Turbulence

The Bureau of Meteorology (BOM) says turbulence is caused by windshear and thermal instability which, either independently or working together, produce a local random variation in wind velocity.

Turbulence is forecast and reported according to its intensity.

- **Light turbulence** has little effect inside an aircraft, producing only momentary and slight changes in attitude and/or altitude.
- **Moderate turbulence** is forecast by the BOM and results in unsecured objects moving about the aircraft and a noticeable strain on seatbelts.
- **Severe turbulence** is also forecast by the BOM. In severe encounters, passengers and crew may be violently forced against their seatbelts. Pilots may experience momentary loss of control as their aircraft is subjected to large abrupt changes in attitude and/or altitude.
- In **extreme** cases of turbulence, aircraft may suffer structural damage.

Light aircraft are more susceptible to the effects of turbulence when the area of turbulence is similar to the size of the aircraft. Eddies do not need to be particularly turbulent to disrupt the attitude of the aircraft.

TYPES OF TURBULENCE

- **Mechanical turbulence** occurs when air flow is forced to diverge around or converge through gaps in natural barriers like hills, or obstructions like buildings.
- **Orographic turbulence** is caused by the large-scale displacement of airflow by natural structures such as mountains and islands. Mountain waves are likely to form when the following atmospheric conditions are present:
  - the wind flow at around ridge height is nearly perpendicular to the ridge line and at least 25kts
  - the wind speed increases with height
  - there is a stable layer at around ridge height.

As the air is forced over the mountain it will descend in the lee and then oscillate in a series of waves, sometimes for long distances. Mountain wave severe forecasts indicate a downdraft of 600fpm or more.

- **Convective turbulence** associated with clouds is not contained to the cloud mass. Cumulonimbus clouds and towering cumulus clouds should all be considered turbulent, with associated updrafts and downdrafts producing rapid altitude changes.
- **Thermal turbulence** describes **convective turbulence** where no cloud exists. It is commonly experienced from late in the morning to mid-afternoon as the earth's surface heats, with rising parcels of warm air creating a bumpy ride for the aircraft. While you may not see any visual indications of this type of turbulence, dust devils may indicate strong upwinds.

- Turbulence associated with **frontal systems and sea breeze fronts** can be significant and extend several thousand feet. These zones generally slope back and broaden with height, extending the turbulent zone considerably.
- **Low level nocturnal jets** are currents of fast-moving air and occur in South Queensland and the Northern Territory (commonly from Daly Waters to Tennant Creek). They are caused by temperature inversions, appear around dawn and dissipate by late morning. They can induce hazardous windshear.
- **Clear air turbulence** occurs outside of convective cloud, generally at high altitudes. It is some of the most severe turbulence and is impossible to detect, either visually or with conventional radar.
- **Wake turbulence** is created when aerofoils produce lift. This applies to all aircraft, including helicopters. The wake is best described as circulations from the wingtips which become counter rotating vortices behind an aircraft. Wake turbulence behind an aircraft can persist for up to 3 minutes, depending on the atmospheric conditions on the runway. The vortices can drift and generally descend in flight between 100 to 200 feet per nautical mile.

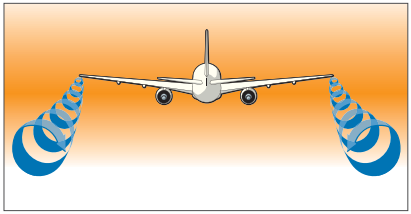

Diagram: Juanita Franzi

PLAN AND PREPARE FOR TURBULENCE

- Check your weather briefing for forecast turbulence
- Exercise extreme caution when operating at non-controlled aerodromes where larger regular public transport or firefighting aircraft and helicopters are arriving and departing
- Be vigilant when flying in the vicinity of high-altitude jet streams
- Remember – you must report encounters with severe turbulence to the appropriate air traffic service provider.