

# The national transportation safety board

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According to the National Transportation Safety Board safety studies, “ The most common weather phenomena for fatal accidents were low cloud ceilings, fog, rain, and snow; nonfatal accidents, on the other hand, were dominated by accidents attributed to unfavorable wind. ” (ANTS, 2005)

Turbulence is defined as “ irregular motion of the atmosphere, as that indicated by gusts and lulls in the wind. ” (Dictionary. Com, n. D. ) This particular phenomenon of nature was able to claim an average of 36 injuries per year, between 2002 and 2013 (Federal Aviation Administration, 2014).

This is a very DOD number, specifically when compared to the more than 800 million people that fly every day (United States Department of Transportation, 2013). While the airlines and all people involved are sure to want that number to be zero, things do happen. According to the Federal Aviation Administration (FAA), the best way for a passenger to avoid injury, caused by turbulence, is “ by keeping their seatbelt buckled at all times. ” (Federal Aviation Administration, 2014) Turbulence can be as mild as barely noticeable to temporary loss of control of the aircraft. All these levels of intensity, and each in between, can cause bodily injury. Reduced visibility is another natural weather occurrence that can severely affect aviation operations.

Reduced visibility can be caused by different weather types; I. E. Low ceiling, smoke, fog, thunderstorms, and even volcanic ash. Cloud ceiling is the meteorological term used for the vertical visibility, or “ the observable distance between the surface and the bottom of the lowest cloud layer of a broken or overcast sky.

(Means, 2014) Not only does the low ceiling endanger aircraft, but it also creates the inability for an airport to function at maximum capacity by laying or canceling flights, and in turn, costing the airlines money due to lost flights. Smoke does not only create pollution, but it can also cause incidents or delays by reducing visibility. Smoke can be carried by the winds, as can the flames that create the smoke. For example, on August 6, 2010, “ as many as 140 flights were delayed” in Moscow because of smoke from forest and peat-bog fires (Catalogs & Slovakian, 2010). This same scenario can be found all over the world, with different amounts of delays and damage, but the story is the same.

To some, volcanic ash may fall into the same category as smoke. However, “ volcanic ash is pulverize rock...

Composed largely of materials with a melting temperature below the operating temperature of a jet engine at cruise altitude. ” (Sales, n. D. ) With that particular explanation, it means that the aircraft would be able to continue its flight over the eruption.

However, anything coming in or going out of the area, of the airport in question, that is threatened with the volcanic ash would either be rerouted, or continue to be grounded, for safety. In 2010, the volcano Joviallyfiskull in Iceland, erupted. This phenomenon grounded hundreds of aircraft, and squired even more to be diverted. The winds were able to carry the ash across multiple European countries, and across the ocean, even as far as Canada. This particular eruption affected flights all over the world (BBC News, 2010). Fog is simply defined as “ a cloudlike mass or layer of minute

water droplets or ice crystals near the surface of the earth, appreciably reducing visibility. ” (Dictionary-corn) Fog is one of the most common reasons for weather delay, especially at the San Francisco International Airport in California (Archival, 2014).

Most people that are interested in the aviation field are well aware of the deadliest crash in aviation history, Tenerife in the Canary Islands. On March 27, 1977, a series of unfortunate events ended up causing the lives of 583 people to be lost. By the time either flight crew saw the other plane in the fog, it was too late to avert the disaster, which arose out of a series of miscommunication among both flight crews and the control tower. ” (Crock, 2006) As the FAA points out, there are different types of thunderstorms that the aviation world must be aware of. They may be classified as: Single Cell, Cluster (Multi Cell), Squall Line, or Supercell. Federal Aviation Administration, 2013, p. 2) Thunderstorms present many dangers such as heavy precipitation, lightning, winds, turbulence, and sometimes hail. Depending on the classification and severity of the storm, maintenance may be temporarily stopped, and flights delayed.

Heavy precipitation is a major cause of reduced visibility. While aircraft do have windshield wipers, sometimes the rain can be too intense, which would require the aircraft to “ fly by radar. ” It is unlikely that hail would create a reduced visibility condition, but it can cause structural damage. The structural damage, depending on the severity, will increase maintenance and can delay flights. Flights can also be delayed, pending the size of the hail, because of the potential for engine ingestion.

Microbursts are yet another weather phenomenon that hinders aviation operations. A microburst is a downturn of cold air that rockets from a thunderstorm with a size of up to KM across and can last as long as seven minutes. These bursts of wind, also known as wind shear, have caused multiple aircraft incidents to include the Eastern Airlines Flight 66 crash of 1975, which claimed the lives of 113 people (Aviation Safety Network, 1975). During final approach the aircraft encountered major wind shear that forced it into an approach tower during final landing maneuvers. This accident was a major contributor to the FAA reassessing their outlook on weather and its effects on air travel. The FAA responded with the development of the Low Level Wind Shear Alert System, LAWS, later upgraded to the current LAWS- RSI system (Pendleton, 2000). Tornadoes occur when steady state thunderstorms are present and can cause severe damage to aircraft on the ground. This became evident in April of 2011 when a tornado struck the Lambert-SST.

