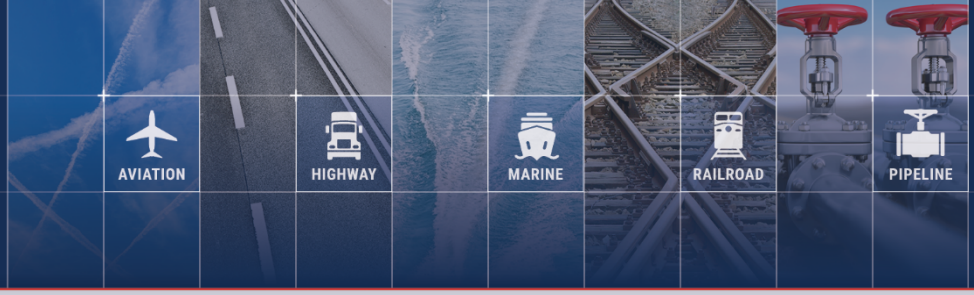

Aviation Investigation Final Report

Location:	CHICAGO, Illinois	**Incident Number:**	CHI95IA215
Date & Time:	July 9, 1995, 21:09 Local	**Registration:**	N440AM
Aircraft:	ATR 72-212	**Aircraft Damage:**	Minor
Defining Event:		**Injuries:**	1 Minor, 64 None
Flight Conducted Under:	Part 121: Air carrier - Scheduled		

Analysis

THE MAIN PASSENGER CABIN DOOR OPENED SHORTLY AFTER TAKEOFF AT APPROXIMATELY 800 FEET AGL. THE AIRPLANE RETURNED TO THE AIRPORT, AND THE DOOR SEPARATED FROM THE AIRPLANE WHILE IT WAS ON FINAL APPROACH. ALL INDICATIONS ARE THAT THE DOOR WAS CLOSED AND LOCKED PRIOR TO TAKEOFF. THE LACK OF DAMAGE INDICATES THE DOOR WAS UNLOCKED/UNLATCHED WHEN IT OPENED. THE AIRPLANE HAD A NEWLY DESIGNED HANDRAIL/DOOR HANDLE INSTALLED WHICH REVERSED THE DIRECTION OF MOTION TO LOCK AND UNLOCK THE DOOR. FOURTEEN AIRPLANES IN THE FLEET INCORPORATED THIS DESIGN. THE NEWLY HIRED #1 FLIGHT ATTENDANT HAD OPERATED THIS HANDLE ON 16 OF HER 60 FLIGHTS SINCE BEING HIRED. SHE HAD BEEN ON DUTY ABOUT 14.5 HOURS ON THE DAY OF THE INCIDENT WITH ONLY 5 HOURS OF SLEEP THE PREVIOUS NIGHT DUE TO HER FLIGHT SCHEDULE. SHE STATED THERE WAS A VERY LOUD 'HUMMING NOISE' COMING FROM THE DOOR PRIOR TO IT OPENING.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this incident to be: the flight attendant's failure to follow procedures which resulted in her inadvertently opening the main cabin door in flight. Factors associated with the incident were: the flight attendant's fatigue due to lack of sleep and a long duty day, interference with habit regarding the direction of motion of the door locking handle, and inadequate design of the door locking handle by the manufacturer.

Findings

Occurrence #1: MISCELLANEOUS/OTHER
Phase of Operation: TAKEOFF - INITIAL CLIMB

Findings
1. DOOR,PASSENGER - SEPARATION
2. (C) PROCEDURES/DIRECTIVES - NOT FOLLOWED - FLIGHT ATTENDANT
3. (F) FATIGUE(FLIGHT SCHEDULE) - FLIGHT ATTENDANT
4. (F) FATIGUE(LACK OF SLEEP) - FLIGHT ATTENDANT
5. (F) HABIT INTERFERENCE - FLIGHT ATTENDANT
6. (F) ACFT/EQUIP,INADEQUATE DESIGN - MANUFACTURER

Factual Information

HISTORY OF FLIGHT

On July 9, 1995, at 2109 central daylight time, an ATR 72-212, N440AM, operated by Simmons Airlines, as American Eagle Flight 4127 (Eagle 127), experienced a loss of the rear cabin entry door during climb after taking off on runway 4L from the O'Hare International Airport, Chicago, Illinois. The airplane received minor damage to the door structure and aircraft fuselage. One flight attendant received minor injuries. The cockpit flight crew, 1 flight attendant and 61 passengers reported no injuries. Following the door separation, the flight which was bound for South Bend, Indiana, returned to O'Hare International Airport, and landed without incident.

