



Weather related occurrences

IASCC 8th-9th September 2010, Cologne

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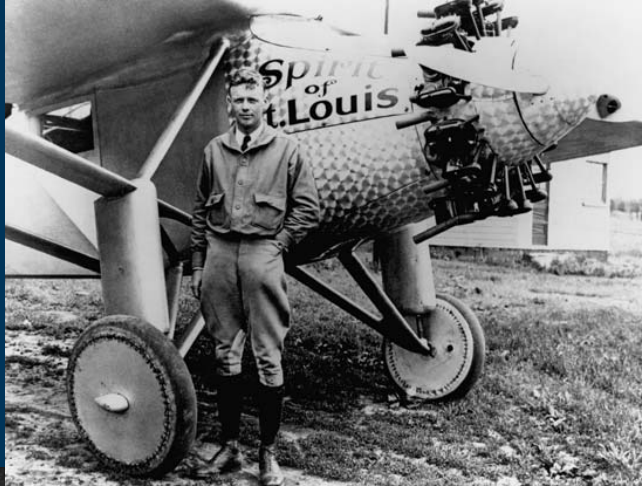
Safety Analysis and Research

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A bit of history





Weather Phenomena

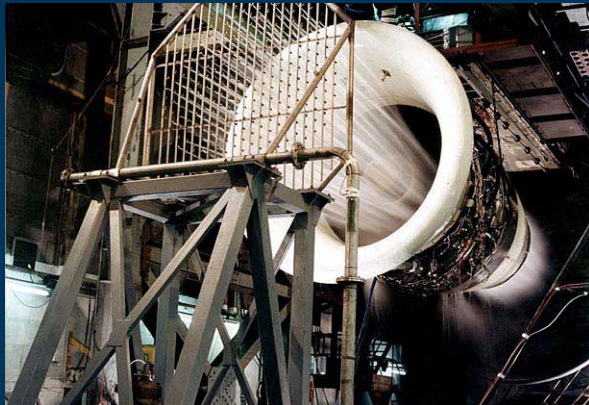
- Ice
- Rain
- Hail
- Turbulence
- Wind/Windshear
- Temperature extremes





Aircraft Certification

- Aircraft are certificated to fly within unfavourable weather conditions.



- Sometimes these limits might be exceeded due to:
 - ✧ Lack of awareness of actual conditions
 - ✧ Lack of awareness of certification limits
 - ✧ Certification specifications may no longer reflect actual weather conditions
 - ✧ Weather observation not being accurate or timely



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Weather hazards and safety

Ice — Accumulation on surfaces, loss of control

Rain — A risk factor in runway excursions, a limit to visibility

Hail — Serious damage to aircraft surfaces and windshield

Turbulence — No detection, may injure crew and passengers

Wind/Windshear — A risk factor in runway excursions, loss of control

Temperature extremes — A factor that may bring an aircraft outside its tested certification limits or assumptions

Visibility obstructions- A factor affecting work load and situational awareness



Weather and safety

- **Fact: encounter with severe weather hazards has led to accidents.**



The accident narratives are provided for the purposes of this presentation only. Reports from AAIB contain the full details and exact circumstances of the occurrences. These reports take precedence over this presentation. Information may have changed as investigation continues.



Ice accretion

October 1994, USA
Aircraft: ATR 42

The aircraft experienced a rapid roll and crashed during an uncontrolled descent. The loss of control was attributed to a sudden and unexpected aileron hinge moment reversal that occurred after a ridge of ice accumulated beyond the de-icing boots.

