



Smoother Rides Through Better Turbulence Forecasting

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DTN has devoted years of research with some of the top scientists in the aviation weather community to arrive at the future of turbulence forecasting, vastly improving awareness of adverse weather for pilots, flight operations managers, and flight planners.

DTN^o



These forecasts are part of a larger suite of Aviation Flight Hazards products. They are designed to bring precision and accuracy to turbulence forecasting, and to improve operational safety and costs due to smarter routing.

This advanced offering provides higher-resolution, more frequently updated forecasts than possible with other currently available technology. This information can be easily integrated into flight planning systems to allow for flight plan optimization, used in flight following by aircraft dispatchers, and finally as a display in tablet form to be used by pilots, allowing a common weather view for all aviation stakeholders.

Despite advances in weather prediction and modeling, commercial airlines continue to experience unexpected turbulence that presents a hazard to passengers and crew. Turbulence encounters account for more than 70 percent of all weather-related incidents. While meteorologists can show skill when

it comes to forecasting certain types of turbulence, other more subtle causes of turbulence are much more challenging, and can lead to errors ranging from over-forecasting the event to missing it entirely.

Turbulence or rough air can be subdivided into visible and invisible causes. Clouds, especially thunderstorms, create turbulence of varying severity. Thunder clouds, or cumulonimbus clouds, are filled with parcels of air moving up and down at great speeds and often contain ice crystals as well as rain drops. These particles can be seen by the aircraft's radar, enabling the flight crew to avoid the storms and hence the turbulence. Other causes include thermals, as heat from the sun makes warm air masses rise and cold ones sink.

Thunderstorm Turbulence

Turbulence associated within and in the vicinity of thunderstorms or cumulonimbus clouds. A cumulonimbus cloud hanging with protuberances is usually indicative of severe turbulence.

Clear Air Turbulence

Clear Air Turbulence or CAT is the most treacherous kind of turbulence because it is invisible (occurs in clear air), can occur without warning, and at any time during flight. CAT is caused by air masses moving at different speeds, and as a result CAT is most encountered in and around the Jet Stream where the troposphere and the tropopause meet.



\$150,000

Estimated cost of diversions due to turbulence (depending on airline and number of passengers involved)¹

>\$30,000

Estimated cost of an unscheduled inspection and a day of service as a result of a turbulence incident for an airline¹

\$9-11 Million per year

Workers compensation claims, lost work time, medical expenses, and additional expenses (such as travel and overtime) to fulfill the schedule variances created by the unavailability of the injured flight attendant¹

\$1 Billion per year

Total estimated annual costs for delays and cancellations associated with turbulence²

1. Lindsey, C.G. (2000). A Baseline of Turbulence Impacts on Commercial Air Carrier Operations. Report No. NWRA-CR-00-R210. Prepared for Honeywell Commercial Electronics Systems by Northwest Research Associates, Bellevue, WA.
2. Triplett, W. (2005, March). Air and Space Magazine. Retrieved from Air and Space Smithsonian: <http://www.airspacemag.com/flight-today/the-calculators-of-calm-7629296/?page=2>