At 2036:40, Eagle 127 requested and received an IFR clearance for the flight to South Bend, Indiana. At 2058:42, Eagle 127 was instructed to taxi to runway 4L. Eagle was cleared into position and hold on runway 4L at 2107:21. This was followed by a takeoff clearance at 2107:53 with the instruction to fly heading 060 after takeoff. At 2109:44, Eagle 127 requested to return to the airport for an immediate landing. At 2110:12, Eagle 127 was instructed to make a left teardrop turn back to runway 22R. During the turn back to the runway at 2111:12 Eagle 127 requested to have the emergency equipment standing by. At 2112:48, Eagle 127 was cleared to land on runway 22R. Eagle 127 landed uneventfully and at 2115:44, while taxiing to the penalty box, the crew stated to the Inbound Ground Controller that they had a door come open in flight.

The emergency equipment followed Eagle 127 to the penalty box. The #1 flight attendant was removed from the airplane and transferred to a local hospital. The passengers were deplaned by use of a ladder and were bused to the terminal area.

INJURIES TO PERSONS

There were no injuries reported by the 60 ticketed passengers on board the airplane. In addition there was one in- lap infant who was also not injured. The 2 cockpit crewmembers and the #2 flight attendant were not injured.

The #1 flight attendant was transported to Resurrection Medical Center by a Chicago Fire Department E.M.S. Unit. She was treated for multiple contusions and abrasions to her left hand and forearm. She also stated that her right leg and arm were sore. This Flight Attendant stated she received these injuries when she threw herself forward onto the floor in an attempt to get away from the open door. She stated she hit her arm on a galley cart and the floor.

DAMAGE TO AIRCRAFT

Several areas of the outer skin on the separated door were compressed. Two vertical intercostals within the door were buckled. Minor damage occurred to the aircraft fuselage. See Structures Group Chairman Report for further details.

PERSONNEL INFORMATION

Captain

The captain held an airline transport pilot (ATP) certificate ratings for airplane single- and multiengine land. He also possessed a flight instructor certificate with ratings for airplane single- and multiengine instrument airplane. The captain was type rated in the ATR 72 and SD-3. At the time of this incident the captain had approximately 5,200 hours total flight time with about 1,200 hours in ATR 72/ATR 42 airplanes.

The captain was interviewed on July 10, 1995. He stated this was his first flight in N440AM on this day. He continued to state that the preparation for the flight was normal. He stated that the #2 flight attendant seat was deferred on the Master Minimum Equipment List (MMEL) so the #2 flight attendant was going to be sitting in seat 1B.

The captain stated that he had no indication that there were any problems with the main cabin entry door prior to takeoff. He stated that taxi and takeoff were normal until reaching an altitude of about 600 feet agl. It was at this time, according to the captain, that they received a "master caution single chime" and a "door unlocked" warning. Simultaneous with these warnings a pressurization loss occurred and vibrations were felt. He stated they leveled the airplane and slowed the airspeed to 130 knots indicated airspeed. He stated the #2 flight attendant called and stated there was a problem in the back of the airplane. He instructed her to stay away from the rear cabin door as it was unlocked. He then informed the first officer that they needed to return immediately to the airport. The first officer coordinated the return to the airport with air traffic control.

The captain stated they used 15 degrees of flaps for takeoff and had lowered the flaps to 30 degrees for the landing. He stated the climb sequence was complete with the gear retracted when they received the master caution indication. He stated there were noticeable yet controllable yaw oscillations when the door opened and he felt the door did not separate from the airplane until short final approach when the oscillations seemed to dissipate.

The captain stated that the cockpit crews rely on the cockpit annunciator lights to let them know when the doors are closed.

First Officer

The first officer held an ATP certificate with ratings for airplane single- and multiengine land. He also possessed a flight instructor certificate with ratings and limitations for airplane

single- and multiengine instrument airplane. In addition, the first officer held a ground instructor rating. At the time of the incident the first officer had approximately 2,650 hours total flight time with about 900 hours in the ATR 72/ATR 42 airplanes.

The first officer agreed with the events as related by the captain but reiterated that he remembered hearing the captain telling the flight attendant to "stay away from the door." He stated that upon landing he went to the back of the airplane and saw the #1 flight attendant in the mid-cabin area. He stated that passengers had wrapped her arm in magazines secured with rubber bands. He then escorted the injured flight attendant off of the airplane.

The first officer stated that this was to be their last leg of the day. He stated that this same cockpit and cabin crew had flown together from O'Hare to Indianapolis and back to O'Hare on the day of the incident.

