Overview

- Australian Situation
- Current Regulations and Policy
- CASA Infant Restraint Project – Phase II (2008-2009)
- Conclusions so far.
- CASA/RMIT Infant Restraint Project – Phase III
Australian situation

- Australian Standard for Child Restraints in Motor Vehicles has required top tether use since 1975.
- CASA requires installation of CRS in accordance with manufacturer’s instructions – installation in aircraft requires top tether use for Australian CRS.
- AS/NZS 1754 does not currently allow for ISOfix or LATCH type attachment.
Australian Aviation Situation

- CAR 251(1) “….. seat belts shall be worn by all crew members and passengers…..”

- CAR 251(3) “CASA may direct that a type of safety harness ….. be worn in place of a seat belt…..”

- CAO 20.16.3 Para.13.2(1) “An infant may be carried in the arms or on the lap of an adult passenger, in a bassinet or in an infant seat…..”

- CAAP 235-2(1) Para 2.1 “An infant carried in the arms of an adult passenger (lap held) must be restrained…..”
CASA Infant Restraint Project – Phase I

- 2006 – 2007
CASA Infant Restraint Project – Phase I

- Assessed the contribution of the top tether strap to the restraint performance of a sample of Australian Automotive child restraints in an airline seat.
CASA Infant Restraint Project – Phase I

- Assessed the performance of a sample of European ISOfix child restraint systems in aircraft seats.
- Universal Child Lower Anchorage – two 6 mm round steel bar loops – 40mm x 25 mm, 280mm lateral centres
CASA Infant Restraint Project – Phase I
CASA Infant Restraint Project – Phase II

- 2008-2009
- This project
  - ISOfix, LATCH, conventional attachment
  - Lower Anchorage loads gathering
  - CRS/Child/Aft adult occupant interaction
- 11 dynamic tests conducted
- Two part program
Child Restraints

- Part 1:
  - CRS seated behind empty seat
  - Child Restraint performance, Child injury levels, Lower Anchorage loads
  - ECE-R44 and AS/NZS 1754 CRS
  - ISOfix, LATCH and lap belt attachment methods
  - Rigid, instrumented, Lower Anchorage design
  - No Top Tethers
P3 Head Injury (FF)

Attachment Method

Belt  LATCH  ISOfix

HIC

Australian #1
Australian #2
European FF
P3 Chest Injury

Chest Acceleration (g)

Attachment Method

Belt  LATCH  ISOfix

Australian #1
Australian #2
European FF
Child Restraints

- Part 2:
  - An adult occupant seated behind a CRS
  - Child Restraint performance, Child injury levels, Adult injury levels, Adult/Child interactions
  - ECE-R44 and AS/NZS 1754 CRS
  - ISOfix, LATCH and lap belt attachment methods
  - In-seat Lower Anchorage design
  - No Top Tethers
P3 Head Injury (FF)

- Belt
- LATCH
- ISOfix

HIC

- Australian #1
- Australian #2
- Australian #2 + 50% HIII
- European FF
- European FF + 50% HIII
Child Restraints

- What did we find?
  - All CRS performed adequately without anti-rotation devices
  - Lower Anchorage peak load of 5.1kN (peak lap belt load 6.5 kN)
  - Lap belt -> LATCH -> ISOfix – reducing excursion
  - Child injury levels reduced with rear occupant
  - Adult injury levels increase with CRS installed?
  - New adult injury measures for certification?
    - Tibia bending
    - Neck Injury
Child Restraints

- How does this compare to a child in his/her own seat ..... or, a lap held child?
Head Acceleration (Fore/aft)

- Kid fwd 16g
- Adult aft 108g

Acceleration (g)

Time (ms)
Adult Head Injury

![Graph showing Adult Head Injury with different attachment methods and their corresponding HIC values.]

- Belt
- LATCH
- ISOfix

Key:
- Australian #2
- European FF
- No CRS
- Lap held

HIC values range from 0 to 2500.
Child in own seat or lap restrained

- Conclusions
  - 3 year old head injury higher than standard adult injury.
  - Practicalities of 3 year old seated position questionable.
  - Measured injury mechanisms for lap held child high.
  - True injury mechanisms of lap held children and nursing adults not measurable and subjective.
  - Crushing injuries applied by nursing occupant weighing 7 times more than infant.
  - Momentary compression force of $\frac{1}{2}$ tonne on 18 month old head.
  - Measured adult injury mechanisms low !?!
Child Restraints

- Where to from here?
  - Infant Restraint Project – Phase III
  - CAAP 235-2(1) revision
  - Airworthiness Bulletin
  - TSO-C127a/SAE8049a revision
  - AS/NZS 1754 revision
  - Flight Safety Australia Article
  - Public Education
Public Education
Questions?

"I don't know about you, but I'm not too wild about these new child restraints."