NATIONAL TRANSPORTATION SAFETY BOARD
OFFICE OF AVIATION SAFETY
WASHINGTON, D.C.

October 15, 2009

Survival Factors Group Chairman's Factual Report of Investigation

A. Accident : DCA09MA021

LOCATION	:	Denver, Colorado
DATE	:	December 20, 2008
TIME	:	1818 Mountain Standard Time
AIRCRAFT	:	Boeing 737-500, N18611
OPERATOR	:	Continental Airlines, flight 1404

B. Survival Factors Group

Chairman	:	Mark H. George National Transportation Safety Board Washington, D.C.
Member	:	Jason T. Fedok National Transportation Safety Board Washington, D.C.
Member	:	Assistant Chief Charles W. Davis Denver Fire Department Denver, Colorado
Member	:	Mark Gabel Federal Aviation Administration Renton, Washington
Member	:	Chris Hartman Continental Airlines Houston, Texas
Member	:	Sherri Kelly Federal Aviation Administration Denver, Colorado
Member	:	Steve Lee Denver International Airport Denver, Colorado

Member	:	Susan McCormick Federal Aviation Administration Denver, Colorado
Member	:	Kathryn Reneau Continental Airlines Houston, Texas

C. Summary

On December 20, 2008, at 1818 mountain standard time, Continental flight 1404, a Boeing 737-500 (registration N18611), equipped with CFM56-3B1 engines, departed the left side of runway 34R during takeoff from Denver International Airport (DEN). The scheduled, domestic passenger flight, operated under the provisions of Title 14 CFR Part 121, was enroute to George Bush Intercontinental Airport (IAH), Houston, Texas. One of the five crewmembers was seriously injured, and five of the 110 passengers were seriously injured. There were 45 minor injuries, and no fatalities. The airplane was substantially damaged and experienced post-crash fire. The weather observation in effect at the time of the accident was reported to be winds at 290 and 24 knots with gusts to 32 knots, visibility of 10 miles, a few clouds at 4000 feet and scattered clouds at 10,000 feet. The temperature was reported as -4 degrees Celsius.

D. Details of the Investigation

1.0 Airplane Configuration

The airplane had a two-class cabin with first and economy classes. There were eight first-class passenger seats and 106 economy-class passenger seats. The airplane was equipped with six emergency exits; two Type I exits at the front of the airplane, two overwing Type III exits, and two Type I exits in the aft of the airplane. Each of the Type I exits included door-mounted escape slides for evacuation. Three galleys were installed: G1 located forward of door 1R, G2 located aft of door 1R, and G4B located on the aft bulkhead aft doors 2L and 2R. Three lavatories were located within the airplane: Lav A was forward of Door 1L, Lav D forward of door 2L, and Lav E forward of door 2R. There were two crewmember seats and two observer's seats in the cockpit. There was an aft-facing double flight attendant jump seat on the forward bulkhead, and an aft-facing double flight attendant jumpseat on the aft bulkhead forward of the 2L door. There was also a single aft-facing flight attendant jumpseat near the 2R door (see Figure 1, cabin configuration).

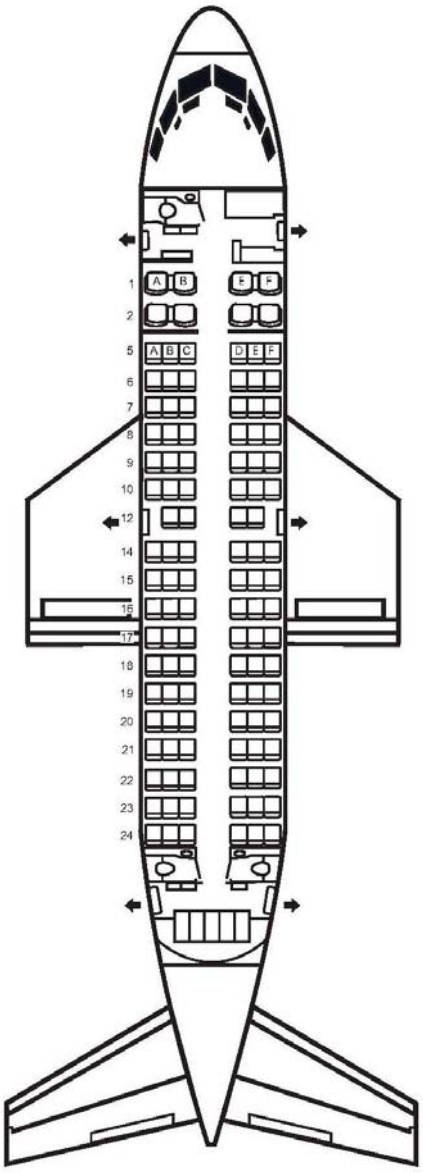

Figure 1. Cabin Configuration

2.0 Crew Information

2.1 Cockpit Crew Interviews

Summaries of flight crew interviews are included in the Operations Group Chairman's Factual Report.

2.2 Cabin Crew Interviews

The interviews were conducted on December 21, 2008 in Continental Airlines Offices in Denver. Present for the interviews were: Mark George, NTSB; Sherri Kelly, FAA; Susan McCormick, FAA; Kathryn Reneau, Continental Airlines; and Scott Garber, Continental Airlines.

Regina Ressler
Height 5'9", Weight 175 pounds, Age 31
Date of Hire 4/17/97, Last Recurrent Training Date 8/11/08.
FAA certification number: 2893884

Ms. Ressler was lead flight attendant (FA) on the accident flight. She sat on the forward jumpseat, inboard.

The take-off roll seemed to be normal before climbout. When the airplane reached top speed, she felt the airplane "fishtail" which she did not think was unusual. She could tell the pilots tried to compensate but the speed did not decrease, and the airplane continued to fishtail back and forth. She felt the airplane's left wing dip, and then the airplane began to go up and down "violently" four to five times, "like a boat on cresting waves." She was thrown about in her jump seat with her legs and feet being tossed up and down. While her feet were pounding on the floor, her ankle was injured. The jump seat did not perform as well as she expected, and her "butt" slid out from under her and she went sideways during the violent motion. Her restraint devices were "snug" but not "cutting into her lap." When the takeoff roll began, she was in her brace position.

Once the airplane came to a stop, the emergency lighting system activated automatically, she noted that it was "very bright." She could see flames through the porthole on the 1R door and through the windows of the first class section. She also noticed a "white dust (haze)" in the cabin but no smoke. There was no communication from the flight deck, and she did not attempt to contact them. Due to the fire, she felt that it was necessary to begin the evacuation immediately.

She assessed the conditions outside of door 1L through the porthole. She opened the door "with ease" and the evacuation slide inflated with no problems. She thought the color of the slide (charcoal and grey with small lights) made it hard to distinguish in the darkness. She was expecting either a yellow or orange slide "like the ones in training." She noted that the angle of the slide was "very shallow" due to the close proximity of the ground; she said that the far end of the slide touched the ground. At some point, she realized that the door had not locked against the fuselage, but was not able to correct it immediately due to passengers crowding around the door area. She later was able to push the door all the way open and get it locked into position. She yelled her commands "Come this way" while she blocked the 1R door by standing in the forward galley entry area. Passengers did not need assistance as they exited the airplane, although there was a first class passenger assisting at the end of the slide.

During the evacuation she saw a female passenger bring a "large black bag" with her. The bag was impeding the passengers egress because it hit the back of the seats as she proceeded down the aisle. She yelled at the female passenger to "leave it," and the passenger dropped the bag in a seat and quickly exited the airplane. She also saw small children "clinging to their parents," and passengers who appeared to be very frightened.

She looked down the aisle and noticed "some" overhead bins were open. Bags and debris were in the aisle. She believed that the items in the aisle were dislodged from the storage area under the seats rather than from the overhead bins.

As her area started to clear, she noticed a "bottleneck" of passengers at the left overwing exit. There were two deadheading pilots directing the evacuation in the overwing exit area. She yelled "I am open, come this way" and the deadheading pilots directed passengers towards her exit.

When all passengers were gone, she noticed that the deadheading crewmembers were checking the cabin area. She "banged" on the flight deck door to check on the pilots. She received no response so she tugged on the door handle several times and then "ripped" the door open. The pilots were still in their seats and did not say anything. They both were able to get out of the airplane under their own power although they were "very badly" hurt.

She heard the deadheading first officer say that the cabin was clear. She exited the airplane followed by the first officer. As she was trying to get away from the airplane, she realized her ankle "didn't work." She started to crawl away and two unknown persons helped her away from the airplane. She saw a blind passenger alone in the field nearby. She called to her and helped her get away. A fireman showed up and took both her and the blind passenger to the firehouse in a fire truck. She was carried inside the firehouse and sat on a rolling office chair.

She saw the triage area that was set up in the fire house. She saw one man with blood on his forehead. She was then wheeled to an ambulance in the office chair and was placed in the front of the ambulance. She was taken to the hospital and her ankle was X-rayed. She had sustained a severe sprain to her right ankle. She was discharged from the hospital the same evening.

Pamela Howard
42 years old, 5'4," 140 lbs.
Date of Hire: 7/20/90; Last Recurrent Training: 6/24/08
Position: Aft-facing double jump seat at 2L door, seated outboard.
FAA certification number: 2891140

Prior to take off, everything seemed normal. During takeoff, as the airplane approached top speed it began to "fishtail." At first she thought it was normal, but then the airplane continued to swerve first to the left and then to the right, and then started

bouncing. At that point she realized something was wrong. The airplane did not slow down and began bouncing "violently."

When the airplane came to a stop, she attempted to contact the flight deck using the interphone, with no response. The emergency lights had come on and were "very bright." She saw flames through the porthole at the 2R door and realized that there was fire on the right side of the airplane. Due to the fire she initiated an evacuation, opening the 2L door. While she was opening the door, passengers began crowding forward, and she commanded them to "back up". She noted that the use of an authoritative tone appeared to control the passengers and they were cooperative. She was surprised at how easily the door opened and the slide inflated without any problem. She shouted her commands "Come this way." The ceiling panel between the two aft lavatories was hanging down into the aisle. She held it up so passengers could get through. She blocked the 2R door by standing in the galley with her back to it.

When the passengers had cleared out, she left FA Felipe at the 2L door to continue the evacuation and proceeded to her secondary exits, the over wing window exits. She saw that two deadheading pilots were at that exit commanding the evacuation. She ran all the way to the 1L door and checked the airplane for remaining passengers. She looked back and saw the deadheading pilots also checking the airplane for passengers. She believed all passengers were off of the airplane and she exited through the 1L door. When she got outside she saw FA Felipe on the slope using a flashlight and a megaphone to direct passengers away from the airplane to a building at the top of the hill. She began direct passengers away from the airplane up the hill to the shelter of the building. Once inside the building she attempted to get a headcount and assisted with injured passengers. She was uninjured and was later bused to the terminal with the passengers.