#1 Flight Attendant

The #1 flight attendant was first interviewed in the early morning hours following the incident as she was preparing to leave the hospital after having been treated for injuries sustained during the incident. She stated that she had just flown in from Indianapolis and this was to be her last leg of the day. She was acting as the "lead" or #1 flight attendant in the rear of the airplane during the incident flight and that the #2 flight attendant was sitting in seat 1B because the forward jumpseat was broken.

She stated she closed the main passenger entry door and looked to assure that both "eyelets" were showing green indicating that the door was locked. She stated they would show pink/red and white stripe if the door was not locked. She stated she then sat in her jumpseat and strapped herself in using both the seatbelt and shoulder harness. She stated she heard a loud "humming" noise coming from the door after takeoff. She stated the noise got progressively louder until the door came open.

She stated that once the door came open, her reaction was to get away from the open door. She stated she started yelling "help me, help me" as she unfastened her restraints and dove forward into the aisle. Several passengers helped pull her into the cabin area and held onto her for the remainder of the flight.

She stated she sustained her injuries when she dove onto the floor.

According to the #1 flight attendant, she did not use the interphone to contact either the #2 flight attendant or the cockpit crew regarding the noise from the door. When asked to describe the procedure for closing the door, the #1 flight attendant twice stated that you pull the door up, disconnect the pin and pull down on the handle to lock the door. After an Association of Flight Attendants union representative reminded her that this airplane had the new modified door, she corrected herself and said you "pull the handle up" to lock the door.

The #1 flight attendant stated she graduated from training on June 6, 1995, and she spent most of her time flying in the ATR-72. She once again reiterated that she was strapped into her jumpseat when the door came open.

The #1 flight attendant was interviewed again later in the afternoon on the day following the incident. Once again she stated she did not see anything wrong with the door prior to takeoff and that the noise she heard was very loud and unlike anything she has ever heard in the past. She stated that the handle was in the up position and the green eyelets were showing during the time she was hearing the noise. She reported hearing a loud "pop" and being "jerked toward the door" when the door opened up. She stated she did not know at what point the door actually separated from the airplane.

She stated that the simulator she was trained on had the modified door handle and that there were no emergency procedures for this type of emergency. (The American Eagle Inflight Manual, Section 60-1, page 11, addresses procedures for Unusual Air Leaks.)

This flight attendant had been on pager reserve. She stated that on the day prior to the incident she was called around 1300 for 1500 duty time. She stated she flew three legs that day and spent the night in Milwaukee, arriving at the hotel after 2200. On the day of the incident she received a 0500 wake-up call and reported for duty at the airport at 0630. She estimated she had approximately 5 hours of sleep. On the day of the incident she flew as the #2 flight attendant from Milwaukee to Chicago; Chicago to Grand Rapids; Grand Rapids to Chicago; Chicago to Ft. Wayne; and Ft. Wayne back to Chicago, arriving at 1630. Upon arriving back in Chicago, additional trips as the #1 flight attendant were added to her schedule. These trips were Chicago to Indianapolis; Indianapolis to Chicago; and Chicago to South Bend with a completion time of 2105. The incident occurred on the flight to South Bend. She stated she had flown on ATR-72s all day. The incident leg was her first trip of the day on an airplane with the new modified door.

#2 Flight Attendant

She stated that on the day of the incident she had flown from Chicago, to Indianapolis, and back to Chicago. She stated that on the incident flight her duties were to perform the safety demonstration, insure that the cabin was secure and the passengers had their seat belts on. She stated she was not responsible, nor did she operate the main cabin entry door. She stated that prior to the flight, she remembered hearing the #1 flight attendant "pull down" to lock the entry door as this was her cue to begin her duties. She did not hear any noises nor was she aware of any problem with the entry door prior to the flight until it opened.

The #2 flight attendant stated she was sitting in seat 1B with her back to the cabin because her jumpseat was inoperative. Her first indication of a problem was that she had to clear her ears because of a change in cabin pressure. She then heard someone yelling "help me" from the back of the airplane. She stated she jumped up out of her seat, turned around and saw the "confusion" in the back of the airplane. She then heard the interphone chime and picked it up.

It was the captain telling her to stay away from the door. She stated she informed the captain that the other flight attendant (#1) had been sucked out of the door. She then noticed passengers holding onto the flight attendant and informed the cockpit. She stated she then sat back in her seat and yelled to the passengers to make sure their seat belts were fastened.

She stated she had been a flight attendant for American Eagle for approximately 3 years and the trip to Indianapolis was the first time she had flown with the #1 flight attendant.

