National Transportation Safety Board
Aviation Accident Final Report

Location:	CHICAGO, IL	**Accident Number:**	CHI94FA039
Date & Time:	11/15/1993, 1513 CST	**Registration:**	N16762
Aircraft:	BOEING 727-227	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	86 None
Flight Conducted Under:	Part 121: Air Carrier - Scheduled		

Analysis

THE FLIGHT CREW REPORTED IT WAS A HEAVY TRAFFIC PERIOD, AND ATC WAS USING PARALLEL RUNWAYS. THEY REPORTED THEY WERE VECTORED ONTO A LONGER THAN NORMAL FINAL APPROACH, AND SLOWED DOWN EARLIER THAN USUAL. 25 DEG FLAPS WAS SELECTED TO MAINTAIN THE ASSIGNED AIRSPEED, BUT THEY DELAYED LANDING GEAR EXTENSION BECAUSE OF THEIR DISTANCE FROM THE RUNWAY. NUMEROUS GENUINE AND 'PHANTOM' TCAS TRAFFIC ALERTS WERE RECEIVED DURING THE APPROACH, WHICH DISTRACTED THEM FROM THE CHECKLIST. AT 500 FT AGL, THE GPWS SYSTEM BEGAN TO SOUND 'WHOOP WHOOP TERRAIN', AND THE CREW STATED THEY WERE DISTRACTED BY ALL THE NOISE IN THE COCKPIT, AND CONFUSED BY THE 'TERRAIN' MESSAGE FROM THE GPWS. WHEN THE GPWS WAS (AUTOMATICALLY) INHIBITED AT 50 FT AGL, THE CREW RECOGNIZED THE LANDING GEAR WAS NOT EXTENDED. THEY EXECUTED A GO-AROUND, AND THE AFT FUSELAGE STRUCK THE RUNWAY IN THE PROCESS.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: THE CAPTAIN'S FAILURE TO ASSURE THAT THE LANDING GEAR WAS EXTENDED FOR LANDING. FACTORS RELATED TO THE ACCIDENT WERE: TRAFFIC ALERT DISTRACTIONS, THE FLIGHT CREW'S FAILURE TO USE THE CHECKLIST, AND INADEQUATE COMPANY SYSTEMS TRAINING.

Findings

Occurrence #1: WHEELS UP LANDING
Phase of Operation: GO-AROUND (VFR)

Findings
1. (C) GEAR EXTENSION - NOT PERFORMED - PILOT IN COMMAND
2. (F) DIVERTED ATTENTION - PILOT IN COMMAND
3. (F) CHECKLIST - NOT FOLLOWED - PILOT IN COMMAND
4. (F) INADEQUATE TRAINING - COMPANY/OPERATOR MANAGEMENT
5. (F) CHECKLIST - NOT FOLLOWED - COPILOT/SECOND PILOT
6. (F) CHECKLIST - NOT FOLLOWED - FLIGHT ENGINEER

Factual Information

HISTORY OF THE FLIGHT

On November 15, 1993, at 1513 central standard time, a Boeing 727-227, N16762, operated by Continental Airlines, Inc., as Flight 5148, providing scheduled air carrier service between Houston, Texas and Chicago, Illinois, sustained substantial damage to the lower portion of the aft fuselage when it contacted the runway during a go around at Chicago's O'Hare International Airport (ORD). The go around was initiated when the flight crew realized the landing gear was not extended for landing. The three flight crew members, four flight attendants, and seventy nine passengers reported no injuries. Visual meteorological conditions prevailed at the time of the accident, and the flight operated on an IFR flight plan. The flight operated under 14 CFR Part 121, and originated from Houston, Texas, approximately 1312.

The flight crewmembers stated when they arrived in the Chicago area, it was a heavy traffic period and ORD Air Traffic Control (ATC) was using parallel runways (27L and 27R) for landing. The flight crewmembers stated they were radar vectored onto a longer than normal (estimated 17 to 18 miles) final approach for Runway 27L, and received early assigned airspeed reductions, which they attributed to the volume of traffic. The crew members estimated they were on an eight mile final for the runway when ATC assigned an airspeed of 150 knots. The flight crew selected twenty-five degrees of flaps to maintain the assigned airspeed. They stated they elected to delay landing gear extension "until normal gear extension point" and continued the approach.

The flight crewmembers stated they received Traffic Collision Avoidance System (TCAS) Traffic Alerts (TAs) throughout the approach. The Flight Engineer (FE) stated they broke out of the clouds about 2,500 feet Mean Sea Level (MSL) and visually identified a TCAS traffic alert target (a Boeing 747) on the parallel approach for Runway 27R.

