timely manner.

in either cabin. At the 10,000 ft chime, all three flight attendants appeared behind schedule in securing the cabin and galleys for landing. One of the observers who was recording both of the flight attendants in first class accidentally continued recording after the chime. The resulting data confirm that both flight attendants were significantly behind and were securing the cabin and galley after the “prepare for landing” announcement.

Philadelphia–Dallas. As shown in Table 5, this flight had the longest service time of the domestic flights. Nevertheless, both cabins missed most of the service deadlines and performed many of the safety and security duties improperly. For reasons that are not apparent in the data, the first-class meal service was very slow. Although the floating flight attendant moved promptly to first class to assist, the service took well over 2 hr instead of the scheduled 1.5 hr. Because the meal service was so slow, two cockpit guards were performed during the service rather than after the service. The first cockpit guard duty occurred in the middle of the meal service. One of the flight attendants did not perform the first portion of the duty and continued the meal service, a violation of the air carrier’s security procedures. Near the end of the meal service, the aircraft began its descent and one of the first-class flight attendants performed the DSCC1 promptly. Shortly thereafter, the crew was required to perform the second cockpit guard duty. Both flight attendants began the cockpit guard duty and then left their assigned stations to complete the meal service, a second violation of security procedures.

Surprisingly, 18 min after the aircraft had begun its descent, the first-class flight attendant began preparing a meal for one of the passengers, a process that continued for another 8 min. By this point, the floating flight attendant had returned to the main cabin, leaving the first-class flight attendant alone to perform the service and the safety and security duties. This flight attendant did not perform the lavatory inspection and, by the 10,000 ft chime, was significantly behind in securing the cabin and the galley.

Because the floating flight attendant remained in first class longer than normal to assist, the main cabin flight attendant began the second beverage service alone. The second service had to be completed because this flight was scheduled for two beverage services. The second service had just begun when the aircraft began its descent. The flight attendant performed the DSCC1 promptly and resumed the service. When a beverage service is performed during descent, the crew might have insufficient time to perform its landing duties, which was the case on this flight. Neither the last lavatory check nor the last 15-min inspection was performed. Both of the main cabin attendants were still picking up service items and had not begun to secure the galley or the cabin before the 10,000 ft chime. The main cabin was left unattended for approximately 3 min on each of two occasions.

Toronto–Dallas. These main cabin flight attendants present perhaps the clearest example of the trade-off between service standards and safety and security duties. As seen in Tables 6 and 7, this cabin crew met all of the service performance standards but failed to perform most of the safety and security duties appropriately. In the main cabin, the first beverage service was performed on schedule. After the completion of the service, the floating flight attendant moved to first class to assist, completed the service there, and returned to the main cabin. Subsequently, both main cabin flight attendants went to the first-class cabin for 3 min, leaving the main cabin unattended. After their return, they began preparing for the second beverage service, which was scheduled for this flight. The flight then encountered turbulence. Both main cabin flight attendants performed their safety compliance checks promptly and sat in their jumpseats.

After approximately 10 min, the main cabin flight attendants returned to duty and began the second beverage service. By this time, the aircraft had begun its descent. From a safety perspective, beginning the second beverage service during descent was a questionable decision for several reasons. During descent the aircraft could maneuver suddenly, especially during final approach, which could cause the flight attendants to lose their balance or drop service items, potentially injuring passengers. Because some angles of descent are steep, carts with faulty brakes or carts that are improperly locked can roll forward, again potentially injuring passengers or crew. Additionally, a late beverage service might not provide sufficient time for the cabin crew to pick up and store the service items properly and secure the cabin and galley before touchdown. Indeed, both of these flight attendants were significantly behind in their duties at the time of the 10,000 ft chime.

While the main cabin flight attendants were performing the second beverage service, the crew was required to perform a cockpit guard. This presented the cabin crew with a dilemma. Rather than risk having the service carts in the aisle during final approach, the main cabin flight attendants continued the beverage service. The first-class flight attendant performed the cockpit guard duty alone, which was a violation of the air carrier's policy and presented a security risk.

Like the main cabin crew, the first-class flight attendant met the service standards but performed the safety and security duties poorly (see Tables 6 and 7). She conducted the first 15-min inspection late and delayed the safety compliance check when turbulence was encountered. The reasons for this tardy performance are not apparent, especially because this flight attendant did not return to her jumpseat during turbulence. During descent, she left first class unattended for almost 4 min, again for reasons that are not apparent. This flight attendant clearly was behind in the performance of her duties at the 10,000 ft chime and did not begin securing the galley or the cabin until after the aircraft had passed through 10,000 ft. No DSCC1 was performed in either cabin on this flight because the seat belt sign was left on after the turbulence encounter.

SUMMARY

Flight attendants have three different sets of duties: safety, security, and passenger service. The primary goal of this study was to examine the potential conflict between the passenger service as instantiated in airline-specified performance standards and the prompt execution of safety and security duties. Two secondary goals concerned determining the effect of (a) available service time, and (b) turbulence on the crew's ability to achieve the performance standards and on the timely execution of safety and security duties.

