

Measuring Indirect Emissions of MACs

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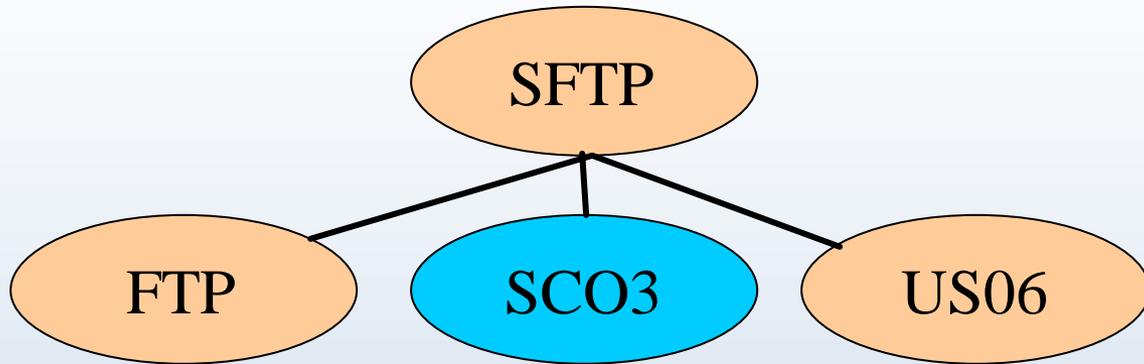
Mobile Air Conditioning Summit 2005

SESSION 3 – RESEARCH ACTIVITIES AND PANEL
DISCUSSION

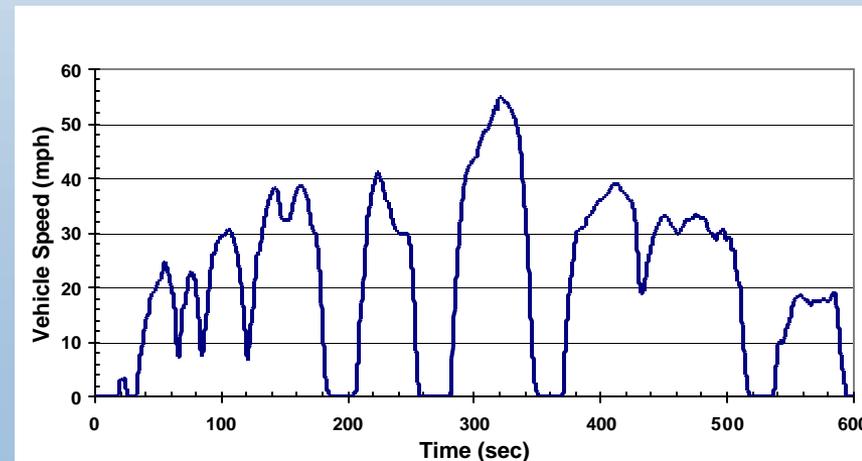
Title: Verification Testing for Direct and Indirect Emissions of Mobile Refrigerants – Developing Best Practices, Standards, and the Road to Implementation