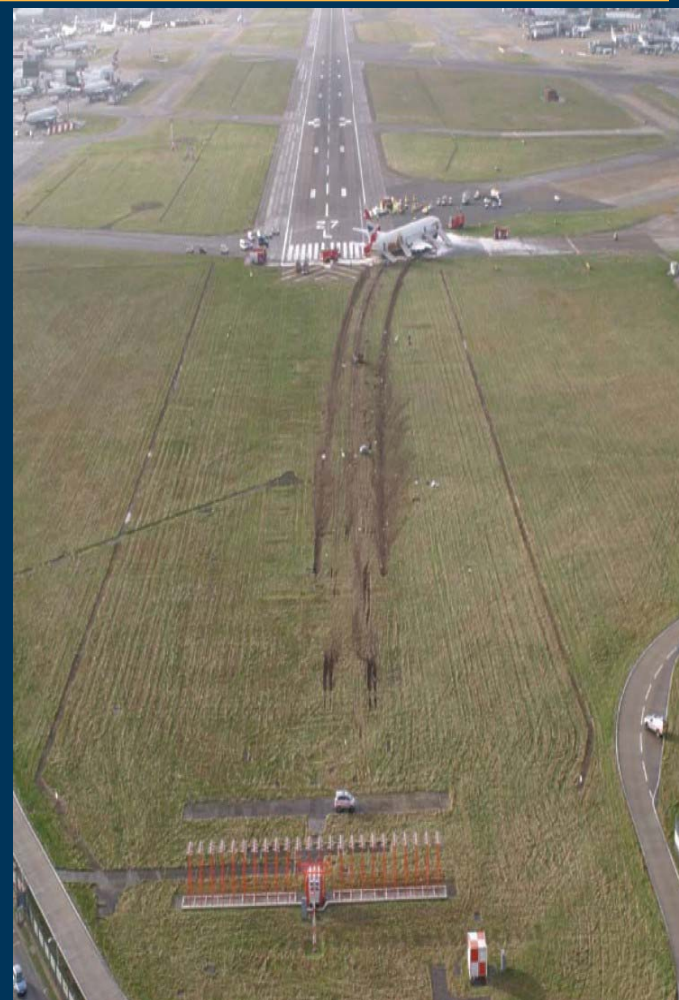




Ice in fuel

**January 2008, UK
Boeing 777-200**

It is suspected ice from within the fuel system restricted the fuel flow which resulted in reduced engine power during the approach. This reduction led to a loss of airspeed and the aircraft touching down some 330m short of the runway. Very low temperatures were encountered during the flight and the descend of the aircraft.





Extreme Wind

**March 2008, Germany
Airbus A320**

During the landing sequence the aircraft wingtip made contact with the runway. The landing took place at gusting winds of 47 knots, as the storm system 'Emma' was passing through Europe.





Windshear

August 2005, Canada Airbus A340-300

During landing in a severe and rapidly changing thunderstorm the aircraft was not able to stop before the end of the runway and overran. The aircraft ended up in a gully and caught fire. The aircraft was destroyed but there were no fatal injuries.





Thunderstorm

**Hong Kong,
1999**

Boeing MD-11

The aircraft made a hard landing during a severe thunderstorm. Its right main gear contacted the runway first. The right engine then impacted the runway, the wing detached and a fire ensued.





Rapid wind shift

March 2009, Japan
Boeing MD-11

During the flare the aircraft encountered strong shifting winds. The aircraft touched down hard and bounced twice. At the second bounce the left wing broke and the wing tank ruptured, a fire erupted as the aircraft veered to the left. The aircraft was destroyed by impact forces and fire. Investigation is ongoing.





Hail

June 2006, Korea, Airbus A321



October 2009, Italy, Airbus A319



August 2003, Switzerland, Boeing 737





Severe Turbulence can kill

**October 1981,
Netherlands
Fokker F28**

During a short flight from Rotterdam to Eindhoven the aircraft entered an area of severe turbulence (possibly tornado). The wing structure broke in midair and the aircraft crashed uncontrolled into the ground.





Turbulence causes many injuries

- The leading cause of injuries!
- On average 20 occurrences of injuries from turbulence every year.
- Turbulence cannot be detected by aircraft radar
- The exact presence of turbulence at high altitudes cannot be detected from the ground
- Pilot reporting of such weather phenomena is not accurate



Other weather occurrences

- Avoidance of storm systems may cause congestion or fuel emergency situations
- Strong crosswinds and tailwinds may make landings particularly challenging
- Intense weather phenomena increase work load and sometimes reduce safety margins in the system.

