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Dust Devil/Whirlwind Accidents & Incidents

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Dust Devil/Whirlwind Accidents & Incidents

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Abstract

This brief report expounds on the dust devil interaction case findings from the ASRS Database, NTSB Aviation Accident Database, and ASN. A full, detailed research effort on the aforementioned cases can be found in the Microsoft Excel document supplementing this report. First, the author of this report offers a glossary of terms and definitions that the reader may need to know. Then, the author analyzes the data regarding dust devil related accidents and incidents and the connection between the behavior of dust devils and the behavior, size, and power of the aircraft involved. Finally, the author formulates safety recommendations on dust devil avoidance and recovery and how this research effort has benefitted him. In the appendix, one will find a series of graphs and a table to help illustrate the extensive data that the author found.
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Glossary

- **Aircraft Owners and Pilots Association (AOPA)**: an independent organization that aims to protect and educate aircraft owners and pilots so that general aviation can prosper and continue to grow in a positive way.

- **National Transportation Safety Board (NTSB)**: a U.S. government agency whose main goal is to find the probable causes for accidents and provide viable safety recommendations.

- **NTSB Aviation Accident Database**: accessible online, a large database of aviation accidents and incidents investigated by the NTSB with full written reports for events as far back as 1962.

- **Aviation Safety Reporting System (ASRS)**: a voluntary reporting system managed by NASA for pilots who wish to truthfully share potentially helpful information about their accidents or incidents, anonymously and without consequence.

- **Aviation Safety Network (ASN)**: a service of the Flight Safety Foundation that aims to provide every professional pilot that has an interest in aviation with the latest and most reliable information on airliner accidents and safety issues.

- **Dust devil/whirlwind (weather phenomenon)**: a vortex or “mini-tornado” of almost any size and any intensity that is formed by rising surface heat, is often self-sustaining, and can be visible with dust, dirt, or debris caught in its rotation.

- **Pilot-in-Command (PIC)**: the final authority of the cockpit and is ultimately responsible for the safety and operation of the aircraft.
NTSB Definitions

- accident: anytime that any person boards an aircraft with the intention of flight between the time they disembark and there is substantial damage to the aircraft or any person suffers death or serious injury.
- incident: any occurrence other than an accident that could affect the safety of operations.
- substantial damage: damage that badly affects structural strength, flight characteristics, or performance of the aircraft and requires a major repair or replacement. This type of damage excludes that which involves landing gear, wheels, tires, flaps, bent aerodynamic fairings, dents and small punctures in aircraft skin, ground damage to propeller blades, or damage to only a single engine (NTSB).

Analyses of Incidents and Accidents

154 cases were reported of accidents and incidents involving dust devils, whirlwinds, or anything suspected to be of the sort. I went through each case that ASRS, NTSB, and ASN had to offer involving the apparently ambiguous weather phenomenon. ASRS had cases that went as far back as 1989, NTSB, 1968, and ASN, 2009. Each case had its own unique details and qualities of dust devils. A number of them, however, created some common threads or patterns in terms of what happened to the aircraft while encountering a dust devil. One common thread was that the aircraft experienced turning tendencies and altitude deviations that the PICs believed were out of their control even with full input of flight controls and power. Another pattern is that nearly every encounter involved the aircraft in the takeoff/climb or approach/landing phase. In some instances, what the pilots experienced was characteristic of microbursts or strong
downdrafts. For example, a fair amount of single engine, fixed wing aircraft experienced a drop or “push down” of the aircraft, preventing it from climbing or maintaining altitude. Others were lifted up then quickly dropped because of the sudden and random updrafts. Some aircraft were even lifted up and dropped although they were stationary on the ground. In any event, most, if not, all of the PICs did everything they could to maintain control of the aircraft, some even crashing under control and inflicting minimal damage to the vehicle. A further analysis of these reports revealed a number of statistics about the pilots, aircraft, and types of dust devils involved.