Albert Felipe
Height 5'9," Weight 200 pounds, Age 35
Date of Hire 09/10/98; Last Recurrent Training Date 07/26/08,
Prior to CAL, he worked for one year as an FA for Rich International Airways.
Position: Aft-facing double jump seat at 2L door, seated inboard.
FAA certification number: 2890004

During the take off roll, he did his 30-second review. Approximately 9 to 10 seconds into the take off roll, the airplane veered to the left, "fishtailed," then it "compensated" and veered to the right. Then it "rolled back" to the left, it felt like the pilots added more power. He thought they were lifting off but then the airplane started "violently going up and down." The force of the impact took him out of his brace position. His head kept pounding the headrest, which he believes caused his neck and shoulder injury.

After the airplane came to a stop, both he and FA Howard got out of their jump seats. He assessed the 2R door and saw "orange flames" through the porthole. He noted that the emergency lighting system was already on. He started yelling commands, while

FA Howard called the flight deck. He yelled at FA Howard to open her door while he held people back. He assisted FA Howard with the door, and as the door opened, the slide automatically inflated. The exit and slide was "very close" to the ground. The slide was "not useful" for the evacuation; the passengers stepped on the slide then on to the ground area. He noted that the slide was "dark in color" and was "very difficult" to see. He saw panels hanging down between the aft lavatories, and they needed to be held up out of the passengers' way during the evacuation so they would not hit their heads. He yelled for passengers to come to the 2L exit. Passengers brought their carry-on items. There "seemed to be" a lot of debris in the aisle. He noticed a couple of overhead bins were open and passengers were trying to get their carry-on bags. He could not use the command to "jump into the slide," so instead he yelled for them to "come this way, get out". While he was conducting the evacuation, FA Howard went to the overwing exit to help with the evacuation there. There were deadheading crewmembers (a captain and first officer) assisting with the evacuation at the left over wing exit. He thought that the passengers got out "very quickly."

After all the passengers were off, he grabbed the flashlight and went through the cabin with the deadheading captain to ensure no passengers were left onboard. He said that he went through the cabin twice doing a "cabin sweep" looking for passengers. As he was going through the last time, the airplane interior started to fill up with white smoke that turned black almost immediately. He smelled fuel and smoke and an odor of "burning plastic." As he went out the 2L exit, he grabbed the megaphone and started yelling to the passengers to get away from the airplane. He directed them, with the flashlight, up the hill, and into the building.

He ran down the hill several times to help passengers get up the hill and into the building. Once everyone was in the firehouse, he checked on the passengers and helped to triage those that were hurt and got them to the firemen.

2.3 Cabin Crew Training

All cabin crew members held valid certificates issued by the FAA. They were qualified on the B737 airplane and had successfully completed annual recurrent training earlier in 2008. The 2008 Recurrent training program required flight attendants to demonstrate emergency operation of B-737, B-757, B-767, and B-777 doors and window exits.

Continental Airlines' flight attendant inflight manual and 2008 Recurrent Training program outlined procedures to be used in the event of an unplanned land evacuation. Excerpts from the manual and training program appear below:

30-second review

Pertinent reference material and training:

- *Inflight Manual*, Chapter 5, Standard Operational Procedures (S.O.P.), Page 1 details 30-Second Review required prior to every takeoff and landing:
  "The 30-second review is an important mental review of emergency procedures and is required before each takeoff and landing…" The 30-second review consists of a mental review of among other things, the brace positions, exit operation (including secondary exits, if applicable), dedicated assist space, evacuation commands, potential ABAs, factors that may influence an emergency, and evacuation procedures.
- *Inflight Manual*, S.O.P. tab, Flight Attendant Safety Checklist (list of FAA- and Continental-required safety duties for every phase of flight from Prior to Customer Boarding through Landing, Taxi and Arrival):
  "Perform 30-second review"
- Recurrent Training 2008 CBT Training Module: Emergency Procedures Preparation. Focuses on the 30-second review as a means of preparation for unplanned emergencies.

Commands: brace –for-impact

Pertinent reference material and training:

- *Inflight Manual*, Chapter 1, Emergency, Page 10 (Unplanned Emergencies):
  "Upon first indication of an unusual situation, shout and repeat the command: 'BEND OVER! HEADS DOWN!'
- Recurrent Training 2008 – Evacuation Test
  During exercise, the command sequence is triggered by audible (recorded) signal from flight deck to "Brace for Landing". Failure to give command "Bend Over! Heads Down!" during evacuation exercise results in unsatisfactory rating and remedial training is required.
- Recurrent Training 2008 CBT Training Modules for 737, 757, 767 and 777 Door Exit Review in emergency mode depicted commands being given by flight attendants on signal to "Brace for Landing" from flight deck.

Flight attendant authority to initiate evacuation

Pertinent reference material and training:

- *Inflight Manual*, Chapter 1, Emergency, Page 9:
  "Flight attendants are responsible for customer safety. When an emergency occurs, flight attendants must take immediate and deliberate action and maintain control to ensure the safety of passengers and fellow crew members."

- *Inflight Manual,* Chapter 10, Emergency, Page 10:
  "In a situation where flight attendants must take immediate action in the interest of safety, flight attendants should attempt to contact the flight deck crew prior to initiating and evacuation. However, if conditions exist where danger is obvious and imminent, or contact is not possible, flight attendants should evacuate as quickly as possible by using the appropriate commands."
- Recurrent Training 2008 – Evacuation Test:
  Evacuation initiated at command of "Easy Victor" from flight deck.
- Recurrent Training 2008 CBT Training Module Emergency Procedures Preparation describes an unplanned evacuation scenario using a command of "Easy Victor" from the flight deck as the initiative for evacuation.
- Recurrent Training CBT Training Modules for 737, 757, 767 and 777 Door Exit Review in emergency mode depicted evacuation being initiated at "Easy Victor" signal from flight deck.

Evacuation procedures

Pertinent reference material and training:

- *Inflight Manual:* Chapter 1, EMERGENCY, Page 9:
  "If an evacuation is necessary, flight attendants must continually monitor conditions inside and outside the cabin and adjust their actions accordingly."
- Inflight Manual: Chapter 1, EMERGENCY, Page 10:
  UNPLANNED EMERGENCIES (LAND & WATER)
  Upon first indication of an unusual situation, shout and repeat the command:

  "BEND OVER! HEADS DOWN!" This puts customers in a protective position for impact.

Deciding To Evacuate

- Once the aircraft stops, you should hear one of two announcements:

  "EASY VICTOR, EASY VICTOR" or
  "REMAIN SEATED, REMAIN SEATED"

- If you hear "EASY VICTOR, EASY VICTOR" proceed immediately with an evacuation.
- If you hear "REMAIN SEATED, REMAIN SEATED" the captain is determining whether to evacuate. Flight attendants are to assess conditions at their assigned exits and await further instructions from the flight deck crew.
- If an evacuation is necessary, the captain may announce, "EASY VICTOR, EASY VICTOR."

- If an evacuation is not necessary, the captain will make the appropriate announcement. Flight attendants are to keep customers seated.

  CONSTANT AWARENESS DURING THIS TIME IS ESSENTIAL.

- In a situation where flight attendants must take immediate action in the interest of safety, flight attendants should attempt to contact the flight deck crew prior to initiating an evacuation. However, if conditions exist where danger is obvious and imminent, or contact is not possible, flight attendants should evacuate as quickly as possible by using the appropriate commands. An evacuation should not be initiated until the aircraft comes to a complete stop and the engines have been shut down.

- *Inflight Manual:* Chapter 1, EMERGENCY, Page 21 (CONDUCTING LAND EVACUATION – Assess Conditions):
  - Assess conditions (look for fire or other hazards inside and outside the aircraft).
  - Shout "STAND BACK!"
  - If route is usable, proceed with evacuation.
  - Continue to assess conditions throughout the evacuation.
- *Inflight Manual:* Chapter 1, EMERGENCY, Page 22 (CONDUCTING LAND EVACUATION – Blocked/Unusable Exit):
  - If exit is unusable, block and redirect customers to alternate exits.
  - Shout commands as appropriate.
  - Use arm/hand gestures to direct customers to nearest usable exits.
  - Instruct ABA to continue blocking exit.
  - Proceed to the nearest unmanned usable exit.
- *Inflight Manual:* Chapter 1, EMERGENCY, Page 22 (CONDUCTING LAND EVACUATION – Flow Control):
  - Continually evaluate conditions both inside and outside of exit. If an exit becomes unusable after opening, block the exit and redirect.
  - Keep an even flow of customers moving toward exits. Do not allow one aisle or exit to become crowded while another is available to relieve congestion
- Recurrent Training 2008 CBT Training Module for Emergency Procedures: After emergency evacuation is initiated and the flow of customers at your primary exit slows, proceed to secondary exit (if applicable).
- Recurrent Training 2008 – Secondary Exit Emergency Operation
  Each flight attendant must demonstrate emergency operation of a 737 plug and gull window exit, 757, 767 window exit and the 757-300 and 767-400 3L/R plug door. The flight attendant must then correctly demonstrate the operation of the window exit and sequence of commands.
- *Inflight Manual,* Chapter 4, 737, Page 124 – Emergency Operation
  "Push door until fully latched open."

- Recurrent Training 2008 – Evacuation Test
  Flight attendants are required to demonstrate proficiency in operating door in the "emergency" mode. Failure to ensure the door is "latched open/locked in place" does not disqualify their performance on the door from receiving a satisfactory rating; they receive a "satisfactory but debrief" on the procedure.
- Recurrent Training 2008 CBT Training Modules for 737, 757, 767 and 777 Door Exit Review in emergency mode states "The door should lock against the fuselage."

- *Inflight Manual,* Chapter 4, 737, Page 124 – Emergency Operation:
  "Hold assist handle and pull red manual inflation handle."
- *Inflight Manual,* Chapter 1, Emergency, Page 22 – Activate Usable Exits
  "Inflate slide (always pull inflation handle, regardless of slide type, except 757 doors)."
- Recurrent Training 2008 – Evacuation Test
  Flight attendants were required to demonstrate proficiency opening each of the doors in emergency mode, which included pulling the red inflation handle (with the exception of the 757 aircraft). Failure to pull the red inflation handle results in an unsatisfactory rating for the door. Secondary testing is performed at the end of the day. If unsuccessful during secondary testing, the flight attendant is placed on non-qualified status and brought in the following day for remedial training and proficiency testing.
- Recurrent Training 2008 CBT Training Modules for 737, 767 and 777 Door Exit Review in emergency mode depicted the flight attendant pulling the red inflation handle as a required step and included a close up of the flight attendant's hand pulling the inflation handle.

2.3.1 CAL Exit Row Seating Program

In accordance with CFR Part 121.585, Continental Airlines maintains an Exit Seating Program, that; 1) defines those seats within Continental's fleet of aircraft which are designated as exit seats; 2) the criteria for selecting passengers that may occupy those seats, and; 3) other procedures that are to be utilized during the implementation of the program.

According to the CAL policy, for a passenger to be eligible for seating in an exit seat, the passenger must:

1. Be at least 15 years of age and able to perform all of the functions listed below without assistance.
2. Have no pre-existing condition that might cause personal harm or prevent the person from performing all of the functions listed below.
3. Not be traveling with a customer who requires special care, such as a small child, that would prevent the person from performing all of the functions listed below.
4. Read well enough to understand the instructions, provided by Continental in printed or graphic form, for opening exits and other emergency procedures.

