



AVIATION



HIGHWAY



MARINE



RAILROAD



PIPELINE

Aviation Investigation Final Report

Location:	Pittsburgh, Pennsylvania	Incident Number:	DCA22LA133
Date & Time:	June 21, 2022, 09:45 Local	Registration:	N37513
Aircraft:	Boeing 737-9	Aircraft Damage:	None
Defining Event:	Wrong surface or wrong airport	Injuries:	174 None
Flight Conducted Under:	Part 121: Air carrier - Scheduled		

Analysis

This analysis discusses the incorrect runway landing at Pittsburgh International Airport involving United Airlines flight 2627. The airplane had been cleared to land on runway 28C, but the flight crew aligned the airplane with and landed on parallel runway 28L.

The flight crewmembers reported that, before beginning the descent into the terminal area, the first officer (the pilot monitoring) programmed the flight management computer (FMC) for the area navigation (RNAV) approach to runway 28C. During the descent, the crew was instructed twice by PIT approach control to change the landing runway. The crew was first instructed to expect a visual approach to runway 32; a short time later, the crew was provided vectors for the visual approach to runway 28C.

Once on the base leg of the approach, the crew reported that the airport was in sight, and the controller cleared the airplane for the visual approach to runway 28C. The captain (the pilot flying) stated he visually acquired the precision approach path indicator (PAPI) lights. Runways 28C and 28L both had PAPI lights located on the left side of the respective runway. The captain stated that he observed one set of PAPI lights, which he thought were associated with runway 28C.

The captain requested that the first officer extend the centerline of the approach from the next waypoint, at which time the first officer reported that both FMC control display units had blanked, taking away the backup lateral and vertical navigational guidance to runway 28C. Although the PAPI lights provided vertical guidance, the first officer attempted to diagnose and restore the FMC's lateral guidance, which created a distraction at a critical phase of the flight that reduced the crew's opportunity to ensure correct runway alignment. A postincident review of FMC data showed that the FMCs experienced a dual reset when the airplane was at an altitude of about 4,000 ft (3,350 ft above ground level). The FMCs rebooted and began transmitting valid data 23

seconds later when the airplane was about 3,128 ft above ground level, about 4 minutes away from touchdown.

While on final approach, the crew requested that the controller confirm that the airplane was cleared to land on runway 28C; the controller provided this confirmation. However, at some point afterward, the controller observed that the airplane was aligned with runway 28L. After verifying that no conflicting traffic existed, the controller decided to allow the flight to continue and land on runway 28L rather than issue a go-around instruction at a low altitude. This flexibility is permitted by Federal Aviation Administration Order 7110.65Z, which allows controllers to exercise their best judgment if they encounter situations not covered by the order. The flight crew subsequently aligned the airplane with and landed on parallel runway 28L, which was located about 1,200 ft to the left of intended runway 28C. Because runway 28L and runway 28C were closely located, it would have been challenging for the controller to have visually detected the misalignment.

The crew stated that, after the airplane landed, the first officer rechecked the automatic terminal information service broadcast, and they thought that it indicated that the PAPI lights for runway 28L were out of service. However, a review of the broadcast revealed that the PAPI lights for runway 10L were out of service.

The dual FMC reset was due to an issue with the system's software, which was known before the incident. A fix was identified and released about 1 month before the incident. The dual blanking of the FMC control display units did not cause the flight crew to align the airplane with and land on the wrong runway given that the airplane was operating in visual meteorological conditions and the flight was cleared for the visual approach to runway 28C.

Although the incident airplane had a runway awareness and advisory system (RAAS) installed in the cockpit, the operator did not select the option to provide crews with an aural alert for the runway that the airplane would be approaching in flight. If the operator had selected this option, the system would have alerted the incident flight crew that the airplane was aligned with a runway that was not consistent with the landing clearance provided by air traffic control, which might have precluded the wrong runway landing.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this incident to be:

The flightcrew's misidentification of the intended landing runway, which resulted in approach to and landing on the wrong runway. Contributing to the incident was the distraction caused by the dual reset of the flight management computer displays.

Findings

Personnel issues	Identification/recognition - Flight crew
Aircraft	Flt management computing sys - Malfunction
Personnel issues	Use of automation - Flight crew

Factual Information

History of Flight

Landing	Wrong surface or wrong airport (Defining event)
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On June 21, 2022, about 0945 eastern daylight time (EDT), United Airlines flight 2627, a Boeing 737-9 MAX, N37513, was cleared for a visual approach to land on runway 28C at Pittsburgh International Airport (PIT), Pittsburgh, Pennsylvania, but the flight crew landed on runway 28L instead. None of the 174 occupants aboard the airplane were injured, and the airplane was not damaged. The regularly scheduled passenger flight was operating under the provisions of Title 14 *Code of Federal Regulation* Part 121 from Chicago O'Hare International Airport (ORD), Chicago, Illinois, to PIT.