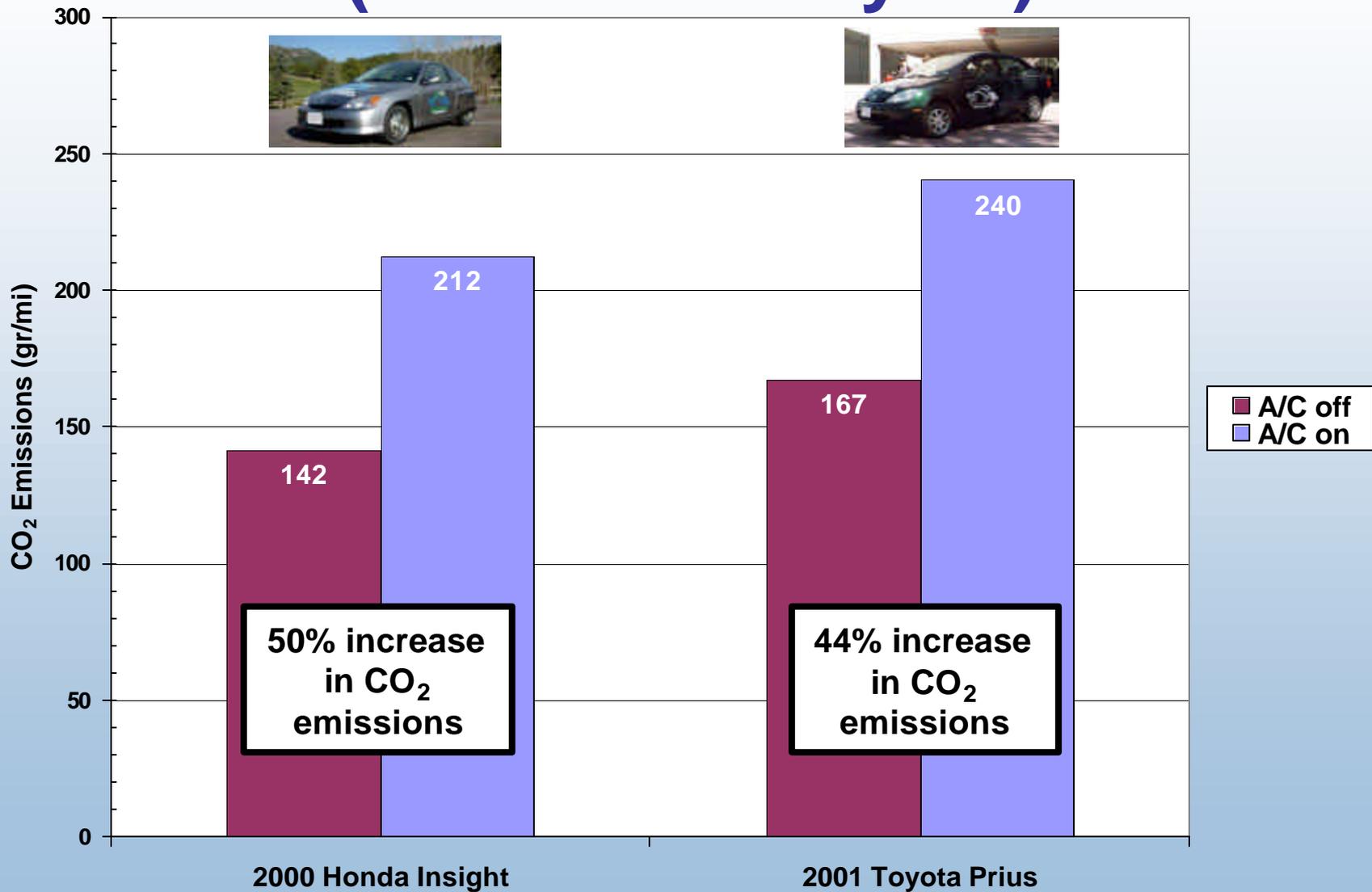
SCO3 Emissions Test



- A/C operating parameters
 - A/C on (max)
 - Airflow to 100% recirc
 - Blower on high
 - Temperature setting at full cool (72°F for automatic systems)
- Environmental conditions
 - Air Temperature = $95 \pm 2^\circ\text{F}$
 - 100 grains of water/pound dry air
 - Radiant heat = $850 \pm 45 \text{ W/m}^2$



Impact of A/C on Hybrid Vehicles (SC03 Drive Cycle)