5. See well enough to perform all of the functions listed below. Persons may wear glasses or contact lenses.
6. Hear well enough to understand commands in the language used by Continental. Persons may wear a hearing aid.
7. Speak well enough to give information to other customers during an emergency.
8. Be able to reach the emergency exit expeditiously.
9. Be able to use both hands, both arms and both legs, as well as maintain balance and be strong and flexible enough to operate the exit and any slide mechanism; open the exit and go quickly through it; stabilize the escape slide; assist others in getting off an escape slide; and clear the exit row of obstructions including window hatches as required. Some window hatches that must be lifted can weigh as much as 58lbs. (26 kgs.), the average weight of a seven to eight year old child.
10. Not be traveling with an oxygen concentrator device.
11. Not be traveling with a pet container.

Initial screening of passengers for eligibility is conducted "visually and verbally" by airport sales agents. The following information is provided to passengers by the airport sales agents, and is also placed onboard the airplane, on cards available to passengers seated in exit row seats:

> Customers seated in Exit Seats should ONLY open an exit at the direction of a uniformed crewmember. To assist crewmembers in an emergency, or if a flight attendant cannot reach the exit, the guidelines to follow are:
>
> 1. Know where all the exits are on the aircraft. Study the briefing card and know how to open the exit closest to you. Follow all verbal and directional hand signals given by a flight attendant.
> 2. If an emergency evacuation is necessary and if a flight attendant cannot get to the exit in your row, you might have to open it. ***First look outside.*** If fire, smoke or water could come into the cabin through the exit, ***do not open it.***
> 3. If it is safe to open the exit, do so as quickly as possible. Keep the pathway to the exit clear. If the exit cannot be opened, go to another exit.
> 4. If the exit has an inflatable emergency slide, you may have to inflate it. Check the briefing card for instructions. When the slide is inflated, shout, "Release seatbelts! Come this way!" Then go out the exit as quickly as possible.
> 5. If there is a slide and there is no immediate danger, wait at the bottom to help people off the slide. Hold onto the slide to stabilize it.
> 6. If there appears to be immediate danger, move away from the slide as quickly as practicable.

Additionally, the CAL exit row seating policy specifies that, after the passengers are seated on the airplane, but prior to closing the boarding door, it is the responsibility of the "A" flight attendant to ensure a "visual check" of the exit row seats is accomplished, and to verify that no exit row seats are occupied by passengers who are unable to perform the functions listed above. Further, prior to closing the entry door, the "A" flight attendant must make a "verification announcement" over the PA system to inform passengers in

the exits rows that additional information is located on the safety information cards. The verbatim verification announcement is as follows:

> "For customers seated in a row of seats identified by the words NO CHILDREN THIS ROW, please review the white exit seating card and the safety information card in your seat pocket. If you cannot meet the standards or are unwilling or unable to perform the actions possibly required of you, without injury, please notify a flight attendant for reseating."

3.0 Passengers

3.1 Passenger questionnaires

Questionnaires were sent to passengers following the accident. To date, 36 completed questionnaires were returned to the Safety Board, and are contained in Attachment 1.

3.2 Interviews

Seat 6E
Male, age 52
Telephone interview by Mark George, NTSB.

He was traveling with his wife (6F) and daughter (6D). He had no background in aviation, although he flew commercially "a lot."

The takeoff roll seemed no different than any other, except the airplane seemed to roll "longer" than usual. The airplane suddenly made a "hard" left turn, and then it got "very bumpy." His wife said, "We're not on the runway anymore." It was very bumpy, and "parts of the ceiling above the luggage rack" fell on his daughter. They hit something "really hard" and the airplane went airborne, he was pulled in an upward direction, then "crashed down really hard." Then, there was a second, harder, crash; "forward and down," the airplane bounced up in the air, came down again, and stopped. He saw fire outside the airplane on the right side.

The flight attendant had the door open and slide out "very quickly." He, his wife, and his daughter went forward, and were out the forward exit with 10 – 12 seconds after the airplane stopped. The slide was visible outside the exit, and his wife "ran" down the slide. The flight attendant was "totally poised," standing on one leg, yelling, "Go, go, go!" He never looked aft in the cabin. He could not tell if there were lights in the cabin due to the "huge" fire outside. Outside the airplane, jet fuel was "everywhere."

After he was outside the airplane, he could see lights on a building (which turned out to be a fire station) up a hill, and the passengers were walking that way. He carried a woman up the hill, then went back down and carried another woman up the hill. He went back down the hill, and saw the firefighters spraying the fire. He met the pilot, copilot and

the flight attendant coming up the hill. The pilots were helping the flight attendant get up the hill. He went back up the hill and into the fire station. It was "pretty chaotic" in the kitchen and dining area. After "about 5 minutes," a firefighter came into the area, and said, "If you're not injured, go into the bay."

After "about 2 hours," shuttle buses took the passengers to the terminal, where they filled out paperwork. Then, "about 2 hours" later, they were released. His wife had whiplash and lower neck pain from an existing back injury; his daughter experienced neck pain. He had a "stiff hip."

Seat 9B
Female, age 31
Telephone interview by Mark George, NTSB.

She was travelling with her 4 year-old son, who was seated in 9C. She had no background in aviation and estimated that she flew commercially approximately 2 -3 times per year.

The takeoff roll seemed "normal," as the airplane accelerated. When it seemed about to take off, the nose and the left wing of the airplane lifted, and then the airplane "turned left." It was very smooth, still; it felt like the airplane was "sliding sideways" with the nose pointed to the left. Then it got "very bumpy, like the bumps on the side of the highway." She saw "sparks" out the left window, and the airplane felt like it went down a long hill. It was "like a roller coaster" going down a steep hill then leveling out. Then, the airplane hit some "big bumps," and went airborne like it had "hit a ramp." The nose of the airplane went up, and then the airplane "slammed down, extremely violently."

She and her son were both wearing their seatbelts. She had hers fastened "snugly," and had fastened her son's seated belt "tightly." While the airplane was bouncing along, she was trying to hold herself and her son against the seat backs. There were more bumps, and then another "ramp," and the airplane went airborne again. When the airplane slammed to the ground the second time, it was even more violent than the first time. She could see an "orange glow" in the cabin. The airplane slid a ways, and then stopped moving. After the airplane stopped, she saw the orange glow was coming from outside the airplane on the right side, and it was "growing."

Somebody yelled, "We gotta get out of here!" A few passengers were already standing. She did not remember any lights inside the airplane. During the crash, she did not see any of the overhead bins come open, but did see a "few things" flying around the cabin. She saw other passengers stand up and get luggage out of the overhead bins. She unfastened her and her son's seatbelts, and saw a "big clot of people" at the left overwing exit area. They were taking their time, going "slowly and methodically" through the exit. She saw a passenger from the rear of the cabin, on the right side, leap "like Superman" over the passengers at the overwing area, land on his belly, then get up and run toward the front of the airplane. She looked forward and saw that only four passengers remained on the airplane in the forward part of the cabin. She carried he son forward and was blocked by a

passenger carrying two bags in her left hand and searching for another. She pushed the woman with the luggage out of the way and went past her. Another passenger was standing in the aisle screaming, so she pushed her forward to the exit. She saw a flight attendant at the forward left door that was telling passengers to "get out." She did not notice if the cockpit door was open, but she did not see any pilots in the forward part of the cabin. As she approached the exit, she could not see anything outside the airplane; no slide – nothing. She jumped and landed on the slide, then crawled off the left side.

After she got off the slide, she ran away from the airplane, fearing that it would explode. She wrapped her son in her coat and climbed the hill along with other passengers. There were passengers still on the left wing. During the climb up the hill, she noticed her knee hurt. She met a young soldier along the way that helped her and her child get up the hill. At the top of the hill was a building, and passengers began going inside through a door. Before she went into the building she saw fire trucks arrive at the crash site, but she did not see them discharge any water or foam onto the airplane.

She discovered that she and the other passengers were in a fire station, and it was cold in the open bays, so she found a warmer interior room with a TV and chairs. A firefighter told her that there was a room with a bed, so she and another passenger with a 4-5 month old baby went there and put their children to bed. She went into another room and saw passengers that appeared to have more serious injuries. After a "couple of hours" buses took them from the fire station to the terminal, and they filled out a "lot of paperwork." After that, the passengers were taken to a hotel. Her son was not injured in the accident. She sustained neck and back strains.

Seat 10C
Male, age 33
Telephone interview by Mark George, NTSB

He had been a pilot in the United States Air Force for 9 ½ years, and a pilot in the Kentucky Air National Guard for 5 months prior to the accident. He had experience flying C-130 and T-43 (B737) aircraft. He had been trained on opening doors and escape hatches in the USAF.

He was reading a magazine after he got on the airplane. He did not read the passenger information card or watch the safety briefing prior to the flight, although he remembered looking at a briefing card on a flight about a month before the accident flight. He did not remember whether the flight attendants had briefed the exit row passengers, but he knew he was seated one row forward of the overwing exits.

The takeoff roll seemed normal, until he felt the whole airplane "move to the left," and then make a "hard" left turn. He thought maybe they had already "rotated" and were airborne, but then the airplane started "bumping" and he knew they were still on the ground. He tightened his seatbelt. The airplane continued bumping along at high speed and passengers were screaming. He saw fire out the windows on the right side.

He began thinking about what he was going to do when the airplane came to a stop. He planned to be the first one to open the exit behind him, before "chaos" broke out. He felt a "couple of hard bumps," but they weren't really that bad. He saw "something" under the luggage bins on the right side fall, and he saw passengers holding it up above their heads.

When the airplane stopped, he was the first one out of his seat. He went to the row behind him, stepped over the passengers in that row, and opened the left overwing exit, and threw the hatch out onto the wing. He stepped back into the aisle and let 4 or 5 passengers go out the exit ahead of him. Then, he went out the exit. He shouted, "Go, go, go!" to the other passengers. He did not notice if the emergency lights were on in the cabin, but it "was not dark." Crewmembers were taught in the Air Force to congregate forward of the nose of the crashed airplane, so that was where he headed. He ran past the 1L exit and saw that the slide was inflated and people were evacuating by "running down the slide." He saw a flight attendant at the 1L exit, inside the airplane. After he reached the nose of the airplane, he circled back, to left, and met passengers that were moving away from the airplane, up a hill.

As he joined the group of passengers, he encountered a woman carrying a baby, with a small child walking with her. He picked up the child and carried her up a hill toward a building. He was one of the first passengers to reach the building. He found a door, kicked on it, and the door was opened from the inside by "someone." He pushed the woman and child into the building, then took a "stainless steel toaster" and wedged the door open, so it wouldn't close and lock. He went back down the hill and assisted other passengers up the hill and into the building. He did not see the fire trucks arrive, but did notice them after they had begun to put out the fire. He again went down the hill, and saw that the last people coming up the hill were the flight crew and a flight attendant. He heard the flight attendant say that they had "swept the cabin," and no passengers remained on the airplane.