The flight crew reported that the incident flight was the first leg on the first day of a 3-day trip. The captain was the pilot flying, and the first officer was the pilot monitoring. Before the flight, the crew reviewed and accepted the operational flight plan to PIT, which indicated an arrival on runway 28L. Flight data recorder (FDR) data showed that the airplane departed ORD about 0845 EDT (0745 local time) and that the autopilot was engaged shortly after takeoff until shortly before the final approach to PIT.

The flight crewmembers reported that, before the airplane began its descent into the terminal area, they obtained automatic terminal information service (ATIS) information for PIT via the airplane's aircraft communication addressing and reporting system (ACARS). Per the ATIS information, they briefed the JESEY4 area navigation (RNAV) arrival, and the first officer programmed the flight management computers (FMC) for the RNAV approach to runway 28C.

The flight crew made initial contact with PIT approach control when the airplane was about 25 miles northwest of the airport. The approach controller told the flight crew to expect a visual approach to runway 32. The flight crew retrieved landing data for runway 32, briefed the approach, and programmed and loaded the FMC with the instrument landing system (ILS) approach to runway 32 to back up the planned visual approach.

The controller subsequently offered the crewmembers radar vectors for the visual approach to runway 28C, which they accepted. The captain selected "heading select" on the autopilot and flew the assigned heading while the first officer programmed the FMC for the RNAV approach to runway 28C.

The flight crew established communication with the tower controller when the airplane was about 6.5 miles east of the airport. The crew advised the tower controller about the visual approach to runway 28C, and the controller cleared the airplane to land. According to the crew,

the airplane turned from the downwind to the base leg for the runway at an altitude of about 4,000 ft mean sea level (msl), which would allow the airplane to join the final approach for the runway about 2 miles east of the SUPPR waypoint. The flight crew told the controller that the airport was in sight, and the controller cleared the airplane for the visual approach to runway 28C. During a postincident interview, the captain stated that he visually acquired the precision approach path indicator (PAPI) when the airplane was about 6.5 miles away from the airport. (The captain was using the PAPI for vertical guidance because runway 28C had no ILS. Runways 28C and 28L had PAPI lights associated with the runway, and both sets of PAPI lights were located on the left side of their respective runway.)

The captain requested that the first officer extend the virtual centerline of the approach from the SUPPR waypoint, at which time the first officer announced that both FMC control displays had blanked; thus, only the “ACARS” prompt was showing and available on the menu page of the FMC display units. According to FDR data, the FMC blanking occurred at 0940:13 (as discussed further in the Flight Recorders section), after which lateral and vertical guidance on the MAX display system was unavailable. The captain reported that, at the time of the screen blanking, the PAPI lights were still in sight and that he continued the visual approach to the airport. The captain disconnected the autopilot and autothrottle at 0942:07 when the airplane was at an altitude of about 2,300 ft above ground level (agl).

The flight crew stated that the FMCs came back on when the airplane was between 700 and 1,000 ft agl, but no approach guidance was displayed. The captain stated that, at that time, he could see the airport and the PAPI lights, and that he continued to the airport visually.

About 2 miles from the runway threshold, the first officer contacted the tower controller to confirm that the airplane was cleared to land on runway 28C, and the controller provided confirmation. The airplane then aligned with and landed on runway 28L instead of runway 28C at 0944:42 and subsequently turned right to exit the runway. The figure below is a Google Earth screenshot that is overlaid with automatic dependent surveillance-broadcast ground tracks showing the incident flight aligned with and landing on runway 28L.



During another postincident interview, the tower controller stated that, after he cleared the airplane to land on runway 28C (when the airplane was on a 2-mile final), he observed that the flight crew had aligned the airplane with runway 28L instead of runway 28C. The controller decided that, given the airplane’s altitude, it would be appropriate for the airplane to land on runway 28L. The controller decided not to issue a go-around instruction given that no airplanes or vehicles were on or near runway 28L. The PIT air traffic manager reported that, at the time of the incident, the traffic volume was “light with routine complexity.”

