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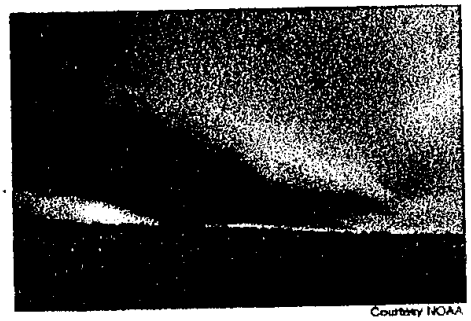
Scientists seek ways to avoid turbulence

Wednesday, June 9, 1999

Research in Colorado employing airborne Doppler radar could soon provide commercial airlines with a way to avoid turbulent weather while in flight.



Courtesy NOAA

Convective turbulence associated with storms and clouds costs commercial airlines $100 million each year.

Sponsored by NASA's Aviation Safety Program, the National Center for Atmospheric Research is guiding the study using three specially equipped airplanes. These planes will fly into and around storms between Fort Collins, Colo., and Cheyenne, Wyo., between June 2 and June 18.

The goal is to find out whether it is possible to detect convective turbulence using airborne Doppler radar. Convective turbulence may be detected by weather radar that bounces radio waves off large raindrops, snowflakes and hailstones.

"Airborne Doppler radar is a promising tool for detecting convective turbulence," said NCAR lead atmospheric scientist on the project Larry Cornman. "If everything goes well, it could be ready for use by U.S. airlines within two years."

Convective turbulence is caused by heat and is associated with storms and clouds. As air heats up, it rises, oscillates and becomes chaotic. This chaotic air is known as convective turbulence.

It is estimated that all kinds of turbulence, including convective turbulence, cost the U.S. airline industry more than $100 million each year due to damaged airplanes, disrupted service and injuries to passengers and crew. Up to 60 percent of aircraft encounters with turbulence are due to turbulence associated with thunderstorms.

Of the three planes flying in the experiment, one is an armored T-28 storm penetration aircraft operated by the South Dakota School of Mines Technology. This plane is outfitted to fly directly into thunderstorms and can withstand the conditions one finds inside a thunderhead: hail, turbulence and lightning.

The other two planes are a Convair 580 and a Sabreliner, owned and operated by AlliedSignal and Rockwell-Collins. Both planes are equipped with onboard radar systems that were developed by the companies that own the plane. Both radar systems are in operation on U.S. airplanes but are only being used to detect low altitude weather problems.

Bob Sharman, another NCAR scientist working on the project, explained that the general format of the experiment is to send the planes into a turbulent area with the aim of measuring the turbulence and taking radar images at the same time.

The T-28 pilot will fly his plane ahead into a storm cloud and report to the other two aircraft what his plane is experiencing, while at the same time gathering both atmospheric and airplane-response data.

Meanwhile the other two planes will collect radar images of the area of turbulence in which the T-28 is flying. If the conditions are not too severe, the T-28 pilot will instruct the pilots of the less sturdy Sabreliner and Convair 580 to follow him into the storm to experience and gather data on the turbulence. Otherwise, he will tell them to veer off out of the area.

Operations in the air are supplemented by operations on the ground. Colorado State University will operate two land-based Doppler radar units to locate storms and verify aircraft data. CSU researchers and their National Science Foundation-sponsored summer students will gather the ground radar data from sites near Greeley and the Pawnee National Grassland. Sounding balloons launched from NCAR's mobile weather van will measure temperature, pressure, humidity and winds. The National Science Foundation is NCAR's primary sponsor.

According to Bob Sharman, the weather has not been cooperative so far. On Saturday, however, the flying team made several penetrations.

The data gathered from these flights will be analyzed over the next year. Scientists are looking for a correlation between the radar images captured of the turbulent areas and what the planes experienced while within them. They hope that the results will allow them to calibrate the airborne Doppler radar on existing commercial airplanes to detect upper level convective turbulence more accurately, and thereby give pilots an opportunity to find a better route.

"Pilots always have to fly through some clouds," explains Sharman. "The question is what is the best part of the cloud to fly through."

NCAR is managed by the University Corporation for Atmospheric Research, a consortium of more than 60 universities offering Ph.D.s in atmospheric and related sciences.

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