RAPID DECOMPRESSION AND HYPOXIA IN AIRCRAFT ACCIDENT AND INCIDENT INVESTIGATION
TRANSPORT ACCIDENT INVESTIGATION COMMISSION

Robin Griffiths, Senior Lecturer in Aviation Medicine and TAIC Consultant Adviser
Dr David Powell
Chief Medical Officer Air New Zealand and Visiting Lecturer
University of Otago Medical School
Presentation

- Epidemiology (RG)
- Characteristics (RG)
- Hazards (RG)
- Analysis and reconstruction (RG)
- Airline perspectives (DP)
- Oxygen/ pressurisation equipment (DP)
- Issues (DP and RG)
Epidemiology

- Data limitations
- High profile accidents
- Incidents
- Extreme RDs
- A SRS data (courtesy Mitch Garber, Medical Adviser NTSB)
Recent Incidents of Note

- Local
  - Metroliner
  - Convair
  - Hornet
- Alaska Air
- Payne Stewart
<table>
<thead>
<tr>
<th>Flight Level (ASRS)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>40K +</td>
<td>4%</td>
</tr>
<tr>
<td>30K +</td>
<td>69%</td>
</tr>
<tr>
<td>20K +</td>
<td>23%</td>
</tr>
<tr>
<td>10K +</td>
<td>4%</td>
</tr>
</tbody>
</table>
Maximum Cabin Alt.

- 20K+  6%
- 14K+  44%
- 10K+  42%
- N/S   8%
DECOMPRESSION RATE

- Rapid: 30%
- Moderate: 30%
- Slow: 21%
- Insidious: 9%
CAUSE

- Controller: 32%
- Structural: 21%
- Pressurisation source: 29%
- Operator: 5%
- N/S: 13%
Practical Problems

- Mask/ headset donning & retention
- Communications
- Sick/ invalid Pax
- Horn and wind noise
- ATC and/ or not declaring emergency
- Smoke/ heat from Oxygen Candles
- Control of A/ C and/ or CA
- Emergency procedures
Physical Hazards

- Noise
- Extraction
- Distraction
- Debris
- Cooling & misting
Physiological Hazards

- Hypoxia
- Gas Expansion
- Hypothermia
- Decompression Illness
- Human performance
RD Effects Determined by:

- $V_c$: Cabin Volume
- $A$: Cross sectional area of defect
- $P$: Cabin pressure altitude
- $B$: Flight pressure altitude
Effects

- Vc Rate
- A Rate
- P-B Severity
- P/B Rate
- B Physiological effects
Analysis

RD Time = $0.22 V_c \times \sqrt{\frac{P - B}{B}}$

OR,

RD Time = $t_c \times P_1$

Time Constant $t_c = \frac{V}{A_c}$

Pressure factor $P_1 = \text{Haber Clamann formula}$
Pressure Dependent Factor

\[ P_1 \]

- \( P/B = 1 \)  \( P_1 = 0 \)
- \( P/B = 5 \)  \( P_1 = 2.9 \)
- \( P/B = 10 \)  \( P_1 = 4.1 \)
- \( P/B = 15 \)  \( P_1 = 4.8 \)
- \( P/B = 20 \)  \( P_1 = 5.3 \)
- \( P/B = 25 \)  \( P_1 = 5.7 \)
Any Questions?