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CHAPTER 21 – MICROBURST

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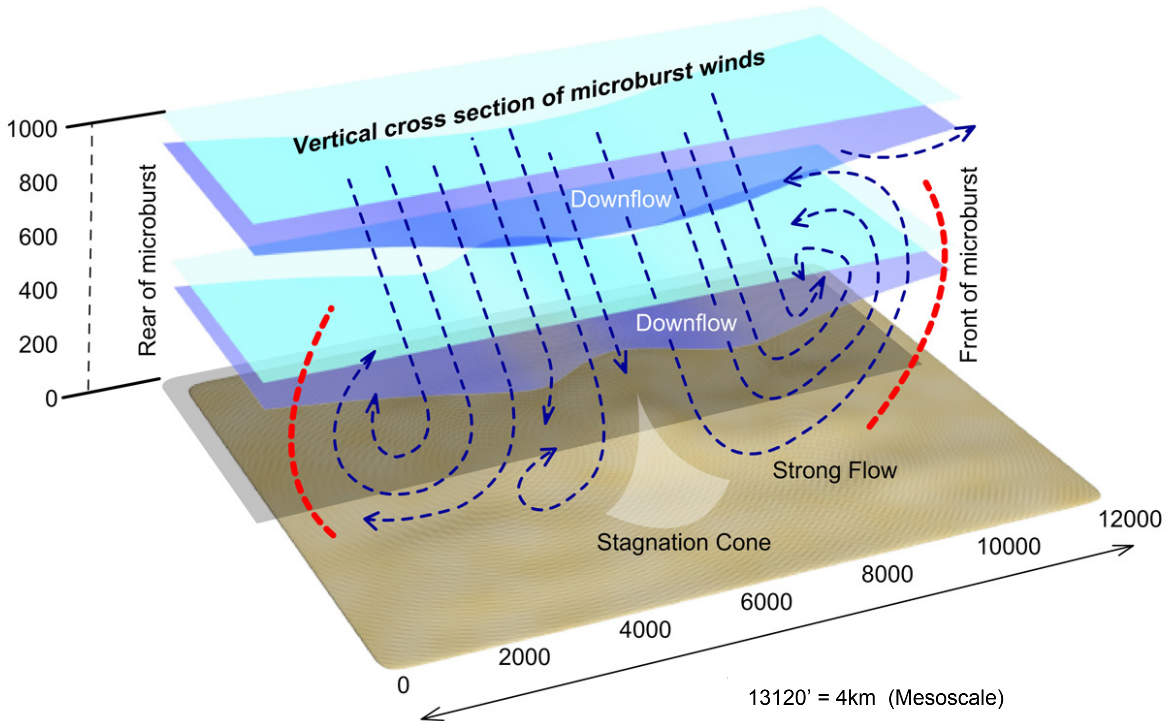
MICOBURST

OVERVIEW

A microburst is the downburst of cold dense air (dry or wet) from the base of a convective cloud (Cb, TCu, Cu, Ac).

A typical Microburst has the Following Dimensions:

- Horizontal distance less than 4km
- Life time of 5 - 15 minutes
- Wind speeds of 146 kts have been recorded
- Horizontal windshear of 50 kts
- Vertical depth of outflow of 1,000 to 4,000 ft.