The building was a fire station, and the door led into the kitchen area. A fireman or EMT told the injured passengers to remain in the kitchen area, and the uninjured passengers to go to another room. He talked to both pilots for "10 – 15" minutes. The pilots both had "extreme" lower back pain. The captain was disoriented and did not know where he was or what had happened. The first officer was "in shock," but was "lucid" and knew what had happened. He stayed with the crew for a while, and then went into the bay with the uninjured passengers. Later, he went outside and watched the firefighters. People were walking around taking names and addresses of the passengers. After a while, ambulances came for the injured passengers.

About two hours after the accident, buses came to the fire station and took the passengers to the "frequent flier club" in the terminal. The passengers were detained "for a while," then put them on buses to a hotel. He had no injuries, although he "banged" his shins "a little."

Seat 14A
Male, age 52
Telephone interview by Mark George, NTSB, on 9-2-2009.

He was travelling with his two sons (seated at 14B and 14C) and his wife (12B). During boarding and taxi out, everything seemed normal. The safety briefing was "just like usual." The flight attendants did not stop in the exit area to give a briefing about the exit row seats, which they sometimes did on other flights. He described himself as a "very" frequent flier, and has flown on Continental many times. He always tried to sit in 14A or 14F on this type of airplane, because of the leg room. Due to the frequency that he has sat in this seat, he was aware that he was in the exit row, and he had studied the briefing card before, but not on this flight.

He described the take off roll as "normal," but the airplane seemed to stay on the ground longer than usual before leaving the ground. Then, the airplane "turned left." It reminded him of a "car taking an entrance ramp" onto a highway. The airplane made the left turn and continued in that direction. He saw the runway edge lights getting closer, then the airplane went off the runway, downhill, and it became "very bumpy." The passengers began screaming when the airplane exited the runway. The ride was like a "roller coaster," then the airplane seemed to go airborne, and came down with a "big bump." At the time of the bump, he saw orange flames outside the windows on the right side of the cabin. From then on, the flames out the right windows were always visible, and he could see them trailing aft. He also saw an orange flame outside the left window on the wing, but it did not persist like the flame on the right side. The lights in the cabin had been dimmed for takeoff, and when the airplane hit the big bump, the cabin went dark.

The airplane then hit a second "big bump," and started to slow down. Up until the second bump, the airplane was "not decelerating." When the airplane stopped, all the passengers immediately stopped screaming, then after a second or two, they all started yelling again. He unbuckled his seatbelt, looked out the left windows for signs of fire, and seeing none, opened the left overwing exit. It was "easy" to open, and he threw the hatch out onto the wing. He later remembered having seen safety briefing cards that depicted the hatch being placed inside the cabin, but, at the time, he automatically threw it out because there was no room for it in the cabin. He stepped through the exit and was surprised that there was no escape slide, and even more surprised at the distance of the step-down outside the exit. His foot slipped on the wing and he fell onto his left knee and slid aft down the wing to the ground. At about this time, he heard the forward and aft slides inflating. He began calling the names of his family members in an effort to locate them. He saw his older son on the wing, and heard his younger son say, "Mom's hurt."

His wife was on the ground aft of the left wing. He had not seen her come out of the airplane, but she told him later that she had slipped on the wing, fallen, and landed on her back, before sliding to the ground. He sent one son away from the airplane, up a hill that was nearby. Then, he and the other son (one on each side) helped his wife up and away from the airplane. She was injured and needed help walking. At that time, he began to notice other passengers milling around and walking up the hill. He and his family walked

up the hill to a building that was at the top of the hill. It was the back of the building, and he did not know what it was. They huddled up next to a fence to try to stay out of the freezing wind. He saw fire trucks arrive on the right side of the burning airplane. Another passenger had gone to the front of the building, then returned and told the other passengers that they could get inside if they walked around. The passengers walked around the building and went inside. He saw that they were in the bays of a fire station; there was a fire truck parked there, some empty bays, and several firefighters present.

There was a "strong" odor of fuel in the station, and the firefighters told them that they could not vent the smell because it was coming from the passengers' clothing. The firefighters poured pitchers of water, and gave the passengers water glasses. The firefighters and other rescue personnel began separating the passengers into three groups: 1) passengers that needed to go to the hospital; 2) passengers that needed an onsite injury evaluation; and 3) passengers that were uninjured. He was surprised at how little trauma he saw among the passengers; there was very little bleeding, and everyone was ambulatory. A paramedic looked at his knee and said he was OK to wait for further medical evaluation. His sons were not injured. His wife was told to go into the kitchen/dining room area, where they were keeping the passengers that were being sent to the hospital. She called him and said she was being taken by ambulance to Denver Health hospital.

The other passengers milled around the bay areas, and filled out paperwork for the airline that asked for names, ages, etc. There were several groups doing the same thing, so, he ended up providing the same information three times. The passengers were loaded onto buses and taken to the President's Club in the terminal where they were debriefed further, and asked for descriptions of the luggage that each passenger had on board. When they were released from the President's Club, he and his sons took a cab to Denver Health to check on his wife. While he was there, he had his knee examined, and the diagnosis was "sprained knee." His wife had "hairline fractures of the vertebra and a contusion on her back." She was subsequently diagnosed with a "torn rotator cuff." He and his family returned to Houston the following morning.

4.0 Airplane Damage and Emergency Equipment

4.1 Seats and restraints

Flight Deck

The captain's seat was removed from the airplane for examination by the NTSB Materials Laboratory. The seat height adjustment did not operate, and the seat would not adjust vertically; it was found in the lowest position. The attachment point for the crotch strap was fractured in an upward direction.

Seat:
Pilot 737
IPECO Part # = 3A 090-0021-06-2
Serial # = 31362
Modification = 25109471 OP-3
Mod. Date = 6-2-00
Mfg. Date = 3-11-98
Model # OA093-0001
TSO C-39a[1]

Restraint:
AmSafe
PNR 5000-4-01A-2396
MFR 35 FB9
DMP RA 0707
S/ASSY 5000 2410 1A 2396
SN 09 MAR 05-19
TSO C-114

The first officer's seat was removed from the airplane for examination by the NTSB Materials Laboratory. No damage was noted except the attachment point for the crotch strap was fractured in an upward direction.

Seat:
Co-Pilot 737
Customer Part # = S 232T 303-1042
IPECO Part # = 3A 090-0022-06-2
Serial # = 30399
Modification = A001 2547 093-25-01
Mod. Date = 5-14-02
Mfg. Date = 2-07-98
TSO C-39a

Restraint:
AmSafe
PNR 5000-4-02A-2396
MFR 35 FB9
DMP RA 0608
S/ASSY 5000 2430 2A 2396
SN 18 MAR 04-66
TSO C-114

The flight crew seats were examined by the NTSB Materials Laboratory, and damage was found to the seat height adjustment mechanisms on both seats. Details of the damage are contained in Materials Laboratory Factual Report 09-055.

Cabin

Flight attendant jumpseats

- Forward flight attendant jumpseat – The seat pan assembly was broken, with the forward edge hanging downward at an angle of approximately 135 degrees to the seat back. The jumpseat was removed from the airplane for examination by NTSB Materials Laboratory personnel. The four-point restraints were operable, and the inertia reels for the shoulder restraints worked normally. The jumpseat was labeled:

Burns Aerospace
Seat DBL-C/A, aft-facing
P/N 91466-519
Model 2501 – 5
MFG 12-83
TSO C-39

[1] TSO C-39a performance standards specify ultimate static loads of: 9g forward, 6g downwards, 3g sideways, 3g upwards, and 1.5g rearwards.

Details of the damage to the forward jumpseat are contained in Materials Laboratory Factual Report 09-055.

-Aft flight attendant jumpseats – The jumpseats in the aft cabin were undamaged and the respective restraints worked normally.

Passenger Seats

First Class:
Koito Industries
Model: ARS-601
TSO C-39b (16 g compatible)[2]

Coach:
PTC (Now B/E Aerospace)
Model: PTC-990
TSO C-39b

Passenger Seat Belts (First Class and Coach):
AmSafe
Model: 502751
TSO C-22f

There was no visible structural damage to seats, floor fittings, or seat tracks, with the exception of seats in rows 2 and 18. Row 2, right side sustained severe burn damage of floor structure, and was partially missing; Row 18 was in the area of circumferential separation of entire fuselage with corresponding separation of the floor structure.

All passenger seatbelts were inspected and found to be structurally sound and were found attached to the seat belt attach fitting on the seats. The seatbelt at 14A (at the Type III exit, LH) was found beneath the seat cushion. The webbed belt material on several outboard seat belts on the right side of the cabin was consumed by fire. The corresponding metal seat belt fittings were found attached to the seats.

Row	LEFT (ABC)	RIGHT (DEF)
2	All fittings attached to seat track – no damage.	Seat track structure below the aft outboard fitting missing due to fire damage. Lower fore-to-aft seat member at seat track was fractured. Outboard baggage bar was fractured. There is deformation of the RH leg assembly due to fire.

[2] Seats that have been approved to meet the 9g requirements in CFR Part 25.561 and the seat structural integrity requirements in CFR Part 25.562 are commonly called 16g ``compatible" seats.

Row	LEFT (ABC)	RIGHT (DEF)
18	Front inboard and outboard fittings were not attached, and seat track below fitting was missing, due to fuselage separation.	Front inboard and outboard fitting are not attached; and fore-to-aft member of the seat leg close to track on the inboard leg was deformed, due to fuselage separation. Seat 18F seat back reclining into seat 19F. Recline lock was detached from the seat frame.

Exits and Slides

All four Type I floor-level doors were found open. The left Type III overwing exit plug door was found on the left wing. The right Type III exit was not open, and had burn damage similar to the surrounding airplane skin. The 1L and 2L emergency escape slides were found deflated and detached from the airplane. The forward girt bar bracket for the 1L slide was broken loose from the floor. The 1R emergency escape slide was stowed in the slide compartment on the 1R door, with the girt bar dangling. The 2R emergency escape slide was lying un-inflated on the ground outside the 2R door, with its girt bar fastened into the girt bar brackets at the door sill.

Statements from ARFF personnel indicated that the 1L and 2L slides had been removed from the airplane during firefighting activities, and that the girt bar bracket was broken during the slide removal process. ARFF personnel also stated that they had opened the 1R and 2R doors to "vent the fire" and to gain access to the cabin.

1L Slide
Boeing P/N 10-61323-478
Air Cruisers P/N D31591-478; S/N 0940
Date Mfg. 1/88
Weight 53.7 lbs.
TSO C69a

1R slide
Slide pack remained in door – not examined

2L Slide
Boeing P/N 10-61323-418
Air Cruisers P/N D31354-418; S/N 0402
Date Mfg. 10/85
TSO C69a
Weight 33.6 lbs.

2R Slide
Boeing P/N 10-61323-433
Air Cruisers P/N D31354-433; S/N 0979
Date Mfg. 6/87
TSO C69a
Weight 35 lbs.