Louis International Airport and caused extensive damage to the airport and numerous injuries (Freedman, 2012). Unlike most other weather phenomenon tornadoes are rather difficult or nearly impossible to detect in advance. In most cases the aviation industry simply avoids or closely monitors severe thunderstorm areas and warns pilots when the danger is present or imminent. Lightning, especially when flying at night, can cause temporary blindness.

“ Looking outside the cockpit can increase danger of temporary blindness from lightning. ” (Brandon, n. D. ) Experienced pilots recommend not cooking

outside of the aircraft, but keeping eyes on the instruments. If a person's eyes have adjusted to the darkness, the sudden flash of light causes the momentary blindness, sort of like having a picture taken and the flash cause's spots. One example of aviation manufacturers attempting to counteract the blinding effect, is the thunderstorm lighting setting in the cockpit.

Lightning also has the capability to puncture an aircraft and damage electronic equipment. According to the FAA lightning has been suspected of causing explosions by igniting fuel vapors, but rarely causes serious accidents. When lightning is close enough, it can also disrupt radio communications and induce magnetic compass errors, permanently. These structural, electrical, and magnetic damages can take many man hours to repair, in conjunction with the monetary loss for the time that the aircraft is out of commission. While all of the previously mentioned weather conditions can happen at any time, there are also seasonal hazards. Snow and ice are more likely to happen in the winter months. Keeping in mind, it depends on the part of the world flying to and from, and that seasons are polar opposites pending on which hemisphere. There are certain aircraft that are specifically designed to takeoff, land, and fly in snowy atmospheres, but not all.

There are specifically designed aircraft that are made to be flown in bad weather, and major snow areas, especially the C-13TH. The Lockheed C-13TH is a specially designed aircraft equipped with skis, for use in the Arctic and Antarctic (Hailed, 1978). However, the majority of passenger aircraft can operate normally with small amounts of snow, however, blizzards that bring

massive amounts can cancel flights and even shut airports down. Blizzards have left passengers stranded inside of airports for days, such as the Northeast blizzard, in January of 2014.

More than 2,000 U. S. Flights were cancelled or delayed to and from Northeast airports, due to “ zero visibility. ” (Davies, 2014) Icing is a major threat to aviation operations and safety, and can cause many problems, not just visibility. “ Airframe Icing has been on the FAA’s Most Wanted List of safety improvements since 1997. ” (Wiener, 2011) Icing occurs mainly in flight, in clouds that contain water droplets that are super cooled, during the winter season. According to the National Transportation Safety Board (NTSB) there have been many accidents that involved lives lost and aircraft crashes, due to icing (NTSB, 2005).

Mechanical icing leads to loss of power because of impaired performance with ice in the fuel cells or air intakes. Structural icing adds weight to the aircraft, creates false readings on the instruments, and makes the aircraft harder to control. The most common icing problem is the leading edge of the wings, which helps with controlling the aircraft. Another snow and icing problem in the aviation field is the aircraft that are sitting on the ground. Aircraft maintainers that work in areas that are prone to snow and ice are probably trained on operation of De-icing equipment. There are a plethora of types of equipment that can be used to apply deicing fluid to the aircraft, but the environmental concern is the fluids.

The deicing fluids are used in general aviation, as well as commercial.

Propylene Glycol Industrial Grade (PIG) is the most common base fluid for

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deicing fluids. It is also the preferred base because of its low freezing point, low toxicity, biodegradability, ease of handling, low corrosive nature to metals, and low flammability (DOD, 2014).

Ice and snow has the ability to impact aviation operations such as diminishing terminal operations by reducing the stability of boarding gates, runways and taxiways. Whether it be slush or standing water, all surfaces that are exposed to the environment are susceptible. “ Even a very small amount of ice on a wing surface can increase drag and reduce airplane lift by 25 percent. ” (Sales, n. D.

, p. 4) The aircraft maintainers and baggage handlers also suffer during these times of cold, ice, and slush. They are constantly exposed to the elements, and still must accomplish the job. The aviation industry puts a lot of resources into action to ensure that passenger safety is a priority. There are studies being done, on a daily basis, to assist the industry in alleviating the amount of weather related incidents, delays, and cancellations. Pilots must take the initiative to do what is safe for themselves, their passengers, and the aircraft.

With consistent training, and attention to weather reports for the specific route, incidents can be minimized. The National Weather Service does its best to stay on top of the constant changes in weather, but the pilots need to stay on top of their training as well. The different types of adverse weather affects aviation operations in many different ways. The four main areas affect are safety, comfort, scheduling and efficiency. Safety should be the first priority of all aviation operations. When safety is not made into a



priority, people and assets are put at risk. The comfort of the passengers and crew is imperative. Rough flights caused by bad weather should be avoided, if at all possible.

When depending on the weather, scheduling is very difficult to maintain. Weather can cause delays, and even cancellations, which then require the assigners and carriers to alter their schedules. Weather adversely affects the efficiency of aircraft operations, the facilities that maintain the operations, as well as human resources. Nature is a force that cannot be controlled, but steps are being taken to minimize the damage and delays that weather causes.

In order to combat the adverse effects of weather, the entire aviation industry needs to continue working together. Federal, state, and private agencies are all working together to minimize the adverse effects that weather causes in aviation. Every person that is involved in aviation affects aviation operations, should be trying to help, in one form or another.