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**Minutia**

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**What Causes Airplane Turbulence?**

By Esther Schultz

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Most of us who have traveled by airplane have experienced turbulence. It is always disconcerting when a plane starts to bounce around, particularly when you look out of the window and can't see anything that might be causing the bumps. So what is it that causes airplane turbulence?

In short, turbulence is caused by the irregular movement of air. As different streams or pressures of air collide they create movement or waves. When an airplane flies through these waves it bounces around. It is like two rivers meeting causing currents and waves. A boat traveling over those meeting rivers would bounce on the water. Airplane turbulence is simply the invisible version of the same. But what causes the irregular air motion?

Close to the surface of the earth, turbulence can be caused by simple winds. It can also occur over mountain ranges where strong winds blow across the mountains. The high ground disturbs the horizontal flow of air above it causing turbulence to aircraft flying through that disturbed air.

The daytime heat can cause air movement resulting in turbulence. The sun causes the lower air to heat and rise, causing convective mixing of the air. That rising and mixing of the air causes movement resulting in turbulence for aircraft traveling through.

When an airplane flies into clouds there is likely to be some turbulence, but not all clouds will create the same level of movement. There are greater updrafts and downdrafts in large, well-defined clouds like cumulonimbus or thunderstorm clouds creating more severe turbulence for planes passing through. On the other hand, layer clouds (stratus) or cumulus have lesser updrafts and downdrafts creating more gentle turbulence.

Within thunderstorms there are strong updrafts and downdrafts of air which frequently cause turbulence for airplanes passing through them. This turbulence is often made worse by other characteristics of thunderstorms such

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as heavy rain and lightning. Below thunderstorms there can be downdrafts of air which can cause intense turbulence. Turbulence can also be experienced around the edge of a thunderstorm. Some thunderstorms move slower than the winds at higher levels. As a result, the surrounding airflow is diverted around the storm causing turbulent movement of air and a bumpy ride for passing airplanes.

While thunderstorms can cause significant airplane turbulence, in reality it is unlikely that many of us will experience this type of turbulence. Thunderstorms are easily avoided by airplanes and civil air legislation requires pilots to remain at least 20 miles from them.

Clear air turbulence is slightly more problematic than other types of turbulence. As its name suggests, it occurs in clear air often where no clouds are visible. It cannot always be predicted so pilots often have no forewarning and it cannot be detected by aircraft radars.

Clear air turbulence typically occurs at high altitudes of 20,000 feet or above. It is usually caused by changes in vertical wind direction. Generally it occurs close to a jet stream, which is a rapidly moving air current. At the core of the jet stream the winds travel at up to 250 mph, but the air around the edge of the jet stream moves at a far slower speed, often as slow as 50 mph. Where the fast moving winds rub against the slow moving winds, turbulent disturbances occur. These disturbances can cause variations in the lift produced by an airplane's wings causing it to bounce.

Clear air turbulence can sometimes produce the phenomenon referred to as "air pockets". An air pocket is a downward air current that causes an airplane to suffer a sudden decrease in altitude. For passengers on board, it might feel as though the plane is falling hundreds of feet. In reality it is unlikely to have dropped more than 20 feet.

It is always worth remembering, though, that while turbulence can be uncomfortable, it is not dangerous. Pilots are kept well informed about areas of turbulence by weather reports and air traffic control so that they can be avoided, and aircraft are built to withstand what Mother Nature can throw at us. As long as your seatbelt is securely fastened no harm will come to you.

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