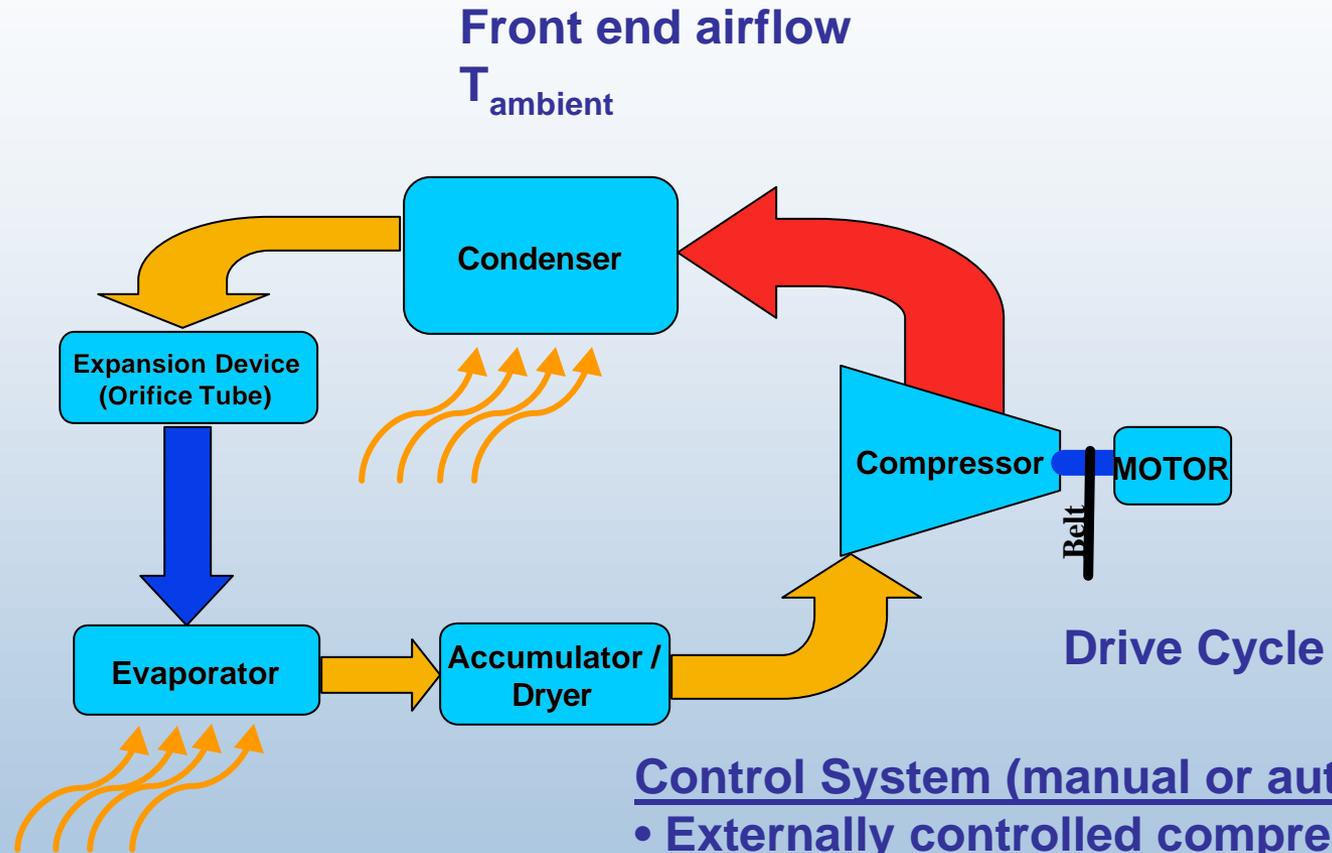


Challenge of Developing a Procedure to Measure Indirect Emissions from MACs

- Reflecting real world impacts of A/C use
 - Human in the control loop
 - Blower probably not on max
 - Temperature lever probably not on full cold
 - A/C may not be on for the full trip (person comfortable, trip length)
 - Use of outside air
 - Vehicles used in a range of climates
- Accounting for emission reduction technologies in advanced systems