Sill heights at exits:

- 1L: 53 inches
- 1R: 55 inches
- Left overwing (trailing edge of wing to ground): 16.5 inches
- Right overwing (trailing edge of wing to ground): 37 inches
- 2L: 18 inches
- 2R: 22.5 inches

Tray table deployment (i.e., tray not stowed)

Row	LEFT (ABC)	RIGHT (DEF)
1	No deployment	Cocktail table on center console deployed
2	No deployment	Cocktail table on center console deployed
5	No deployment	Tables found deployed at 5 EF
6	Table found deployed at 6C	Tables found deployed at 6DEF
7	Table found deployed at 7A	Tables found deployed at 7DEF
8	Tables found deployed at 8B	Tables found deployed at 8DF
9	Tables found deployed at 9C	Tables found deployed at 9D
10	Tables found deployed at 10BC	Tables found deployed at 10F
12	Tables found deployed at 12AC	Tables found deployed at 12D
14	Tables found deployed at 14C	Tables found deployed at 14DF
15	Tables found deployed at 15A	Tables found deployed at 15DF
16	Tables found deployed at 16A	No deployment
17	Tables found deployed at 17E	No deployment
18	Tables found deployed at 18BC	Tables found deployed at 18F
19	No deployment	Tables found deployed at 19DEF
20	Tables found deployed at 20C	Tables found deployed at 20F
21	Tables found deployed at 21BC	Tables found deployed at 21F
22	Tables found deployed at 22ABC	Tables found deployed at 22D
23	Tables found deployed at 23C	Tables found deployed at 2F
24	N/A - AFT ROW	N/A - AFT ROW

Additional Cabin Documentation

- All life vests were found installed in their containers. At Row 18F, the life vest container was not attached to the seat due to fire damage.

- A variety of fire damage was visible to the seats. Many of the seat cushions had burn damage to the dress cover and flame barrier materials with some degradation of the polyurethane foam; this was mostly evident on the right-side of the airplane; however, in row 18 on seat bottom 18B the corner showed evidence of burn damage through the dress cover material. Additionally, other seat components such as arm rests, tray tables and the seat back structure and seat pans were melted or showed evidence of burn damage.
- Outboard armrest on seat 18C was structurally damaged and loosely attached at the pivot location.
- All exit signs were found intact throughout the cabin. Those exit signs overhead in the main aisle way were covered with soot.

Oxygen Masks:

- Four oxygen mask assemblies were deployed from their drop locations: 1) above flight attendant seat at Door 2R; 2) above seats 1A and 1B (on floor); 3) above seats 7DEF, and 4) above 8DEF (deployed with burn damage).

Insulation:

- The insulation materials within the airplane were primarily fiberglass batting encased by Mylar covering films. None of the insulation coverings were marked with a supplier material designation; however, manufacturing date stamps were generally early 1994. Additionally, upon examination of the scrim adhered to the covering film, the material was consistent with manufacturing techniques used by Orcon Corporation and AN-36 material. The material showed no unusual signs of flame propagation though did show signs of shrinkage typical for these materials.

Lavatories:

- Lav A: The ceiling system panel was hanging and supported by the hinge. No observations of fire damage to the internal materials within the lavatory.
- Lav D: The ceiling system panel was hanging and support by the hinge. Soot and flame damage to the inside surfaces of the lavatory and the toilet lid and surrounding shroud.
- Lav E: Significant fire damage to lavatory structure. Flame penetration through outboard wall of lavatory and ceiling. Door had been removed prior to inspection and was outside the airplane on the ground near Door 2L.

Galleys:

- G1: All latches were found engaged and securing contents. Two carts were found installed with no observed damage. Debris was observed on the floor between the two galleys in the cross aisle such as coat hangers, paper, luggage, and clothing materials.
- G2: All latches were found engaged and securing contents.
- G4B: RH inboard coffee maker pot was not installed in the coffee maker and was found several rows forward in the economy section. Compartment 410 carrier position. ¼ -turn latch plate had pulled away from the galley face, and the carrier

was found on the floor adjacent to Lav E. The latch plate had been affixed to galley by adhesive, with no mechanical connectors.

Flight Deck:

- The flight deck door would open and close freely, and the latch engaged normally in the door frame structure. From a position within the flight deck looking aft at the upper LH door area, a gap of approximately 0.125 inches was observed between the door and the door frame.

Passenger Service Units (PSUs):

- The following table describes the condition of the PSUs throughout the cabin. Latches described as "not engaged" were fractured.

Row	LEFT (ABC)	RIGHT (DEF)
1	Installed condition	Installed condition
2	Installed condition	Installed condition
5	Installed condition	Installed condition, fire damage
6	Installed condition	Melted away
7	Installed condition	Melted away
8	Installed condition	Installed, but melted
9	Installed condition	Installed, but melted
10	Installed condition	Installed condition
12	Installed condition	Installed condition
14	Installed condition	Installed condition
15	Installed condition	Installed condition
16	Installed condition	Installed condition
17	Installed condition	Installed condition
18	Unit found on the floor	Installed condition
19	Latches not engaged, found hanging by lanyards	Latches not engaged, found hanging by lanyards
20	Latches not engaged, found hanging by lanyards	Latches not engaged, found hanging by lanyards
21	Latches not engaged, found hanging by lanyards	Latches not engaged, found hanging by lanyards g
22	Latches not engaged, found hanging by lanyards	Latches not engaged, found hanging by lanyards
23	Latches not engaged, found hanging by lanyards	Latches not engaged, found hanging by lanyards
24	Latches not engaged, found hanging by lanyards	Latches not engaged, found hanging by lanyards

- The outboard PSU rail from Row 21 to 24 was fractured.

Ceiling Panels, Bull noses, and Sidewall Light Lens Covers:

- The lowered ceiling panel between lavatories D and E was found in the lowered position and attached by the hinge on the RH side.
- Two ceiling panels were found outside of Door 2L
- Several ceiling panels were found within the airplane interior resting on the tops of economy class seats. Several bull noses and sidewall light lens covers in the aft section of the airplane were unattached and resting within the seat rows 9, 15, 16, 17, 24. Several bull nose parts were found outside of the airplane, forward of Door 2R.

Stowage Bins:

- The following table lists the condition of stowage bins doors. All stowage bins contained passenger luggage.

Above Seat Row	Left	Right
1	Open	Open
2	Closed	Open
6	Open	Closed
8	Open	Open
10	Closed	Open
12	Closed	Closed
14	Closed	Closed
16	Closed	Open
19	Closed	Closed
20	Open	Closed
22	Open	Open
24	Closed	Open

- Overhead bin above 19ABC (fuselage separation area) - the forward upper inserts and plate were pulled out from the bin composite structure; the 9-G tie rod was separated, and the 9G fitting and inserts in the stowage bin were installed.
- Overall condition - left Side: The tops of stowage bins and their doors had soot damage. Those bins with opened doors also had soot damage to the interior. Decorative Tedlar had also shrunken away in spots on many of the stowage bin doors.
- Overall condition - right Side: The tops of stowage bins and their doors had soot damage. Those bins with opened doors also had soot damage to the interior. Decorative Tedlar had also shrunken away in spots on many of the stowage bin doors. Numerous thermoplastic parts were melted.

Windscreens and Class Dividers:

- Forward LH Windscreen Observations - Latches operated on all doors.
- Cabin Class Dividers Observations (Left and Right) - The cabin dividers were intact. They were secure and attached to the overhead bin. The RH divider aft

side cover was burned. The foil covered plastic substrate panels were warped but intact.

- Class Divider Mesh Curtain - The mesh curtain had fire damage and was still attached to curtain track.

Emergency Equipment:

- All required emergency equipment was found in the appropriate stowage locations, with exceptions noted below.
- Emergency equipment located within the windscreen compartments aft of Door 1L was present. Personal items were found within this compartment as well.
- A flashlight and megaphone were missing from their locations on the aft flight attendant seat forward of Door 2L.
- A flashlight was missing above the flight attendant seat forward of Door 1L.
- Equipment within the stowage bin, Row 24, Left could not be completely inspected due to the inability to fully open the door.

Post-Crash Fire Damage:

- Evidence of fire damage was observed on the right side of the airplane from Station 336 just aft of Door 1R to Station 949 forward of Door 2R. Portions of the fuselage skins and structural frames were melted and missing. Greatest evidence of damage occurred in the center section of the fuselage near the wing and engine area and tapered off toward the Door 1R and 2R door areas.
- Across the entire fuselage right side the airframe materials below the top of the passenger windows was missing or was significantly fire-damaged.

4.0 Medical and Pathological

According to information provided by Continental Airlines, 37 passengers and crew were transported to hospitals after the accident. Subpoenas were issued to hospitals to obtain injury information. Data from medical records and self-reported injuries from passenger questionnaires are included in the following table.

Seat	Age	Gender	Height (ins)	Weight (lbs)	Injury MR = medical records; SR = self reported
Captain	50	M	68	200	MR: L-1 to L-3 anterior wedge compression fractures and multiple transverse process fractures, T-9 to T-11; left side chest trauma with multiple rib fractures. (Serious)
First Officer	34	M	75	229	MR: Back pain.
Cabin Crew (1L)	31	F	69	175	MR: Ankle Sprain.

Seat	Age	Gender	Height (ins)	Weight (lbs)	Injury MR = medical records; SR = self reported
Cabin Crew (2L)	35	M	69	200	MR: Acute cervical strain; mild smoke inhalation.
1A	57	F	65	135	SR: Broken back; MR: L-2 vertebra compression fracture. (Serious)
1B	Unk	F	Unk	Unk	MR: L-1 vertebra burst fracture. (Serious)
1F	55	M	Unk	Unk	MR: Right shoulder sprain.
2B	50	M	72	185	SR: Compression fracture of two vertebrae; sprained wrist; bruises. (Serious)
2F	57	F	Unk	Unk	MR: T-12 vertebra compression fracture. (Serious)
5F	23	F	Unk	Unk	MR: Right knee sprain.
6A	62	F	63	166	SR: Whiplash; back pain.
8A	12	F	61	70	SR: Sprained ankle.
8B	8	F	56	70	SR: Pinched nerves in neck.
8C	38	F	71	200	SR: Skin abrasions; smoke inhalation; wrist, leg, arm and back strains.
9B	30	F	65	158	SR: Whiplash, back and neck pain; right knee pain; smoke inhalation.
9C	26	F	64	125	SR: smoke inhalation.
9E	73	F	62	145	SR: Bruises, muscle strain; lung irritation.
10B	26	F	64	115	SR: Minor cuts on both knees.
12B	51	F	62	140	SR: Contusion of the back; torn rotator cuff; abrasions (Serious)
14A	51	M	73	250	SR: Sprained knee
14D	14	M	70	115	SR: Headache.
14E	58	F	69	180	SR: Bruised leg.
14F	26	M	75	260	SR: Back, shoulders, neck strain; bruised knees; cut knuckle.
15D	41	F	63	270	SR: Minor bruise on foot.
15F	27	M	Unk	Unk	MR: Sprained left knee/smoke inhalation
16B	31	F	Unk	Unk	MR: Smoke inhalation.
16D	32	F	Unk	Unk	MR: Sprained lumbar spine (back)
17A	63	F	64	160	SR: Head and back pain; abrasions.
17E	39	F			MR: Back pain.
19A	33	F	65	120	SR: Bumps and bruises on head; backache.