AIRCRAFT INFORMATION

N440AM is an ATR 72-212, s/n 440. The airplane was manufactured on March 5, 1995, and received its United States Airworthiness Certificate on March 28, 1995. At the time of the incident the airplane had a total time of 643.5 hours/716 cycle. The airplane had received its "A" check on June 10, 1995, at 200.4 hours/214 cycles.

The airplane was equipped with a new handrail and door handle design which was different than the majority of the ATR-72 fleet. The old type handrail consisted of a handrail which had to be manually removed and stowed in the airplane when the door was closed. American Eagle stated that misuse of the handrail resulted in injuries to passengers and crew, so they requested that ATR develop a new style handrail which did not have to be removed. The new design consisted of a handrail which collapsed and stowed automatically when the door was closed.

A new door handle was incorporated into the design as a result of limited space created by the handrail in its collapsed/door closed position. The old handle was an "eight ball" type handle which was pulled down to latch/lock the door and pushed up to unlatch/unlock the door. The new handle consisted of a loop shaped handle and the direction of motion was reversed so that the handle was pushed up to latch/lock the door and pulled down to unlatch/unlock the door. ATR stated that the direction of travel was reversed as a result of concerns that due to its position and shape passengers/crew could trip on the handle when entering and exiting the airplane.

A review of the Aircraft Maintenance Logs revealed three previous discrepancies regarding the main cabin entry door. The discrepancies were cleared in accordance with the aircraft maintenance manual. Those discrepancies were as follows:

June 5, 1995 Passenger door extremely loud from takeoff to approximately 1500 feet agl and landing.

June 17, 1995 Aft entry door has a seal leak until pressurized. i.e. Takeoff and landing when pressure differential is low. Flight attendant reports noise is very loud.

June 23, 1995 Main cabin door difficult to latch closed.

COMMUNICATIONS

N440AM had communications with both ground and local control at O'Hare International Airport. The flight crew stated there were no problems with the communications and were complimentary of the handling they received.

FLIGHT RECORDERS

The Digital Flight Data (DFDR) and Cockpit Voice (CVR) Recorders were removed from the airplane by Simmons Airlines personnel. The recorders were placed on a flight to Washington D.C. where they were retrieved at the airport by personnel from the NTSB Office of Research and Engineering.

N440AM was equipped with a Fairchild model F800 DFDR, serial number 05198. A Flight Data Recorder group was formed and the recorder was read out in the NTSB laboratory on July 12, 1995. See attached Digital Flight Data Recorder Group Chairman's Report for more details.

N440AM was equipped with an Fairchild model A100A CVR, serial number 61932. The cockpit voice tape was reviewed and with the exception of the "Master Caution" chime, the information was deemed not pertinent. Therefore, a CVR group was not formed and a transcript of the recording was not produced. The sound of the "Master Caution" chime was used to correlate the time of the event with data from the DFDR.

WRECKAGE AND IMPACT

Inspection of the airplane revealed a small section of the aluminum door flange and rubber seal just below the bottom aft shoot bolt rollers was bent outward. All of the shoot bolt rollers were intact and undamaged. Two small punctures were observed in the fuselage skin aft of the door frame. Several reddish paint marks were found on the fuselage skin aft of and below the lower door sill. Several rivet heads in this general area showed evidence of contact. The two door hinge assemblies remained attached to the airplane.

A private citizen located the separated door on July 10, 1995. This citizen contacted the Federal Aviation Administration (FAA) who in turn contacted the NTSB. The door was located in approximately 2 feet of water in the Des Plaines River. The section of the river in which the door was found was located roughly across the street form the intersection of Howard and River Road, in Des Plaines, Illinois. This location correlated with an extended centerline of runway 4L/22R.

The door was recovered by local authorities under the supervision of the NTSB IIC and was transported back to the Simmons Maintenance facility at O'Hare Airport where further inspection of the door was conducted on July 11, 1995. For further details please refer to the attached Structures Group Chairman Factual Report.

SURVIVAL ASPECTS

The cabin door opened shortly after the first officer began to pressurize the cabin; therefore, only a slight pressure differential existed between the cabin pressure and the atmospheric pressure.

The #1 flight attendant jumpseat, located next to the main entry door was inspected after the incident. The seat and restraint system were found fully operational and uncompromised.

Several passengers including the person seated in 1C, stated they did not hear any instructions or information from either the cockpit or the #2 flight attendant after the door opened. They described the #2 flight attendant as being "scared" and "panicked."

