



DOCUMENT  
**GSM-AUS-CPL.024**

DOCUMENT TITLE  
**METEOROLOGY FOR AUSTRALIA**  
**CHAPTER 24 – CLEAR AIR TURBULENCE**

Version 3.0  
November 2014

This is a controlled document. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form, or by any means, electronic, mechanical, photocopying, recording or otherwise, without prior permission, in writing, from the Chief Executive Officer of Flight Training Adelaide.

|                                   |             |
|-----------------------------------|-------------|
| <b>CONTENTS .....</b>             | <b>PAGE</b> |
| <b>CLEAR AIR TURBULENCE .....</b> | <b>3</b>    |
| <b>OVERVIEW .....</b>             | <b>3</b>    |
| <b>CAT CLASSIFICATION .....</b>   | <b>4</b>    |

## CLEAR AIR TURBULENCE

### OVERVIEW

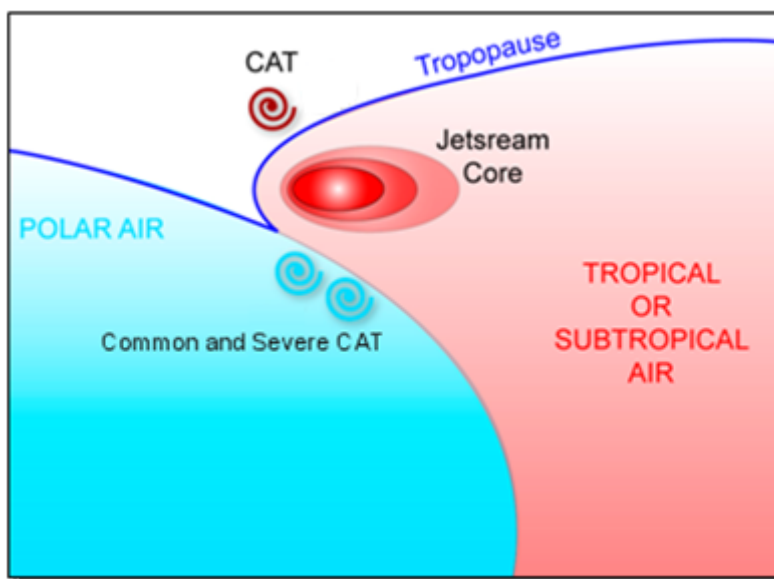
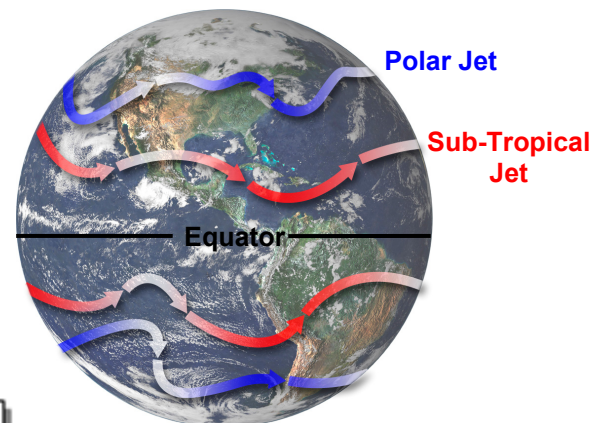
Apart from turbulence at high levels above a vigorous tropical or extra-tropical storm, much of the high level turbulence is found in thin cirrus-type clouds or clear air. Clear Air Turbulence or CAT, has become a common term for this turbulence. CAT in association with fronts was discussed briefly in Chapter 15

The main features of high level CAT are:

- Typically 80 km long, 2,000 ft thick (a climb or descent of 3,000 ft should get an aircraft out of CAT).
- It is more frequent over land than over water.
- It is sometimes associated with mountain waves.
- It is associated with strong horizontal and vertical wind shear.
- It is often, but not always, associated with a jet stream.

A temperature gradient of  $3^{\circ}$  to  $4^{\circ}\text{C}$  per 100 nm is likely to be sufficient to cause a turbulent zone. At any form of inversion (including the tropopause) there is a sudden change in the lapse rate and this is usually associated with vertical windshear.

CAT can be encountered above and below both jets and anywhere the vertical change in wind speed exceeds 5 kts/1,000 ft or the horizontal change exceeds 20 kts/60 nm.



The areas of greatest changes in wind speed are areas of greatest windshear and are therefore areas of greatest CAT. The Polar Jet blows in the warm sector below the tropical (warm) tropopause. At this height the jet stream is above the polar (cold) tropopause. Above the jet stream core there is a reversal in the thermal component which results in a fall in the speed of the upper geostrophic wind.

On both Polar and Sub-Tropical jet streams, the most **frequent** or common area where CAT is, is on the **cold** side and **below** the jet core, however, the most severe is also found on the **cold** side and **below** the jet core.

### CAT CLASSIFICATION

The following turbulence criteria are furnished to assist you in making in-flight evaluation of significant turbulence.

| INTENSITY  | AIRCRAFT REACTION   | REACTION INSIDE AIRCRAFT  |
|--|---|---|
| <b>LIGHT</b><br><br>IAS fluctuates 5 to 15 kts<br><br>< 0.5g at C of G               | Turbulence that momentarily causes slight, erratic changes in altitude and/or attitude (pitch, roll, yaw).<br><br>Report Light Turbulence: or Turbulence that causes slight, rapid and somewhat rhythmic bumpiness without appreciable changes in altitude or attitude. Report as Light Chop. | Occupants may feel a slight strain against seat belts or shoulder straps. Unsecured objects may be displaced slightly. Food service may be conducted and little or no difficulty is encountered in walking. |
| <b>MODERATE</b><br><br>IAS fluctuates 15 to 25 kts<br><br>.5 to 1.0g at C of G       | Turbulence that is similar to Light Turbulence but of greater intensity. Changes in altitude and/or attitude occur but the aircraft remains in positive control at all times. It usually causes variations in indicated airspeed. Report as Moderate  | Occupants feel definite strains against seat belts or shoulder straps. Unsecured objects are dislodged. Food service and walking are difficult.   |
| <b>SEVERE</b><br><br>IAS fluctuates > 25 kts<br><br>> 1.0g at C of G                 | Turbulence that causes large, abrupt changes in altitude and/or attitude. It usually causes large variations in indicated airspeed. Aircraft may be momentarily out of control. Report as Severe Turbulence.  | Occupants are forced violently against seat belts or shoulder straps. Unsecured objects are tossed about. Food service and walking are impossible.  |
| <b>EXTREME</b><br><br>(This category is not used in all countries eg United Kingdom) | Turbulence in which the aircraft is violently tossed about and is practically impossible to control. It may cause structural damage. Report as Extreme Turbulence.  |   |