Seat	Age	Gender	Height (ins)	Weight (lbs)	Injury MR = medical records; SR = self reported
19B	9	F	52	63	SR: Bruises on legs and hands; foot injury.
19C	6	F	45	39	SR: Bruises on legs and hands.
19E	30	F	63	258	SR: Herniated disc; abrasions; belly pain.
19F	28	M	68	206	SR: Knee abrasions; smoke inhalation; MR: Abrasion of left and right knee; contusion of left knee.
20A	37	F	62	190	SR: Sore back/tailbone; frostbite on feet.
20C	61	F	Unk	Unk	MR: Face and head pain; lumbar and thoracic back pain.
21D	62	F	63	149	SR: Right head and cheek bruises; left arm bruises.
21D	52	M	71	191	MR: Back pain.
22B	26	F	Unk	Unk	MR: Facial pain; contusion on upper right eyelid.
22C	35	M	66	155	SR: Abrasions and bruises on arms.
22E	34	F	Unk	Unk	MR: Sore throat/smoke inhalation.
22F	35	F	Unk	Unk	MR: Sore throat/smoke inhalation.
23A	22	F	Unk	Unk	MR: back pain; lumbar strain.
23B	67	F	63	157	SR: Bruised ribs on left side; back pain; MR: Chest wall/lower back pain.
23C	22	F	65	110	SR: Lower back pain; fuel inhalation.
23D	21	M	71	150	SR: Bruises on head; minor whiplash.
24F	29	F	Unk	Unk	MR: Back pain.

4.1 Injury Table

Entries in the Injury Table were compiled from medical records and self-reported injuries from passenger questionnaires.

Injuries	Flight Crew	Cabin Crew	Passengers	Other	Total
Fatal	0	0	0	0	0
Serious	1	0	5	0	6
Minor	1	2	42	0	45
None	0	1	63	0	64
Total	2	3	110	0	115

5.0 Airport and Emergency Response

5.1 Airport

Denver International Airport (DEN) is located approximately 16 miles northeast of Denver, Colorado, at an altitude of 5,431 feet. DEN has six precision air carrier runways. Runway 16R/34L consists of grooved concrete 16,000 feet long and 200 feet wide. Runway 7/25 is grooved concrete 12,000 feet long and 150 feet wide. Runway 8/26 is grooved concrete 12,000 feet long and 150 feet wide. Runway 16L/34R is grooved concrete 12,000 feet long and 150 feet wide. Runway 17L/35R is grooved concrete 12,000 feet long and 150 feet wide. Runway 17R/35L is grooved concrete 12,000 feet long and 150 feet wide. DEN is a 14 CFR Part 139 certificated airport, and is an Index E airport for purposes of aircraft rescue and firefighting (ARFF) capability (Figure 2).

Runway 34R was inspected by airport operations prior to and immediately after the accident. An airfield inspection was conducted at 1025 MST and then an inspection of runway 34R, post-accident, was conducted at 1821 MST. The runway surface was reported as bare and dry. Approximately 1-6 inches of patchy snow was on the shoulders of the runway and in the safety areas. Airport operations conducted a runway friction test at 1921 MST and the recorded test results showed *mu* values exceeding 1.0, indicating a normal/good surface condition.[3]

Field condition NOTAMs issued prior to the accident time were for snow and ice on taxiway surfaces and one for frozen slush and ice on ramp surfaces:

TWYS PTCHY THN PACKED SN AND ICE WEF 0812200235
RAMP PTCHY ½ IN FRZN SLUSH OVER PTCHY THN ICE BRAP WEF 0812200400

Airport snow removal operations were last conducted on runway 34R on December 18, 2008. At that time, the runway was plowed, swept and sanded. The runway was not swept following the application of sand or prior to the time of the accident. No significant accumulations of sand were observed during a post crash inspection. No runway de-ice chemical was used. The last application of runway de-ice chemical on runway 34R was prior to a snow event that occurred on December 18, 2008.

The FAA standard[4] lateral runway safety area (RSA) width for Runway 34R was 250 feet on either side of the runway centerline. DEN maintained the Runway 34R lateral RSAs at 305 feet on either side of the runway, and the longitudinal RSAs at 1,000 feet beyond the thresholds. The runway safety area section traversed by the accident airplane was covered with snow and had ruts approximately 3-8 inches in depth. Runway hold positions on taxiways to Runway 34R were located 330 feet from the runway centerline, in accordance with FAA standards.

[3] The test was conducted using a DynaTest 6875 Runway Slip Friction Tester, without water.
[4] FAA Advisory Circular 150/5300-13, *Airport Design*.

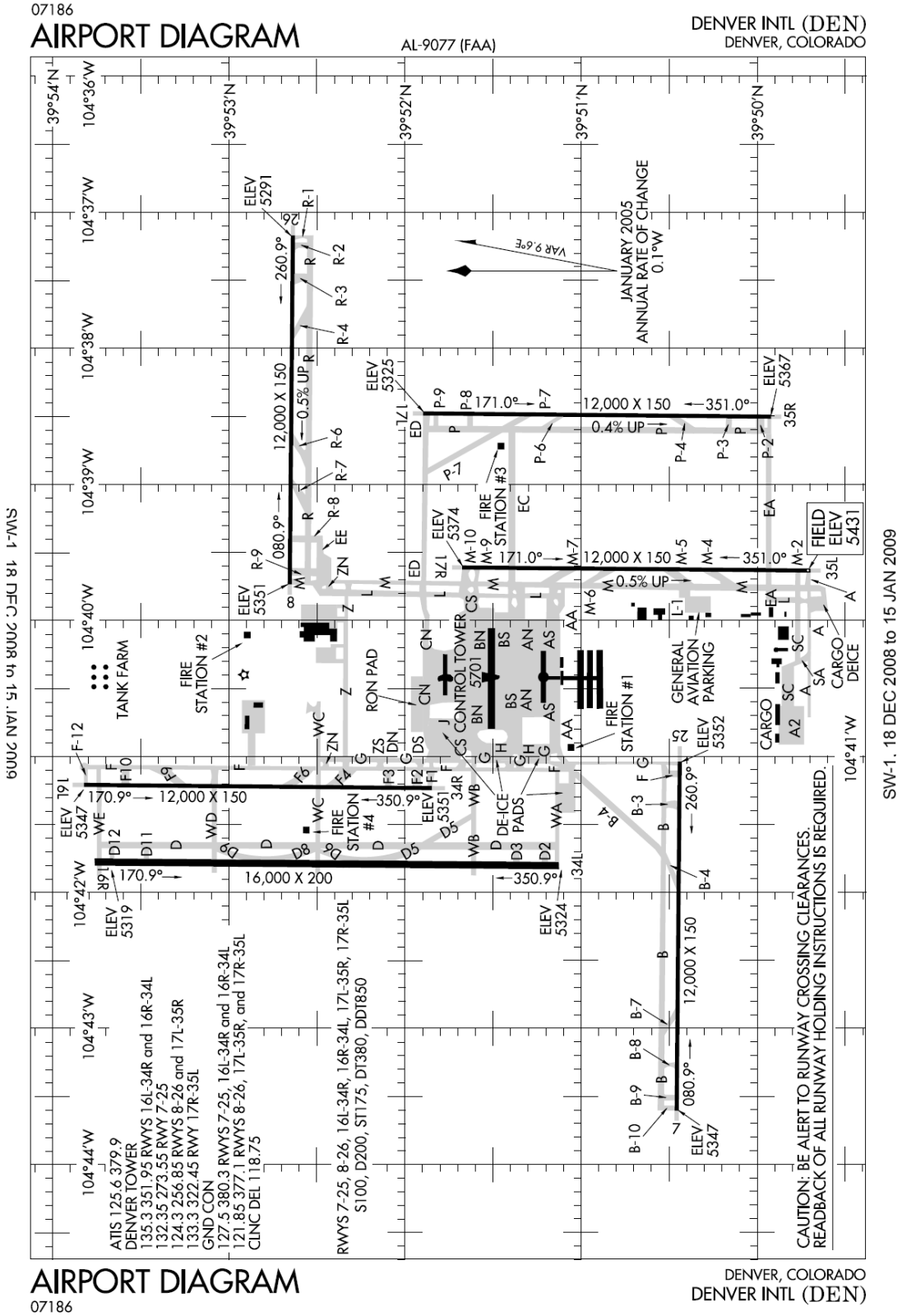

Figure 2. Airport Diagram

According to pre- and post-accident inspection logs, Runway 34R lighting and associated taxiway lighting were operating normally. The runway had both elevated edge lights and in-pavement centerline lighting. The runway lighting systems were set on step 2 at the time of the accident. The accident airplane passed over or near several lighting fixtures and airfield signs, and one taxiway light fixture at Taxiway WC was damaged by the accident airplane.

Letters of Correction were issued for each of the past 3 Annual FAA Certification Inspections. Discrepancies included safety area maintenance on runway 7/25, maintenance and application of paint on taxiway markings, marking of construction areas, record keeping related to "fueler training." No discrepancies affecting Runway 34R were noted. Airport records indicated that surface contaminant (rubber) removal on Runway 34R was accomplished on September 15, 2008.

5.2 Emergency Response

5.2.1 Airport Emergency Plan

Per 14 CFR Part 139 airport certification requirements, DEN maintains an Airport Certification Manual containing a chapter entitled *Airport Emergency Plan* (AEP). The purpose of the AEP is to outline procedures, responsibilities, and duties of participating agencies in order to facilitate the efficient rescue, medical care, proper firefighting operations, and news media coverage during an emergency at the airport. For example, the AEP specified that for a "Red Alert" the following procedures will be followed:

> Red Alert
>
> a) The DEN ATCT (air traffic control tower) may activate the crash net upon notification from any credible agency with essential information regarding an aircraft emergency. The AOM (Aviation Operations Manager) may declare by any means.
>
> b) The Airport ARFF station will notify DFD (Denver Fire Department) dispatcher via phone or radio. DFD dispatcher will immediately notify Denver Paramedic Communications.
>
> c) The Comm Center and AED (Aviation Emergency Dispatcher) will assure that the Alert information has been received by the AOM, DPD (Denver Police Department), and Paramedics by broadcasting information on City radio frequencies. Emergency information is also given over direct telephone line to the DCCC (Denver Combined Communications Center).
>
> d) The AED will dispatch all on-site paramedics to the site.
>
> e) The on-duty AOM will ensure that the appropriate Airport, City, State, FAA and other Federal officials are notified depending on the nature of the emergency. The AOM will activate the ICC (Incident Command Center)

when appropriate or requested by a higher authority specified herein (FAR 139, Section 205, Para. I., Lines of Succession), or the air carrier involved. The AOM will establish the Mobile Command Post, if required.

f) The DCCC will dispatch necessary officers to the Airport. If necessary, they will manage traffic to ensure emergency vehicles access to and from the scene, including to the hospitals. If other municipalities are involved, DPD will coordinate and support, as necessary, other police agencies.

g) Upon arrival at emergency scene, ARFF personnel will take all rescue and firefighting action possible and request assistance if needed.

h) When the situation is under control, the DFD officer in charge will determine what equipment will stand by until aircraft has been removed.