A majority of the reports involved unseen dust devils (without dust or debris in their rotation) and thereby could imply that what the pilots experienced could not have been dust devils but instead random wind shear. I did, however, include them in this analysis because of their similarities with each other and how the aircraft reacted to the encounters, implicating that they did, in fact, encounter “dustless” dust devils. Of the 154 reports, 89 were incidents, 69, accidents, and only 6, fatal (ASN, ASRS, NTSB). Most of the accidents were labeled as such due to substantial damage to the aircraft. The incidents were labeled as such because of the items excluded in the definition of “substantial damage,” such as landing gear or ground damage to prop strikes. The few fatal accidents often involved single pilots who either were inexperienced and did not utilize proper judgment to make the safest decisions or were unfortunate enough to become victims to mechanical or structural defects that escalated after encountering a dust devil. Upon organization of the data, I noticed that most of the reports involved aircraft that were between 1,500 and 3,500 pounds gross weight in a survey range of 300 to 10,500 and above, suggesting smaller but decently sized aircraft such as the Cessna 172, Piper PA-25, etc. Most of the PICs were either Private Pilot or Commercial Pilot certified and/or Instrument rated, with
only 11 of the reports involving student pilots. Following the Federal Aviation Administration guidelines of turbulence intensities, a majority of the dust devils were classified as severe and only 2 were light. And finally, in terms of pilot experience, more than half of the reports involved those with over 1,000 hours, some even having close to 30,000 hours. The average dust devil/aircraft interaction rate per year is 3.21 from 1968 to 2015 with a maximum of 12 in 1999 and a minimum of 1 in 2003 and 2015 each. I also separately calculated the interaction rate for general aviation (GA) aircraft as opposed to airliners since the reports involved predominantly smaller, more weather-hazard susceptible aircraft. For GA aircraft, the interaction rate at an average of about 24 million annual flight hours was calculated to be 0.01 interactions per 100,000 flight hours (AOPA). This interaction rate means that for one single interaction with a dust devil to take place, 10 million flight hours must be flown. Since this interaction rate is very low, a dust devil interaction and thus, a possible resulting accident or incident is fairly rare. Of course, these rates are based on reported incidents and accidents, not accounting for interactions that haven’t been documented or reported.

Safety Recommendations

From my brief analysis of the reports and events that took place during the encounters with dust devils, I can conclude that dust devils can be insidious and nearly impossible to overcome. Pilots often recommend avoiding flying into or near one at all times if possible, and this advice should be heeded since the majority of our aircraft in this day and age are too small, light, or underpowered. Similar to the treatment of thunderstorms, see and avoid dust devils or
whirlwinds at all costs. A good indication of whirlwind activity is weather reports, such as METAR (METeorological Aerodrome Report) observations or PIREPS (Pilot Reports). If one does encounter a dust devil or whirlwind, however, the best action to take is to maintain as much control of the aircraft as much as possible by being very proactive on the flight controls and utilizing the maximum performance capabilities of the aircraft, including power, and if necessary, crash under control.

Benefit

As a professional pilot myself in training, going through these reports has been a learning and eye-opening experience. This research has made me realize what an interesting and threatening weather phenomenon that dust devils really are. They are, in essence, self-sustaining tornadoes, very alike in mechanics and just as hazardous. I have definitely learned to stay away from dust devils and be more proactive in the avoidance and identification of weather hazards while flying.
Works Cited


NTSB. NTSB Aviation Accident Database. NTSB. Web. 23 May 2015.
# Dust Devil Reports since 1968

## Incidents
- 300-1500 lbs: 28 reports
- 1500-3500 lbs: 91 reports
- 3500-6000 lbs: 16 reports
- 6000-10.5k lbs: 5 reports
- 10.5k & above: 5 reports

## Accidents
- 300-1500 lbs: 59 reports
- 1500-3500 lbs: 32 reports
- 3500-6000 lbs: 4 reports
- 6000-10.5k lbs: 6 reports
- 10.5k & above: 3 reports

## Fatal
- 300-1500 lbs: 1 report
- 1500-3500 lbs: 3 reports
- 3500-6000 lbs: 2 reports
- 6000-10.5k lbs: 0 reports
- 10.5k & above: 1 report
Dust Devil Severities

- Extreme (24)
- Severe (102)
- Moderate (26)
- Light (2)

Pilot Experience

- <50 hrs in type or total (15)
- 50-500 hrs (37)
- 500-1k hrs (16)
- 1k or more hrs (78)
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<thead>
<tr>
<th>PIC Certificates &amp; Ratings</th>
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<td>Private</td>
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<td>8</td>
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