TESTS AND RESEARCH

The door warning system consists of four microswitches. Three of these switches are located between the rollers and are activated by the extension of the shoot bolts between the rollers. The fourth switch is located on the lowest latch/lock mechanism on the door. When any one of the microswitches is not activated a cockpit warning is received. This warning consists of a "Master Caution" warning, a single chime, a "Door" light on the CCAS, and a "Cabin" door "UNLK" light on the overhead door warning panel. Power was applied to the airplane and the microswitches were tested. All functioned properly and the corresponding cockpit indications were received. For further details please refer to the attached Structures Group Chairman Factual Report.

In order for the ACARS system to send a "out-of-gate" time to dispatch, two conditions must be met: 1) The main cabin entry door must be locked and, 2) the parking brake must be released. An "out-of-gate" time was received for Eagle 127.

DFDR data indicates that the "Master Caution" chime sounded when the airplane was approximately 800 feet above ground level on a magnetic heading of 62 degrees. The airplanes flight path as retrieved from radar data along with the location of where the door was found indicates the door did not completely separate from the airplane until the airplane was on final approach to land on runway 22R.

ADDITIONAL INFORMATION

According to American Eagle personnel, they first became aware of the reversal in motion to latch/lock the door when the new design was installed on the ATR cabin trainer in August, 1994. American Eagle expressed concerns to ATR regarding the new design in a correspondence dated October 11, 1994, upon receipt of the first airplane with the new design installed. Correspondence between the Federal Aviation Administration, ATR, and American Eagle addressing the new design continued through June, 1995.

At the time of the incident nine ATR 72s had been delivered to American Eagle with the new handrail design installed. In addition, five ATR 42s had been retrofitted with the new design per ATR Service Bulletins. The new handrail design was applicable to both ATR-72s and ATR-42s.

Following this incident, ATR has designed another new door handle design. This design incorporates a new "loop" type handle and returns the handle motion to push up to unlatch/unlock, and pull down to latch/lock.

N440AM was released to an American Eagle representative on July 11, 1995. The cockpit voice recorder was returned to Simmons Airlines on July 14, 1995, and the flight data recorder was returned to same on August 2, 1995.

Pilot Information

Certificate:	Airline transport; Flight instructor	**Age:**	44,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	No
Medical Certification:	Class 1 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	May 23, 1995
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	5200 hours (Total, all aircraft), 1200 hours (Total, this make and model), 3800 hours (Pilot In Command, all aircraft), 217 hours (Last 90 days, all aircraft), 73 hours (Last 30 days, all aircraft), 3 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	ATR	**Registration:**	N440AM
Model/Series:	72-212 72-212	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Transport	**Serial Number:**	440
Landing Gear Type:	Retractable - Tricycle	**Seats:**	69
Date/Type of Last Inspection:	July 6, 1995 Continuous airworthiness	**Certified Max Gross Wt.:**	47465 lbs
Time Since Last Inspection:	22 Hrs	**Engines:**	2 Turbo prop
Airframe Total Time:	644 Hrs	**Engine Manufacturer:**	P&W
ELT:	Installed, not activated	**Engine Model/Series:**	PW127
Registered Owner:	AMR LEASING CORPORTATION	**Rated Power:**	2750 Horsepower
Operator:	SIMMONS AIRLINES	**Operating Certificate(s) Held:**	Flag carrier (121)
Operator Does Business As:	AMERICAN EAGLE	**Operator Designator Code:**	SIM

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Night/bright
Observation Facility, Elevation:	ORD ,668 ft msl	**Distance from Accident Site:**	
Observation Time:	20:50 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	7 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	40°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29 inches Hg	**Temperature/Dew Point:**	21°C / 17°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	(ORD)	**Type of Flight Plan Filed:**	IFR
Destination:	SOUTH BEND , IN (SBN)	**Type of Clearance:**	IFR
Departure Time:	21:08 Local	**Type of Airspace:**	Class B

Airport Information

Airport:	O'HARE INT'L ORD	**Runway Surface Type:**	
Airport Elevation:	668 ft msl	**Runway Surface Condition:**	
Runway Used:	0	**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 Minor, 3 None	**Aircraft Damage:**	Minor
Passenger Injuries:	61 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Minor, 64 None	**Latitude, Longitude:**	

Administrative Information

Investigator In Charge (IIC):	Sullivan, Pamela
Additional Participating Persons:	THOMAS HUTCHINS; SCHILLER PARK , IL JOHN DARBO; DFW AIRPORT , TX DONALD FLANIGIN; CHANTILLY , VA JEFF SEDIN; ROSEMONT , IL
Original Publish Date:	March 21, 1996
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=9766