Annex F of the DEN AEP entitled *Denver Health Medical Center, Emergency Medical Services*, described the responsibilities of Denver Health Medical Center emergency services under the AEP with regard to airport emergencies. Specifically, the Annex outlined procedures used to coordinate all casualty care facilities and personnel in the Denver Metropolitan area, in response to an airport emergency. Since the accident, DEN modified this section of the AEP to include specific procedures to enhance Denver Health's ambulance response to the airport. The modifications to the AEP are italicized below:

Response - Upon notification of an actual or potential mass casualty incident (i.e. Red Alert), DHPD Communications shall continually gather as much information as possible to identify type and magnitude of situation. They shall also:

• *Dispatch 1 member of the DHPD Command Staff, the Post 701*[5] *ambulance and 3 additional ambulances Code 10.*
• *If the 701 post is not staffed, or if it is after hours, dispatch 4 ambulances code 10 to DIA.*
• *Position remaining DHPD ambulances for additional responses to DIA and to maintain coverage to the rest of the City and County*.
• Notify the appropriate agencies for mutual aid responses
a. Denver Metro EMS Consortium Partners
b. Contiguous Mutual Aid Agencies
• Dispatch additional ambulances and resources as requested by Denver Health Paramedic Division personnel.

5.2.2 Aircraft Rescue and Firefighting

The Denver Fire Department Aircraft Rescue Firefighting (ARFF) Division provides emergency services and associated administrative functions at Denver

[5] Post 701 refers to Denver Health paramedics stationed at the airport.

International Airport and the surrounding five mile area. The Division has a staff of 99 firefighters that are assigned to the airport.

The Division Chief of the Fire Department works as a liaison between Airport Operations and the Department of Safety. There are three 24-hour Assistant Chiefs who manage day-to-day Fire Department operations and all associated administrative responsibilities. There are 25 firefighters on duty every day, staffing two structural firefighting companies and seven ARFF vehicles. These fire companies do not respond to any other city incidents. All firefighters are trained to Emergency Medical Technician (EMT) – Basic level. Paramedics from Denver Health Medical Center are stationed at the airport at all times. Ambulance service is provided through Denver Health and may be supplemented by other companies in the Denver metropolitan area, when needed. Since the accident, one ambulance and crew are stationed at the airport 20 hours per day (06:00 AM until 02:00 AM) each day.

DEN has four ARFF stations staffed 24 hours a day, seven days a week, on a 3-platoon shift schedule, creating a 48-hour work week for the fire fighters. Station 1 is staffed with both structural and ARFF equipment. Station 2 houses one structural company and the Red Chief on duty. Station 3 is ARFF only, located on the east side of the airfield. Station 4 is on the northwest side of the airfield and is staffed with one (1) two-person ARFF vehicle. First-line equipment available at DEN is as follows.

- 1 Command Vehicle
- 7 ARFF vehicles
    - 1 - 4,500 gallon Oshkosh with 500 lb Dry Chemical
    - 5 - 3,000 gallon E-Ones with 500 lb Dry Chemical
    - 1 - 3,000 gallon Oshkosh with 500 lb Dry Chemical
- 1 - 100ft Pierce Platform Ladder Truck
- 1 - Class A Pierce Engine
- 1 - Pearce Dangerous Goods Response Vehicle
- 2 - Custom Hummer Mini engines
- 1 - Heavy Rescue
- 2 - Air Stair Trucks
- (2 - Reserve ARFF units are maintained at all times)

ARFF apparatus and personnel by station are in the following table:

Apparatus Call sign		Type	Make	Water (gals)	AFFF (gals)	Dry Chem (lbs)	Crew-members
ARFF Station 1							
	Red 1	ARFF	E-One	3000	405	500	Officer/ Engineer
	Red 2	ARFF	Oshkosh	4500	605	500	Engineer/ Firefighter
	Red 3	ARFF	Oshkosh	3000	405	500	Engineer/ Firefighter
	Truck 31	Structural	Hum-Vee	150			Officer/ Engineer
	Truck 31 bravo	Structural	Pierce	150			Engineer + 3 Tech-nicians
ARFF Station 2							
	Red Chief	SUV	Chev-rolet				Assistant Chief
	Engine 32	Structural	Hum Vee	150			Officer/ Engineer
	Engine 32 Bravo	Structural	Pierce	750			Engineer / Technician
ARFF Station 3							
	Red 5	ARFF	E-One	3000	405	500	Officer/ Engineer
	Red 6	ARFF	E-One	3000	405	500	Engineer/ Firefighter
	Red 8	ARFF	E-One	3000	405	500	Engineer/ Firefighter
ARFF Station 4							
	Red 4	ARFF	E-One	3000	405	500	Lieutenant/ Engineer

Water and Agent Used in the CAL1404 Response

Red 1: 3000 gallons water/300 gallons AFFF[6]
Red 2: 2500 gallons water/330 gallons AFFF
Red 3: 2000 gallons water/80 gallons AFFF
Red 4: 3000 gallons water/100 gallons AFFF
Red 5: 1000 gallons water/40 gallons AFFF

Total: 11,500 gallons water/755 gallons AFFF

[6] AFFF = aqueous film-forming foam.

DEN ARFF maintains a Training Academy managed by an administrative Assistant Chief, a staff of three full time employees and a contingent of adjunct instructors. The Academy facility has a state-of-the-art airplane crash simulator, multiple classrooms, drill ground, ARFF apparatus, breathing equipment, and a full cache of tools and equipment. The DIA ARFF Academy is certified to issue Airport Firefighter accreditation from the International Fire Service Accreditation Congress.

Emergency Response

On the night of the accident, the crash notification was initiated by ATC tower personnel via the DEN CrashNet system. A description of the operation of the DEN Crashnet system was provided by Mr. Kelan Pape, DEN wireline systems manager, as follows:

> The CrashNet is an application that rides on a "conference bridge" system. It is initiated by FAA tower or B Tower by the operator going "off hook" and pushing a button on the phone. The button initiates a series of dtmf (dual-tone multi frequency) tones as part of a "speed dial" system into the bridge that opens the bridge up and instructs the bridge to blast dial a predetermined list of phone numbers. The bridge rings 8 stations per second off the predetermined dial blast list and automatically adds them to the audio bridge once they answer. The FAA tower has "busy indicator" lights on the phone that go from flashing (ringing) to steady (answered) for ARFF 1-4 to indicate to the tower what fire stations are on the audio bridge. Therefore, the tower gets a visual indication, as well as a verbal indication by the ARFF personnel as they pick up. The dial blast numbers include phones in the ARFF stations as well as overhead paging systems. The overhead paging systems automatically answer and audio from the tower is fed into the overhead paging system. Once the initiator activates the bridge, it starts this script and automatic ringdown dial blast. The initiator must hang up to tear down the bridge. I am uncertain of the exact time it takes to completely tear down the bridge, but it does take a very small amount of time (2-3 seconds). This is NOT an intercom system.

According to CrashNet recordings, tower personnel activated the CrashNet system, and told the ARFF stations that an accident had occurred, and that it was in the vicinity of Runway 34 Right and Taxiway Whisky Bravo (WB). The tower employee who made the call attempted to correct the accident location information over the CrashNet system, but was unable to contact the stations.

In an effort to determine the cause of the inability to re-establish contact with the ARFF stations via the CrashNet system, Kelan Pape reviewed the CrashNet tapes, and offered the following comments:

> It seems that the FAA Tower person who initiated, never hung up (or terminated the current bridge) as evident by the series of dtmf tones on the recording after the initial message was delivered. It appears that he tries to reinitiate to activate the bridge without hanging up the handset. He may have "flash hooked" it, but it did not hang up long enough to tear down the bridge. Correct procedure would have been to hang up, pause 2-3 seconds, then go off hook again and hit the dial blast button on the phone.[7]

ATC personnel contacted DEN Ops on the radio and related the correct position of the accident as Runway 34 Right at Taxiway Whisky Charlie (WC). DEN Ops contacted the responding ARFF units and told them the revised position of the accident. Prior to receiving the updated information, several of the ARFF units had arrived at Taxiway WB and attempted to locate the accident airplane. Seeing no accident airplane at Taxiway WB, the ARFF units continued north to the closest airplane in the vicinity, at Taxiway F2. After the correct location of the accident was known, all ARFF trucks proceeded north on Runway 34R to the accident site.

According to ARFF crew statements, truck Red 4, responding from ARFF Station 4, adjacent to the accident site, initially headed west on Taxiway WC, enroute to Taxiway WB, via Taxiway Delta. They heard a radio call to the Airport Operations (Ops) channel that said the accident was at Runway 34R at Taxiway WC. Red 4 made a U-turn and headed east on WC. At the intersection of 34R and Taxiway WC, they did not see smoke, fire, or Ops 7. They heard Red 1 say that he was on the scene and "it was a small aircraft." Red 4 drove south on Runway 34R, and heard another radio call from "Ops 7 or Red Chief" that the crash was at WC, and saw the ARFF trucks driving north on Runway 34R. Red 4 let the trucks pass, and then made a U-turn on the runway, before heading north to the crash site. Additional ARFF crewmember and DEN Airport Operations statements are in Attachment 2.

The following is a written statement provided by Assistant Chief Charles W. Davis (Red Chief) which summarized his recollections of ARFF activities that occurred during the response to the Continental 1404 accident.

> At approximately 1818, Denver Fire received a crash net activation of a crash on RW-34R at Taxiway WB. Due to the way the crash net information was conveyed, and tone of immediately subsequent radio traffic, I felt that this was in all likelihood a major incident. I responded west on TW Z. At that point I initiated a 1st alarm assignment to respond gate 1/ ARFF station 1. This was significantly prior to our firm knowledge of the location and scope of the incident. This alarm level was initiated extremely early due to the remote location of the airport and subsequent distance of off-airport fire department resources. In addition, and prior to arrival on scene, I designated Red 1 as Fire Control Group.

[7] Upon receipt of the initial CrashNet notification, firefighters respond as quickly as possible to the fire trucks and proceed to the reported crash site; these response activities may preclude hearing or answering a second CrashNet call prior to their departure.

As I turned south from TW-Z onto the taxiway heading toward the initial reported location, I could see responding fire companies slowing to investigate in the vicinity of Taxiways F and F2. At that point I heard radio traffic that TW-WC was the correct intersection at RW-34R. As I looked north I saw what appeared to be smoke at about the same time Ops 7 said over the radio that the aircraft was north of our location and to follow him. I repeated over the DFD radio channel for all companies to follow OPS 7 and myself north on RW-34R. Ops 7 was ahead of me as and I entered Runway 34R from Taxiway F and responded to Taxiway WC with fire companies to the scene of the accident. As I responded north on Runway 34R, I noted that the runway was clean and dry with the exception of a significant amount of broken snow along the left side of the runway as I approached Taxiway WC.