The FE reported they received another aural TCAS traffic alert "almost immediately" after the 1000 foot above ground level (AGL) altitude call-out. The target appeared below them, at their three o'clock position, and one mile, moving from right to left across their path. The FE stated "...This caused a large distraction...while we searched for a potential conflict." He indicated that, although spurious, or "phantom" TCAS warnings were not uncommon, "...the threat seemed real because we had already confirmed the B747." He reported all three flight crewmembers gave the potential traffic conflict "...the highest priority" and searched the airspace around them for the traffic. They were unable to visually identify the target.

The flight crew reported as they descended through 500 feet AGL the Ground Proximity Warning System (GPWS) began to sound "Whoop Whoop Terrain." The crew verified they were operating in visual conditions, clear of terrain/obstructions, and continued the approach, as per company policy. The flight crew unsuccessfully attempted to troubleshoot and identify the cause of the GPWS alert, while the GPWS continued to broadcast its "Whoop Whoop Terrain" warning. They stated when they were about 200 feet AGL, they received another TCAS Traffic Alert.

The flight crewmembers reported they were distracted as they continued the approach, calling out altitudes, looking for traffic and trying to determine what was causing the GPWS warning. The FE stated "...for a time there, nothing made sense." At 50 feet AGL the GPWS aural warning ceased. The flight crewmembers stated when the distracting noise stopped, they all

suddenly recognized they "didn't have three green" (the landing gear was not extended.) They added power and performed a go around, scraping the aft fuselage on the runway in the process. The airplane returned to land on Runway 32L without further incident.

Postaccident examination of the landing gear warning system and the Ground Proximity Warning System (GPWS) revealed they were capable of normal operation. Flight crew statements obtained during interview indicated supported this. Copies of pertinent maintenance entries are appended.

DAMAGE TO AIRCRAFT

The #3 VHF antenna and the aft drain mast separated when the aft fuselage touched the runway during the go around. The aft fuselage exhibited dents, punctures and longitudinal scratches. The aircraft pressure vessel was punctured/compromised during ground impact.

COMMUNICATIONS

ATC records indicate at 1512:40, ORD North Local Controller (NLC) was contacted by an American Airlines flight crew member, who indicated the Continental flight did not have the landing gear extended. The NLC coordinated with the South Local Controller (SLC), and at 1512:48 SLC advised "Continental, go around, go around. Continental no gear, no gear." The flight crew reported they did not hear the controller's instructions. They stated they were probably too busy performing the go around to recognize the radio transmission. Controller statements and an ATC transcript are appended.

FLIGHT RECORDERS

The Cockpit Voice Recorder (CVR) and Digital Flight Data Recorder (DFDR) were transported to the National Transportation Safety Board's (NTSB's) laboratory in Washington, D.C. for readout and evaluation. The CVR, a 30 minute, continuous loop tape, contained only nonpertinent postaccident ground crew discussion. The DFDR data indicated the airplane descended on a 270 degree magnetic heading to an altitude of approximately 646 feet MSL before it began to climb. The DFDR Factual Report is appended. The CVR and DFDR were released to the operator upon completion of laboratory examination.

MEDICAL/PATHOLOGICAL INFORMATION

Toxicological test results were negative on all three flight crew members. Results are appended.

ADDITIONAL INFORMATION

The flight crew indicated the landing gear warning system never warned them the gear was not extended. They did not observe three green lights indicating gear down for landing, but neither did they observe a red gear position warning light either. The landing gear warning horn and red light are triggered when the landing gear is not down and locked and either of the following conditions exist:

1. Flaps greater than 25 degrees.
2. Throttle lever/levers in the aft 10 degree position on the throttle quadrant.

The flight crew stated they were established in a stable, power on approach, and never exceeded 25 degrees flaps selected, thus they never triggered the landing gear warning system. The manufacturer stated: "The 727 airplane was certified for flaps 30 or flaps 40

landings....(therefore) the trigger point of the continuous aural warning system was set to...flaps greater than 25." Excerpts from the Boeing 727 maintenance manual are appended.

Continental operates their Boeing 727 airplanes equipped with Sundstrand Mark I or Mark II GPWS units, which provide verbal aural warnings in response to aircraft configuration/operation deficiencies. The accident airplane was equipped with the Mark I GPWS unit, which provides a "Whoop Whoop Terrain" warning "...when the aircraft penetrates below 500 feet with the landing gear not down." This warning will sound continuously until the airplane reaches 50 feet AGL, when it is automatically inhibited. The GPWS maintenance manual indicates the warnings are automatically inhibited below 50 feet of radio height "to reduce nuisance alarms caused by ground-effect induced static pressure fluctuations."