As shown in Table 3, most of the transatlantic crews had difficulty meeting the performance standards, particularly those for the late phase of the flight. Similarly, they did not perform many of the safety and security duties in a timely manner (see Table 4), especially those occurring in descent. Any interpretation of these two tables must take into account the fact that all three crews received reduced rest, with the New York–London crew receiving essentially no in-flight rest. Had these crews insisted on taking their rest breaks, they are likely to have been even further behind their in-flight service schedule, missing more of the performance deadlines and delaying or omitting more of the safety and security duties.

The existence of trade-offs between passenger service and the safety and security duties is most clearly determined from the brief descriptions of each flight. For the transatlantic flights, many of the 15-min inspections, which were performed only during the middle of the flight, were performed late or omitted. More important, some of the final safety compliance checks were omitted; others were performed late. Given that the crews also were late in performing their service duties, no clear trade-off between the passenger duties and the safety and security duties is evident on these flights.

The domestic flight crews had fewer performance standards than the transatlantic crews but several additional in-flight safety and security duties. Observation of the final safety and compliance checks was not possible because of restrictions on the use of the data collection devices. Table 6 shows that the domestic crews had some success meeting the performance standards. Table 7 shows that they had difficulty performing the two, fixed-schedule safety and security duties: the 15-min inspections and the lavatory checks. Of more concern were the cockpit guard duties. Three out of three of the cockpit guard duties were performed incorrectly. In all three cases, the flight attendants interrupted the cockpit guard duty to continue the meal service.

The domestic flight data show several other instances in which passenger service appeared to have priority over safety and security, including instances of beginning a beverage service during descent and beginning to prepare food during descent. However, these activities need to be understood from the flight attendant's perspective; failure to perform these service duties could result in disciplinary actions if they had been reported. Nevertheless, the late inspections,

omissions of the lavatory checks, and interrupted cockpit guard procedure points to a higher priority for passenger service than for safety and security.

This study also addressed two secondary questions pertaining to the effect of service time and turbulence on the achievement of performance standards and on safety and security duties. A comparison of the data for the New York–London versus the London–Chicago flight (Tables 3 and 4) shows only a slight advantage for the longer London–Chicago flight in meeting the performance standards and the safety and security duties despite almost a 2-hr difference in the service time. The main advantage of the longer service time was that the London–Chicago crew did not have to start the second meal service early to complete all of the activities and duties prior to landing.

For the domestic flights, the flight with the shorter service time, Los Angeles–Dallas, actually met more performance standards than the flight with the longer service time (see Table 6). The difference in available service time between the two flights was only 37 min, perhaps too little to have a noticeable impact on performance. Table 7 also shows little difference between the two flights in terms of the timely execution of safety and security duties. Again, the small difference favors the shorter flight.

Contrary to expectations, turbulence, like service time, had little effect on performance. The New York–Paris crew had an ill crew member, an ill passenger, and a short service time in addition to turbulence. The increased workload was reflected in the crew's meeting fewer performance standards than the other two crews. However, they performed their safety and security duties as well as the other two crews. For the domestic flights, the flight with the most turbulence, Toronto–Dallas, met more performance standards than the other two flights and executed their safety and security duties as well, if not better, than the other two flights.

The results of this study indicate that cabin crews are not able to complete all of their safety and security duties in a timely manner while achieving the performance standards specified by the carrier. The domestic flight data raise questions about staffing levels, particularly because the crew size on both aircraft had been reduced a few months earlier. Each of the domestic flight descriptions notes that, by the 10,000 ft chime, all of the flight attendants were behind in their safety and security duties. These results suggest that the domestic in-flight services might be too complex for the current size of the cabin crew.

The fact that both the domestic and the transatlantic crews failed both the safety and security duties and the performance standards in the latter parts of the flight suggests that too many service duties are occurring in the late phase of the flight. Eliminating some of these activities, changing the point at which they are performed, or beginning the second meal service earlier might help reduce the workload late in the flight. Additionally, the use of disciplinary actions to ensure prompt passenger service might cause the flight attendants to focus

on passenger service at the expense of safety and security. Other methods for ensuring passenger service should be explored.

The results of this study should be interpreted bearing five limitations in mind. First, all data were collected on one U.S. air carrier. Consequently, the observations might not be representative of other airlines. Second, as shown in Table 1, not all crew members were observed on the transatlantic flights. The results might have been somewhat different if all of the flight attendants in business class and in the main cabin had been observed (all first-class flight attendants were observed). Third, the data, especially the transatlantic data, were collected relatively soon after 9/11. Some of the safety and security procedures were under development or were being modified at the time the data were collected. Different results might be obtained now after the procedures have been refined and have been in use for several years. Fourth, the transatlantic flights were relatively short international flights. Observations on much longer international flights might give different results. Fifth, different air carriers might have different passenger service schedules. Again, these would provide different results from those found in this study.

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