Pilot Information

Certificate:	Airline transport; Flight engineer; Flight instructor	Age:	51, Male
Airplane Rating(s):	Single-engine land; Multi-engine land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	5-point
Instrument Rating(s):	Airplane	Second Pilot Present:	
Instructor Rating(s):	None	Toxicology Performed:	
Medical Certification:	Class 1 With waivers/limitations	Last FAA Medical Exam:	April 21, 2022
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	March 29, 2022
Flight Time:	(Estimated) 15581 hours (Total, all aircraft), 8380 hours (Total, this make and model), 2235 hours (Pilot In Command, all aircraft), 144 hours (Last 90 days, all aircraft), 72 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Co-pilot Information

Certificate:	Airline transport; Commercial	Age:	51,Female
Airplane Rating(s):	Single-engine land; Multi-engine land	Seat Occupied:	Right
Other Aircraft Rating(s):	None	Restraint Used:	5-point
Instrument Rating(s):	Airplane	Second Pilot Present:	
Instructor Rating(s):	Airplane single-engine; Instrument airplane	Toxicology Performed:	
Medical Certification:	Class 1 With waivers/limitations	Last FAA Medical Exam:	February 8, 2022
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	December 30, 2021
Flight Time:	5500 hours (Total, all aircraft), 3141 hours (Total, this make and model), 1800 hours (Pilot In Command, all aircraft), 79 hours (Last 90 days, all aircraft), 35 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Boeing	Registration:	N37513
Model/Series:	737-9	Aircraft Category:	Airplane
Year of Manufacture:	2019	Amateur Built:	
Airworthiness Certificate:	Transport	Serial Number:	64494
Landing Gear Type:	Retractable - Tricycle	Seats:	187
Date/Type of Last Inspection:	June 3, 2022 Continuous airworthiness	Certified Max Gross Wt.:	169375 lbs
Time Since Last Inspection:		Engines:	2 Turbo fan
Airframe Total Time:	4284 Hrs at time of accident	Engine Manufacturer:	CFM INTL
ELT:	Installed, not activated	Engine Model/Series:	LEAP-1B28 SER
Registered Owner:	UNITED AIRLINES INC	Rated Power:	29317 Lbs thrust
Operator:	UNITED AIRLINES INC	Operating Certificate(s) Held:	Flag carrier (121)

The airplane was equipped with a General Electric Aviation (GE) FMC system, which interfaced with other airplane systems to support lateral, vertical, and time-based navigation guidance. The FMC system comprised two computers and two control display units.

Both computers were removed from the airplane and sent to the manufacturer for evaluation. Data obtained from the computers showed that the dual blanking of the FMC displays was caused by a dual FMC reset that occurred during the descent into PIT. GE stated that this reset was consistent with a known software exception (problem) related to a vector/discontinuity

combination followed by a waypoint with a “required navigation Performance.” This problem was introduced in a version of the Boeing 737 flight management system software that included refinements to GE’s earth model.

The software exception occurred in the air and resulted in a “numeric error” exception in the earth model. The FMC manufacturer developed a procedural workaround, and the error was corrected in the subsequent version of the software. Boeing issued a service bulletin about the software update in May 2022.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	KPIT	Distance from Accident Site:	
Observation Time:	09:45 Local	Direction from Accident Site:	
Lowest Cloud Condition:	Few / 5000 ft AGL	Visibility	10 miles
Lowest Ceiling:	Broken / 25000 ft AGL	Visibility (RVR):	
Wind Speed/Gusts:	5 knots /	Turbulence Type Forecast/Actual:	None / None
Wind Direction:	239°	Turbulence Severity Forecast/Actual:	N/A / N/A
Altimeter Setting:	30.18 inches Hg	Temperature/Dew Point:	21°C / 13°C
Precipitation and Obscuration:			
Departure Point:	Chicago, IL (KORD)	Type of Flight Plan Filed:	VFR/IFR
Destination:	Pittsburgh, PA	Type of Clearance:	VFR; IFR
Departure Time:	07:46 Local	Type of Airspace:	Class C

Airport Information

Airport:	Pittsburgh International Airport KPIT	Runway Surface Type:	Concrete
Airport Elevation:	1203 ft msl	Runway Surface Condition:	Dry
Runway Used:	28L	IFR Approach:	None
Runway Length/Width:	11500 ft / 200 ft	VFR Approach/Landing:	Traffic pattern

At the time of the incident, PIT had four paved landing surfaces for airplanes: 10R/28L, 10C/28C, 10L/28R, and 14/32. Runway 10R/28L was 11,500 ft long and 200 ft wide, and runway 28L was serviced by a four-light PAPI on the left side of the runway and a medium-intensity approach light system with runway alignment indicator lights. Runway 10C/28C was 10,775 ft long and 150 ft wide and was serviced by a four-light PAPI located on the left side of

the runway and runway centerline lights. The centerline of runway 28C was about 1,200 ft from the centerline of runway 28L. The distance from the air traffic control tower to the runway 28C threshold was about 7,500 ft.