Conditions which result in the "Whoop Whoop Terrain" warning are as follows:

1. Rate of descent exceeds certain threshold values.

2. Terrain closure rate exceeds certain threshold values, dependent on aircraft configuration.

3. Takeoff altitude loss or takeoff rate warning.

4. Below 500 feet AGL with landing gear not down.

5. Gear down, but flaps not extended sufficiently when operating between 200 and 500 feet AGL, with a sink rate exceeding certain values.

6. Below 200 feet AGL with gear down, but flaps not selected to the landing position.

The GPWS unit installed in the accident airplane will also sound a "Glideslope Pull Up" message in the event of an inadvertent descent below Glideslope when an ILS frequency is selected by the pilot. No more specific vocabulary warnings are available in the Mark I GPWS units. The Sundstrand Mark II GPWS unit offers an expanded vocabulary which allows for more specific warnings as to the nature of the airplane deficiency. The expanded vocabulary includes "Too Low Gear," "Too Low Flaps," "Too Low Terrain," "Sinkrate," "Don't Sink," and "Minimums." Excerpts from the Sundstrand maintenance manuals are appended.

The flight crew stated they were confused by the "Terrain" terminology under those circumstances. They ascertained they were operating clear of terrain, in daylight, visual meteorological conditions, and continued the approach. The flight crew members stated they received training in the operation of the GPWS system. They were academically familiar with the various triggering flight conditions/events, but they expected a more specific warning. They stated they had not experienced the GPWS Mark I aural warning ("Whoop Whoop Terrain") for landing gear before, and with the other distractions during the approach, they were unable to decode its significance. Continental has incorporated the accident scenario into its training curriculum, and GPWS specifics are now addressed in classroom and simulator exercises.

Pilot Information

Certificate:	Airline Transport; Commercial; Flight Engineer	**Age:**	43, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 Valid Medical--no waivers/lim.	**Last Medical Exam:**	08/18/1993
Occupational Pilot:		**Last Flight Review or Equivalent:**	
Flight Time:	11000 hours (Total, all aircraft), 8200 hours (Total, this make and model), 10000 hours (Pilot In Command, all aircraft), 160 hours (Last 90 days, all aircraft), 60 hours (Last 30 days, all aircraft), 6 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Manufacturer:	BOEING	**Registration:**	N16762
Model/Series:	727-227 727-227	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Transport	**Serial Number:**	21245
Landing Gear Type:	Retractable - Tricycle	**Seats:**	152
Date/Type of Last Inspection:	09/04/1993, Continuous Airworthiness	**Certified Max Gross Wt.:**	190500 lbs
Time Since Last Inspection:	512 Hours	**Engines:**	3 Turbo Fan
Airframe Total Time:	43721 Hours	**Engine Manufacturer:**	P&W
ELT:		**Engine Model/Series:**	JT8D-9A
Registered Owner:	UNITED STATES TRUST CO. NY	**Rated Power:**	14500 lbs
Operator:	CONTINENTAL AIRLINES, INC.	**Air Carrier Operating Certificate:**	Flag carrier (121)
Operator Does Business As:		**Operator Designator Code:**	CALA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	**Condition of Light:**	Day
Observation Facility, Elevation:	ORD, 667 ft msl	**Observation Time:**	1450 CST
Distance from Accident Site:	0 Nautical Miles	**Direction from Accident Site:**	0°
Lowest Cloud Condition:	Unknown / 1800 ft agl	**Temperature/Dew Point:**	6°C / 2°C
Lowest Ceiling:	Overcast / 1800 ft agl	**Visibility**	12 Miles
Wind Speed/Gusts, Direction:	4 knots, 280°	**Visibility (RVR):**	0 ft
Altimeter Setting:	30 inches Hg	**Visibility (RVV):**	0 Miles
Precipitation and Obscuration:			
Departure Point:	HOUSTON, TX (IAH)	**Type of Flight Plan Filed:**	IFR
Destination:		**Type of Clearance:**	VFR
Departure Time:	1312 CST	**Type of Airspace:**	Class B; Class E

Airport Information

Airport:	O'HARE INTERNATIONAL (ORD)	**Runway Surface Type:**	Asphalt
Airport Elevation:	667 ft	**Runway Surface Condition:**	Dry
Runway Used:	27L	**IFR Approach:**	None
Runway Length/Width:	10141 ft / 150 ft	**VFR Approach/Landing:**	Go Around

Wreckage and Impact Information

Crew Injuries:	7 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	79 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	86 None	**Latitude, Longitude:**	

Administrative Information

Investigator In Charge (IIC):	JODI L REEVES	**Adopted Date:**	12/19/1994
Additional Participating Persons:	RUSS RAUPP; SCHILLER PARK, IL GERARDO MARTINEZ; SCHILLER PARK, IL		
Publish Date:			
Investigation Docket:	NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at pubinq@ntsb.gov, or at 800-877-6799. Dockets released after this date are available at http://dms.ntsb.gov/pubdms/.		

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