Examples

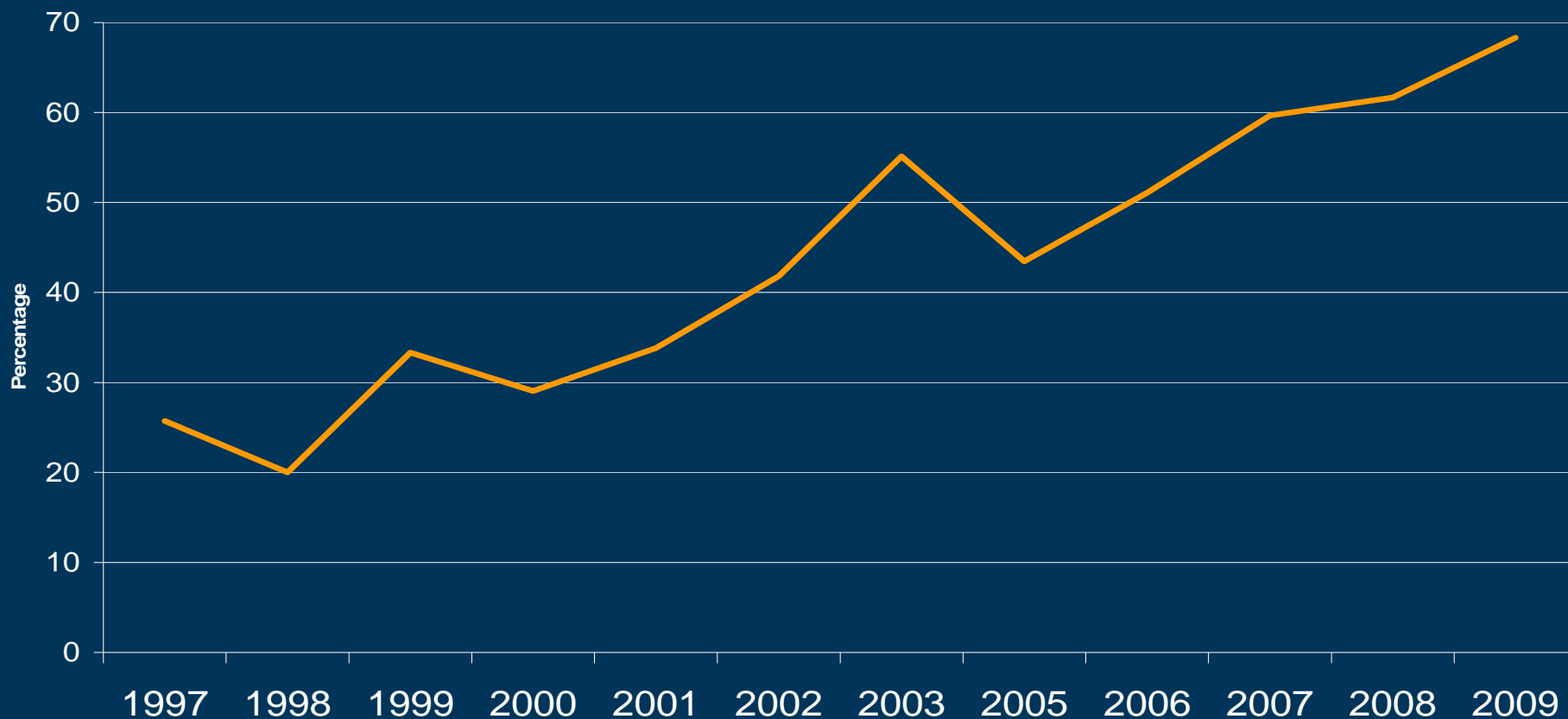
- The combination of a wet/contaminated runway and crosswind increases the risk of a runway side excursion by a factor of 7 for landings and a factor of 9 for take-offs.
- Almost 40% of runway excursions occur on a wet or contaminated runway



Concern is rising!

Increasing proportion of accidents related to weather

(EASA MS registered, accidents, Commercial air transport operations)





What will the future bring?

- Is there any change in weather/climate pattern?
- Are extreme weather conditions to be seen more often?
- What are the new weather related emerging threats?
- What mitigation measures shall the aviation system develop?
- How should the measures be implemented?



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Thank you