Wreckage and Impact Information

Crew Injuries:	6 None	Aircraft Damage:	None
Passenger Injuries:	168 None	Aircraft Fire:	None
Ground Injuries:		Aircraft Explosion:	None
Total Injuries:	174 None	Latitude, Longitude:	40.491501,-80.232902

Communications

The Federal Aviation Administration (FAA) Airport Traffic Control Tower (ATCT) was in operation at the time of the incident. According to the FAA, the flight established communication with the local controller approximately 6.5 miles east of the airport. The flight crew advised the controller they were on a visual approach to runway 28C, and the controller cleared the flight to land on runway 28C. According to radar data, on an approximately 6-mile final, the flight joined the final for runway 28L. About 2-mile final the flight crew requested verification of their clearance to land runway 28C. The controller advised of mowers in the vicinity and cleared the flight to land on runway 28C. The controller subsequently observed the flight had lined up with runway 28L. The controller exercised their best judgment, as allowed in FAA Job Order 7110.65Z, that for the safety of the flight that it was best to allow the flight to land on runway 28L. Given their low altitude and noting there were no airplanes or vehicles on or near runway 28L, he decided not to issue a go-around to the flight.

The traffic volume was classified as being “light with routine complexity” and no other aircraft or vehicles were on runway 28L. The air traffic control tower was located about 1 1/2 miles from the approach end of runways 28L and 28C.

Flight recorders

The FDR was found to be in good condition, and the data were extracted normally from the recorder. The FDR recording contained about 27 hours of data. The FDR data showed that, at 0940:17, parameters sourced from the FMC began to show an error pattern consistent with the FDR not receiving data from the FMC ARINC data bus. According to Boeing, the fault condition must be present for at least four successive data points for it to be annunciated in the output data frame recorded on the FDR. On the basis of the sampling rate of the affected parameters, the data loss condition began at 0940:13.

The error pattern in the FMC-sourced data continued for about 13 seconds, at which time it transitioned to a no computed data error pattern. That error pattern continued for about 6 seconds, and the FDR began receiving valid data again at 0940:36. The FMC “valid” parameter was in the VALID state for the entire flight.

Additional Information

Runway Awareness and Advisory System

The United Airlines *737 Flight Manual* stated that the runway awareness and advisory system (RAAS), an enhancement to the ground proximity warning system (GPWS), provides aural callouts and visual alerts on the navigation display to assist pilots with situational awareness during ground operations, approaches to landing, and go-arounds. RAAS required the following conditions for proper operation:

- terrain and airport runway database is in the GPWS computer,
- aircraft is approaching an airport in the RAAS airport runway database, and
- GPS and other required signals are available with an accuracy that meets minimum requirements.

When enabled, RAAS callouts operate without any required action from the pilots. Visual display of RAAS callouts and alerts on the navigation display requires the selection of the terrain feature.

Audible alerts associated with an approach and landing included “caution taxiway,” which would sound if an airplane aligned with a taxiway when the airplane was at an altitude between 150 and 250 ft agl. United Airlines selected, as part of its option package for RAAS, to disable the airborne alerts that announces the runway that a company flight was approaching to minimize any distractions while on final approach and maintain a “quiet cockpit” environment.

Federal Aviation Administration Order 7110.65Z

Federal Aviation Administration Order 7110.65Z prescribed air traffic control procedures and phraseology for use by air traffic control personnel. The order required controllers to be familiar with the provisions in the order that pertained to their operational responsibilities. The order stated that, if a controller becomes aware that an aircraft is aligned with the wrong surface, the controller should “inform the pilot” and either “issue control instructions/clearances” or “if time permits, verify the pilot is aligned with the correct runway” and “issue control instructions/clearances as necessary. In addition, the order allows controllers “to exercise their best judgment if they encounter situations not covered by [the order].”

Administrative Information

Investigator In Charge (IIC):	Hauf, Michael
Additional Participating Persons:	Ryan Hurling; United; Chicago, IL Todd Gentry; FAA AVP Steve Demko; ALPA Eric J. East; Boeing; Seattle, WA
Original Publish Date:	August 3, 2023
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this incident.
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=105303

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