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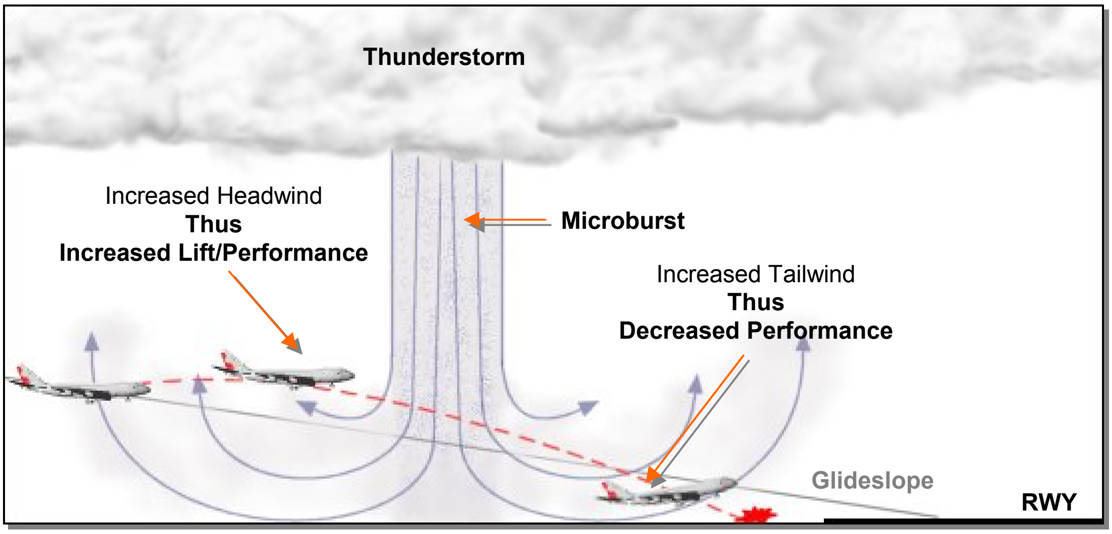
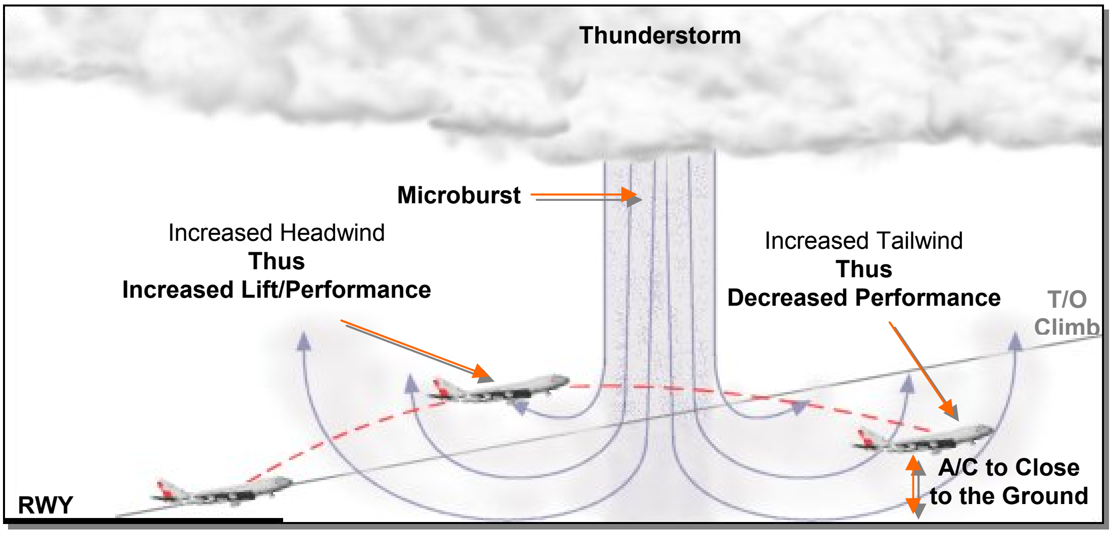
The following two diagrams show the effect on an aircraft flying through a microburst on an approach and on departure.

Note:

- Initial improved performance
- Decreasing headwind
- Strong down-draught
- A strong tailwind.



Effect on Microburst on an Approach



Effect on Microburst on Take-off

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Keeping in mind the previous two diagrams; note the changes in wind direction as each of the following aircraft flew through a microburst.

Micro burst caused Faro DC-10 crash

Stormy weather and gusty crosswinds appeared to be a major factor in the Martinair McDonnell Douglas DC-10 (PH-MBH) crash at Faro, Portugal on 21 December, 1992.

