Log 2363

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: July 20, 1992
In reply refer to: A-92-57 and -58

Honorable Thomas C. Richards
Administrator
Federal Aviation Administration
Washington D.C. 20591

On March 3, 1991, a Boeing 737-200 airplane, operated under 14 Code of Federal Regulations (CFR) Part 121 as United Airlines flight 585, crashed during its approach to the Colorado Springs Municipal Airport, Colorado Springs, Colorado. Visual meteorological conditions prevailed at the time and the flight was on an Instrument Flight Rules (IFR) flight plan from Denver, Colorado. At about 0944 Mountain Standard Time (MST), numerous witnesses reported that shortly after rollout onto the final approach course to runway 35, the airplane rolled steadily to the right and pitched nose down. The airplane continued to roll to the right and pitch down until it was almost in a vertical attitude before colliding with the ground. The airplane was destroyed, and the 2 flight crewmembers, 3 flight attendants, and 20 passengers aboard were fatally injured.

As part of the investigation, which is continuing, the Safety Board has been examining several issues, including the possibility of intense small-scale orographically induced weather disturbances in the Colorado Springs area. Along the front range of the Rocky Mountains these disturbances mainly occur during the winter months.

On March 3, 1991, highly dynamic weather conditions existed along this front range. Strong mountain waves were occurring, accompanied by severe turbulence, updrafts and downdrafts. Strong surface winds were also reported. Several reports of horizontal axis vortices (rotors) were noted in the area north of the airport.

The investigation to date has revealed evidence of local small-scale meteorological disturbances in the area south of the airport. For example, about 0800 MST on the morning of the accident, the pilot of a Beech King Air airplane reported encountering a "terrible shear" in the area of the accident. The pilot stated that he lost 20 knots of airspeed and 100 feet of altitude. Ten to 15 minutes prior to the accident, a person outside his home, about 6 miles west of the accident site, observed several

rotor clouds south of the airport. He estimated the height of the rotor clouds to be 7,000 feet above mean sea level, which is about 800 feet above the Colorado Springs airport elevation.

Analysis of Geostationary Operational Environmental Satellite (GOES) data on the Safety Board's McIDAS[1] showed a cloud feature at around 12,000 feet moving north of the Colorado Springs area at an estimated speed of 80 knots. The southern extended axis of this feature passed over the accident site about the time of the accident. There is also evidence of this cloud feature at the surface. Witness reports noted brief strong winds along the northwest to southeast axis through the accident site. One person who was east southeast of the accident site reported a brief gust of wind that he estimated at more than 90 miles per hour. According to scientists at the National Oceanic and Atmospheric Administration (NOAA), a small-scale intense atmospheric disturbance could be generated or accompanied by this feature.

Also, in Colorado Springs there is an Air Quality Network consisting of meteorological sensors that measure several parameters, including wind, temperature, and pressure. The sensors are located throughout Colorado Springs, and several of them are near the accident site. The data from the network were analyzed by the Safety Board using McIDAS and showed an area of converging winds just south of the accident site. Vortices would tend to form along this line of convergence.

On March 4, 1991, the day after the accident, a University of Wyoming meteorologically instrumented Beech King Air airplane flew approaches into the Colorado Springs Municipal Airport to provide data for the accident investigation. The data showed a region of decreased wind speeds east of Pikes Peak in the area of the accident. This region extended from about 5 nautical miles south of the airport to 3 to 5 nautical miles north. There was a wind reversal (strong northwest to light southeast winds) in this region, and vortices were present along this interface. Eight hundred to one thousand feet per minute vertical velocities were recorded during the flights. Although the meteorological conditions on March 4, 1991, were not precisely the same as those the day before the accident, the Safety Board believes that the conditions were similar. In addition, these data are consistent with the Safety Board's analysis of the Air Quality Network data for March 3.

The Safety Board believes that small-scale atmospheric

---

[1] Man computer Interactive Data Access System. A weather data and analysis computer system developed and managed by personnel at the Space Science and Engineering Center at the University of Wisconsin at Madison. The data are obtained by modem and displayed and analyzed on the Safety Board's PS/2 McIDAS Workstation.

disturbances generated by the terrain in the Colorado Springs area occur in the area south of the airport. However, the Safety Board is unsure of the intensity and structure of these disturbances or of their frequency. In addition, the Safety Board has not yet determined whether or how these disturbances might have related to the accident involving United Airlines flight 585.

In an effort to better understand the weather conditions at the time of the accident, the Safety Board, the Federal Aviation Administration, Boeing, and United Airlines contracted last Spring with scientists at the National Center for Atmospheric Research (NCAR) to numerically model the meteorological conditions in the Colorado Springs area for the day of the accident. The modeling activity was completed in late February of this year. However, because of the complex nature of the meteorology, the modeling was unsuccessful. Nevertheless, based on a similar successfully modeled case in January 1989, the scientists did conclude that small-scale intense atmospheric disturbances could occur in the area south of the Colorado Springs Municipal airport. This conclusion was also supported by scientists from NOAA. Both the scientists from NOAA and NCAR believe that detailed observational data are needed for the Colorado Springs area to better define the structure, severity and frequency of these possible hazards.

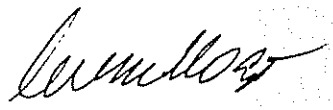
The Safety Board believes the evidence indicates that local small-scale meteorological disturbances occur in the area south of the Colorado Springs Municipal Airport. Although these disturbances can be hazardous to aviation, the degree and frequency of the hazard is unknown. Therefore, the Safety Board believes that an observational program should be developed and implemented in the Colorado Springs area to detail and define these possible aviation hazards before the next season of such weather. The results obtained in Colorado Springs should be used to determine whether further study on a regional scale is required.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Develop and implement a meteorological program to observe, document, and analyze potential meteorological aircraft hazards in the area of Colorado Springs, Colorado, with a focus on the approach and departure paths of the Colorado Springs Municipal Airport. This program should be made operational by the Winter of 1992. (Class II, Priority Action) (A-92-57).

> Develop a broader meteorological aircraft hazard program to include other airports in or near mountainous terrain, based on the results obtained in the Colorado Springs, Colorado, area. (Class II, Priority Action) (A-92-58).

Acting Chairman COUGHLIN, and Members LAUBER, KOLSTAD, HART, and HAMMERSCHMIDT adopted these recommendations.



By: Carl W. Vogt
Chairman