Parameters that Impact A/C Load

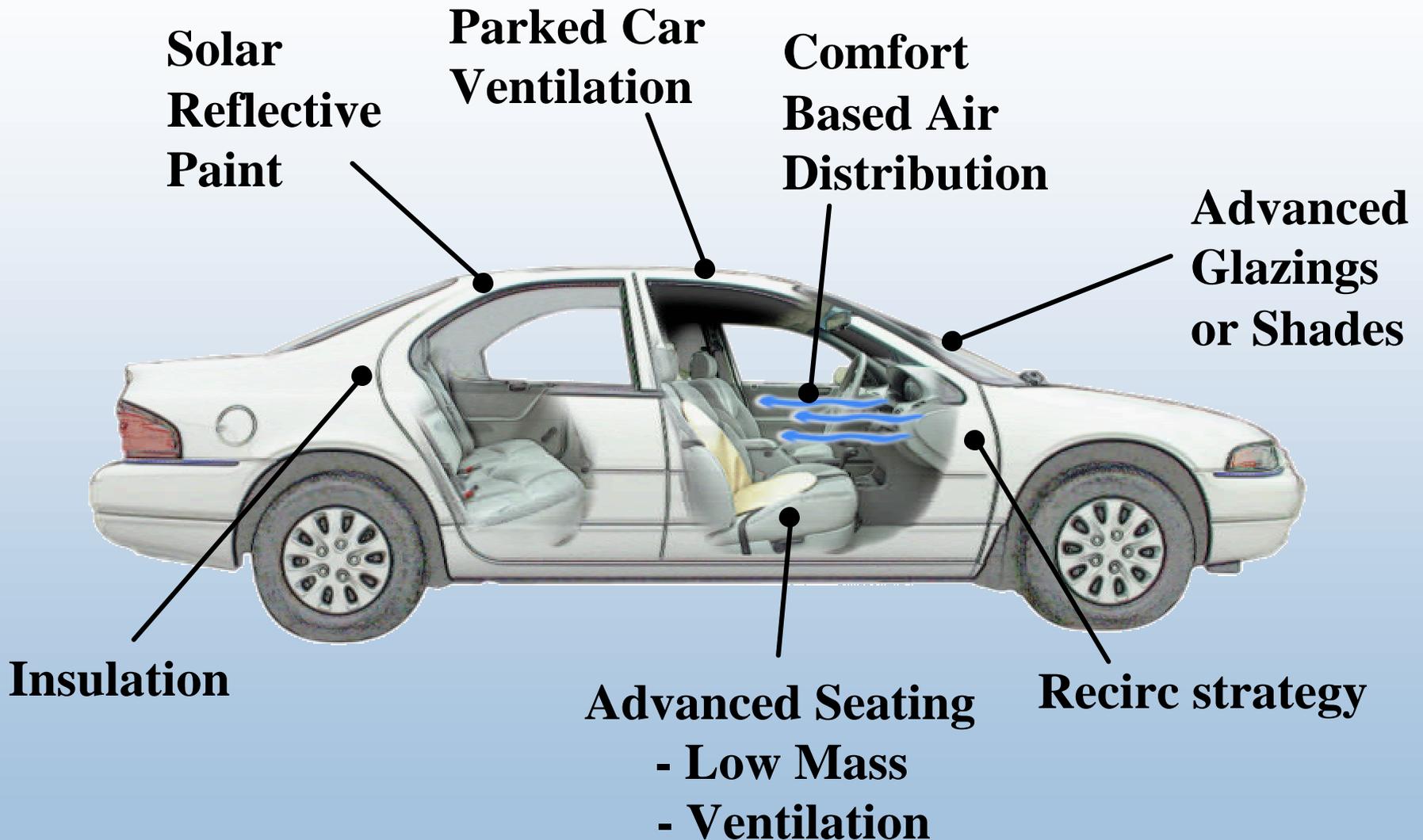


Recirc position (manual or automatic)
Humidity (ambient or cabin)
 T_{air} (ambient or cabin)

Control System (manual or automatic)

- Externally controlled compressor
- Automatic temperature control
- Idle off strategy
- Driver selection