Martinair president Martin Schröder says the crash was caused by a micro burst.

On landing, the right wingtip hit the ground, causing the aircraft to leave the runway, break into three sections and burn. The Dutch charter flight was carrying a crew of 13 and 327 passengers. The deaths resulting from the crash are reported at 54, with others badly injured. Both pilots survived.

The aircraft, a DC-10-30F (Convertible) built in 1975, was on its second approach to land when it crashed, its crew having abandoned the first attempt because of a storm. Weather in the region was reported as showing a significant development of cumulonimbus clouds and electrical storms, with general conditions at the airport at around 08.30 (local time) reported as wind from the southwest at 40km/h (21kt), gusting to 60km/h in heavy rain, with fair visibility.

There was no emergency call from the crew or other indication of problems. The flight-data recorder and cockpit-voice recorder have been recovered. □

A ROW HAS blown up between the Portuguese and Netherlands air-safety authorities over the crash in December 1992 of a Martinair McDonnell Douglas DC-10 at Faro Airport, Portugal.

The aircraft landed heavily, after flying through at least two microbursts, on a runway described by local authorities as "flooded" The right main landing-gear fractured and a fire broke out after the right-wing tanks ruptured.

at the time. The change of weather occurred as the aircraft was on short finals, at 150ft (45m), when the windspeed and direction changed abruptly from 150°/20kt (37km/h) to 220°/40kt. "The crew did not expect the existence of windshear phenomena," it says. □

21.c. Two Microburst Related Incidents

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CRASH PROBE FOCUSES ON SEVERE MICROBURST

EDWARD H. PHILLIPS/WASHINGTON

National Transportation Safety Board officials are focusing increasing attention on wind shear and microburst activity that may have caused the crash of a USAir DC-9 at Charlotte, N.C., on July 2.

The Douglas DC-9-31 was destroyed in the crash and 37 of the 57 persons on board were killed.

At an NTSB public hearing in Charlotte last week, flight crewmembers Capt. Michael R. Greenlee and First Officer James Hayes testified that the wind shear encountered during the final segment of the instrument approach to Runway 18R exceeded any they had previously experienced or were trained to cope with. The aircraft's Honeywell Wind Shear Detection System failed to alert the crew.

Greenlee told safety board officials that both he and Hayes saw a thunderstorm cell about 2 mi. south of the airport as the DC-9 entered the downwind leg for landing. Airborne radar showed two cells, however, including a smaller one east of the airport (*AW&ST* July 11, p. 24).

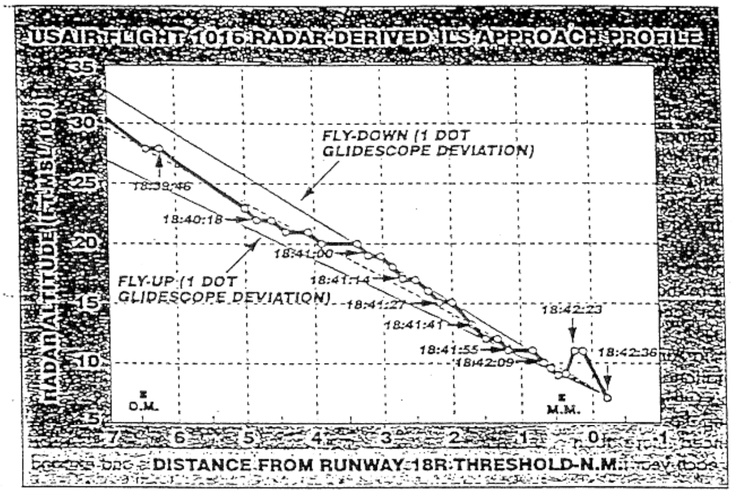
Because of the second cell and its proximity to the approach end of Runway 18R, Greenlee told Hayes they would abandon the approach to the west if necessary. About 2 mi. from the runway, rainfall began. Two other aircraft landing ahead of USAir 1016 reported "smooth" approaches to 18R.