Upon arrival of the scene, I took a position south and above the crash scene directly north of ARFF station 4. I assumed command of fire operations as fire operations section chief. I could see a relatively intact Continental B737 with smoke and fire showing on the right side of the aircraft. Smoke was showing from doors L1 and L2 and from the crack amidships on the fuselage. There was significant wind from the west as shown by the fire and smoke. The aircraft was on its belly and the left engine had separated from the aircraft. Passengers had evacuated the aircraft and were standing away from the aircraft on the left side. Some passengers were moving up the embankment toward fire station 4. I did not see anyone evacuate the from cabin doors L1 and L2. Cabin doors L1 and L2 were open and escape slides were deployed and lighted on the ground. I designated Truck 31 as Rescue Group and Engine 32 as EMS group and staging at TW D and TW EC for off airport fire resources. Fire Control Group (all ARFF apparatus) led by Red 1 immediately arrayed around the aircraft and began applying AFFF to main body of exterior fire and aircraft skin. Main body of fire on right side of aircraft was extinguished by ARFF apparatus in very short order. Significant fire remained in the interior of the cabin and under several parts of the fuselage and wing. Red 4 and Red 6 crew took 1 ¾ inch AFFF hand line in L2 to attack interior fire. Red 4/6 crew extinguished fire in rear lavatory area and forward for several rows. Rescue Group took 1 ¾ inch AFFF hand line from Red 3 and entered L1 and extinguished fire in forward galley area and fought fire toward the rear of the cabin. In concert with the interior firefight, Rescue Group members conducted an interior primary search for passengers. Balance of Rescue Group detached the girt bar and opened R1 from the outside and proceeded to open R2 to assist in primary search. Primary search reported negative by Rescue Group. Rescue Group initiated secondary interior search again with negative results. Interior fire was extinguished by both crews using a total of two hand lines. Interior ventilation accomplished by all cabin doors open and strong winds from west. Red 6 and Red 8 ARFF apparatus and crews released from scene to

return to ARFF station 3. Shortly thereafter Rescue Group conducted a third interior search with an infrared camera looking for victims and hidden fire with negative results for victims reported. First exterior search performed in immediate area of aircraft by Rescue Group with infrared equipment with negative results. Spot fires under right wing and in lower fuselage extinguished by ARFF crews using 1 ¾ inch AFFF hand lines. Overhaul of interior cabin was not ordered to preserve condition for NTSB investigation. Slight overhaul was done by fire crews to right side lower fuselage at wing box/ root area to access hidden spot fire. Cockpit configuration not disturbed by DFD personnel. Fuel leak was dammed downstream by fire personnel in attempt to slow contamination into environment.

Concurrently to above, fire control and rescue efforts, EMS Group had placed two fire apparatus in "V" formation on top of hill with emergency lights on to direct passengers into Firehouse 4. Passengers cued up and walked through "V" and into station 4 with one exception which required assistance from the E32 crew. As passengers entered station 4, EMS group separated passengers showing signs of injury or complaining of symptoms. Injured passengers were moved to the day room area for triage and treatment by Denver Health personnel. All others were moved to apparatus floor by Fire personnel. Three additional non-airport DFD companies assigned to EMS group to assist with triage, treatment and transport. Additional staged non-airport fire department resources were placed in service and escorted street side. Of 110 passengers and 5 crew, 38 were transported by ambulance to local hospitals for further evaluation and treatment. After being asked of their medical condition again, and reporting no injuries, balance of passengers and crew were kept at station 4 until transported to A concourse for release.

Initial perimeter was established under Fire Department supervision and entry and exit control points designated under Fire direction. Rehabilitation with food was established with busses in vicinity of mobile command post. Recall of 10 off duty airport firefighters was initiated to respond to additional alarms or requests for service.

Airport companies returned to service as appropriate and equipment re-serviced. Fire watch established at approximately 0000 hours on 12/21/08 and continued through approximately 1700 hours, that date.

Radio Transmission Chronology

The following table of radio transmissions was compiled using tapes from DEN Operations, Denver Fire Department, and the DEN CrashNet system. The table does not contain every call, verbatim, that was made – only those pertinent to the response. The purpose of the table is for chronological reference only, and no attempt was made to

harmonize the various source clock times with one another. A summary of Denver Health radio calls and responding ambulances was supplied by Denver Health and is in Attachment 3.

Time	Source	From	To	Dialogue
18:17:27	ATC	ATC	CO1404	"CO1404 … cleared for takeoff."
18:18:42	ATC	Unk	ATC	"Tower it looks like you have a plane go off of 34R on the left side."
18:18:55	ATC	ATC	CO1404	"CO1404 - Denver Tower" (no answer)
18:19:02	ATC	Unk	ATC	"He's off the runway."
18:19:03	Crashnet	ATC	ARFF	"Tower's up - we've got a crash off of Runway 34R at Whiskey Bravo… Whiskey Bravo… off of 34R."
"	Crashnet	ARFF	ATC	"34R off of Whiskey Bravo."
"	Crashnet	ATC	ARFF	"Yes, sir."
"	Crashnet	ATC	unk	A series of beeps/tones can be heard. "Yes, but we told them Whiskey Bravo because that's what they told me first. Picking up again."
18:19:50	ATC	ATC	Ops	"Any Ops vehicle on Denver Tower, any Ops vehicle?"
18:19:56	ATC	Ops 9	ATC	"Ops Nine's on frequency."
18:19:59	ATC	ATC	Ops 9	"Ops 9, just had an aircraft departure roll off 34R exited the runway at Whiskey Charlie, appears to be on fire immediately adjacent to the firehouse – red alert."
18:20:01	Ops 1	Comm Center	Ops 7	"Information from Crashnet: crash off of 34R at Whiskey Bravo, no further info, will let you know."
18:20:10	ATC	Ops 9	ATC	"OPS 9 copies."
18:20:14	ATC	ATC	Ops 9	"Ops 9, [aircraft] appears to be north of Whiskey Charlie and west of Runway 34R adjacent to the firehouse."
18:20:19	Ops 1	Ops 7	Comm Center	"Make notifications for Red Alert."
18:20:28	Ops 1	Ops 10	Ops 7	"The new info from the Tower - this is B Tower - 34R Whiskey Charlie - 34R Whiskey Charlie."
18:20:33	ATC	ATC	Ops 9	"Ops 9, traffic's coming out of the station going the wrong way; They need to go eastbound out of the firehouse."
18:20:35	DFD	Red Chief	DFD Dispatch	"Report of crash, 34R - unknown aircraft type - start first alarm assignment. Have them stage at Gate 1."
18:20:42	ATC	ATC	any	"Any rescue vehicles on frequency?"
18:20:50	ATC	Ops 7	ATC	"Tower - Ops 7's on. Go."
18:20:57	ATC	ATC	Ops 7	"Ops 7, west of Runway 34R, immediately north of WC, immediately east of the firehouse, on fire, in the ditch off the runway."
18:21:09	ATC	ATC	Ops 7	"Ops 7 - we're going to show runway 34R closed at this time, all your equipment can cross 34R."
18:21:20	Ops 1	Ops 7	Red 4	"RED 2 [RED 4], Ops 7, 34R is closed - you can get on the runway now - I've got the smoke in sight from aircraft."
18:21:28	Ops 1	Red 4	Ops 7	"Red 4 entering [Runway 34R] at Whiskey Charlie."
18:21:34	ATC	Ops 7	Red Lead	"Red Lead, Red chief on OPS 1, 34R is closed, cross the runway, you have immediate access to the aircraft. 16L/34R is closed."
18:21:35	DFD 1	Red 1	Red Chief	"Red 1 on scene, small aircraft, investigative mode right now, stand by."
18:21:47	Ops1	Ops 7	Comm Center	"Show 16L/34R closed with tower - all crash equipment has immediate access to the area - we have the smoke in sight."
18:22:02	ATC	ATC	Ops 7	"Ops 7 it appears your truck is going southbound on, uh, 34R, is that what they want to do… away from the aircraft?"

Time	Source	From	To	Dialogue
18:22:08	ATC	Ops 7	ATC	"I'll turn them around tower, I'll turn them around."
18:22:09	ATC	ATC	Ops 7	"Yeah, he was stopped there at Whiskey Charlie, it looked like he was going right at it. It's north of Whiskey Charlie, you can see the glow north of Whiskey Charlie and west of 34R."
18:22:24	ATC	ATC	Ops 7	"OK, everybody that's on 34R needs to go northbound, it's immediately adjacent to the firehouse that's on Whiskey Charlie."
18:22:25	Ops 1	Ops 6	Ops 7	"EOC activated."
18:22:37	DFD 1	Ops 7	All red equip-ment	"Red lead and all equipment follow me I see the smoke - Just north of Whiskey Charlie - come northbound."
18:22:40	ATC	ATC	Ops 7	"Ops 7, if you get just immediately west of 34R and just north of Whiskey Charlie, you'll see the glow coming out of there, I can see the flames right now/"
18:22:48	ATC	Ops 7	ATC	"I have it tower, I have it. I have the glow, can we confirm the aircraft type."
18:22:50	Ops 1	Ops 8	Comm Center	"Red 4 following Ops 7 heading north."
18:22:53	ATC	ATC	Ops 7	"It's a Boeing 737."
18:22:57	DFD 1	Red Lead	All red Equip-ment	"Join up and get on the Runway guys - northbound - follow me and OPS 7."
18:23:01	DFD 1	Ops 7	Red Lead	"Red Lead - Ops 7 - we have a 737 off the runway - on fire - I say again it is a 737."
18:23:18	Ops 1	Ops 7	Comm Center	"We have confirmed a 737 is off runway - there's smoke & fire."
18:23:29	Ops 1	Ops 5	Ops 7	"I recommend we close west airfield at minimum - I can coordinate if you wish."
18:23:38	DFD 1	Red 4	All red equip-ment	"Come on to Kewaunee - it is off Kewaunee."
18:24:05	DFD 1	Red Chief	Dispatch	"737 Continental on fire down just directly north of fire station 4."
18:24:09	Ops 1	Ops 7	Ops 6	"Send out immediate notification for Red Alert."
18:24:35	DFD 1	Red 1	Red Chief	"We're applying water on aircraft right now - we got passengers going to the east of the aircraft right now."
18:25:43	Ops 1	Ops 7	EOC	"Aircraft relatively intact - it is on fire - passengers evacuating aircraft - going to ARFF Station 4."
18:26:18	Ops 1	EOC	Ops 7	"Five buses sent to staging point - ARFF 1."

6.0 Survival Aspects

6.1 Evacuation

According to interviews with the flight attendants, the evacuation was ordered by the flight attendants due to fire outside the airplane. The passengers were evacuated through the left forward and left aft Type I floor-level exits by the crew, and the left Type III overwing exit was opened and used by passengers. The escape slides at 1L and 2L inflated automatically. The flight crew and cabin crew evacuated after the passengers were out. The evacuation was concluded prior to fire entering the cabin. The cabin crew

and ARFF personnel directed passengers to a fire station near the crash site. Injured passengers were triaged and treated by firefighter/EMTs and on-airport paramedics at the fire station.

7.0 Attachments

1. Passenger Questionnaires
2. ARFF Crew and Airport Operations Statements
3. Denver Health Response Chronology
4. Passenger Information Card
5. Photographs