Advanced Technologies

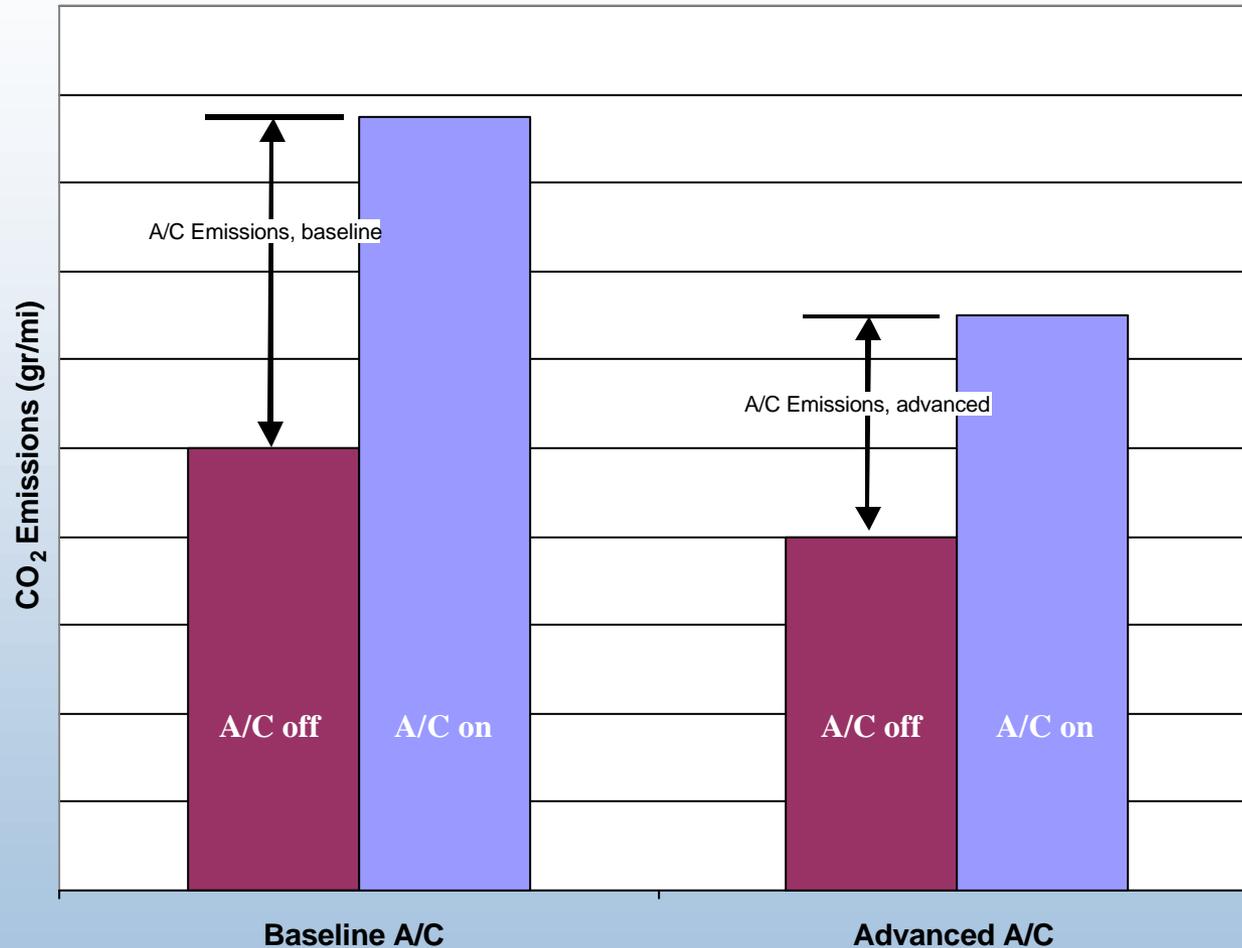


Potential Procedure

- Similar to SC03
- Cabin thermal load
 - Radiant (limitations of lights)
 - Electrical (complicated analysis)
- Representative environment (not worst case)
- Control settings to reflect real world use



Measurement of A/C Indirect Emissions



$$\text{Emissions Reduction} = \text{Emissions}_{\text{baseline}} - \text{Emissions}_{\text{advanced}}$$