DURING A FREQUENCY change from approach control to the Charlotte control tower, the crew missed a crucial wind shear warning affecting the entire airport, the NTSB said. "Rain intensity increased abruptly and dramatically," Greenlee said. At about 1,200 ft. msl., airspeed increased 10 kt. and "we lost all [forward] visibility." He called for a go-around.

"A few seconds after that, we just dropped," Greenlee said.

As the go-around began, airspeed was 147 kt. and the DC-9 was nearly 200 ft. above the runway elevation. Data from the flight recorder indicates that engine power increased significantly about 21 sec. before the initial sound of impact was recorded by the cockpit voice recorder.

AS PLANNED BY both pilots, Hayes began a climbing, right turn. The aircraft had risen about 150 ft. when airspeed began to decrease. Flaps were retracted to 15 deg. from 40 deg., and engine pressure ratio (EPR) had stabilized at 1.82 and continued for 8 sec., the safety board said.



Pitch and roll attitudes had increased to 15 deg. nose up and 17 deg. right bank, respectively. As the DC-9 lost airspeed, Greenlee told Hayes to lower the nose. "Down, push it down!" he said. Greenlee immediately called for "Firewall power!" and put his right hand upon Haye's left hand in an attempt to push the power levers farther forward. He also took control of the aircraft.

The stickshaker activated. Pitch attitude decreased to 5 deg. nose down as the aircraft transitioned from the climbing right turn to a descent. Altitude above the runway elevation was about 350 ft. and decreasing. The ground proximity warning system sounded as the DC-9 descended toward the ground.

Seven seconds before the initial impact, airspeed had decreased to 116 kt. and pitch attitude was 2 deg. nose up, according to NTSB investigators. "I attempted to keep the wings level and maintain aircraft control," Greenlee said, as airspeed decayed further and the DC-9 sank below treetop level.

Less than 1 sec. before the aircraft struck the ground, EPR began to increase above 1.82. Pitch attitude was about 5 deg. nose up, bank angle was 4 deg. right wing down and airspeed was 142 kt. The first of three successive impacts occurred at 6:42:35.6, 749 ft. msl. and 2,170 ft. southwest of Runway 18R's threshold. The aircraft's impact heading was 214 deg. magnetic.

Based upon data derived from a meteorological model used for simulating clouds and microscale phenomena, USAir 1016 probably encountered a strong microburst early in its lifecycle and "during its period of greatest intensity," Fred H. Proctor said. He is a weather scientist with the Flight Dynamics and Control Div., NASA/Langley Research Center, Hampton, Va. The microburst may have formed and dissipated in only about 40 sec. before moving slowly to the northwest.

Proctor described the model phenomena as the "most intense microburst that we have numerically simulated from any case study to date." He estimates the microburst was spawned within a thunderstorm with tops less than 30,000 ft., and would have been associated with moderate to heavy rainfall.

"I DO NOT RECALL ever seeing rain fall that heavily," Greenlee told NTSB investigators.

Results from the three-dimensional simulation "show favorable corroboration" with data from the DC-9's flight recorder, according to Proctor. The simulation produced "an unusually intense microburst characterized by a large velocity change over a relatively small scale," he said. The burst was "driven by a small diameter, but high reflectivity, rain shaft about 3.5 km. (2.2 mi.) in diameter," according to Proctor.

Time	Wind
6.39.40	110° 19 kts
6.40.56	110° 21 kts
6.41.05	190° 13 kts
6.42.03	110° 21 kts

21.d. Microburst Related Accident Report

VISUAL DETECTION OF POSSIBLE MICROBURSTS

a) Virga

b) Lowering Cloud Base

c) First rainfall

d) Bulbous Cloud Base (mamatus)

e) A ring of dust on the ground or waves on the sea

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