Indirect MAC Emissions Workshop Summary

15JUL10

Test Equipment Impact

- Basic specifications for facilities
  - Solar load requirements
  - Blockage corrections/Airflow over the vehicle
  - Distance to the nozzle for front end re-circulation
  - Instrumentation requirements
- Correlation between facilities and “real world”
  - Vehicle types required
  - Select key vehicle parameters
  - Define band of acceptance
  - Define Road Test Process
  - Develop test facility simulation
- New test vs Replacement test
  - Facility capacity issues
  - Timing
- Automatic systems vs manual systems
  - Breath vs discharge air temperatures

Vehicle Test Setup

- How are panel outlets positioned?
  - Directly toward temperature measurement location?
- What breath level temperature is required?
  - Settings for manual and automatic systems
- Is real occupant comfort a criteria when determining that the system cooling load can be reduced after reaching a certain breath temperature?

System Controls

- Manual
- Automatic
  - Type of temperature program setting
- Air Selection
  - Recirculation
  - Outside air [OSA]
- Dual Zone

- Need to define how to set all of these!

Drive Schedule Impact

- Constant speed vs Transient Speed
  - Need Pros/Cons
  - Impact of transient load control factors
- Soak and Cool-down vs steady state
  - Need Pros/Cons
  - Solar load per ISO13837?
- Metrics to use
  - MPG, l/100 km/, l/hour
  - Fuel consumed by vehicle vs fuel consumed by MAC
- Impact of different engine efficiencies
- Global procedure vs localized procedure(s)
- Hybrid and electric vehicle considerations

Passenger Compartment Cool-down vs Steady State

Soak/Cooldown & Steady State	Steady State
Measures cooldown and steady state A/C fuel use	Steady State A/C fuel use only
Soak precludes powertrain preconditioning drive cycle for A/C on test	Powertrain preconditioning can be the same for A/C off and A/C on
Increased cost, time, and complexity	Quicker and less costly
Solar lamps (or some other heat source) required for soak	Solar lamps less important but still relevant
Drivers commonly use A/C in a cooldown mode	Steady state only misses common hot soak/cooldown condition

Drive Cycle vs. Constant Speed Points

Drive Cycle	Constant Speed
A/C fuel use can be a small part of overall fuel use, difference between A/C on and A/C off fuel use can be small, impact of uncertainty, multiple tests needed,	Less uncertainty, no drive trace issues
Measure effect of changing compressor rpm (accelerating and decelerating refrigerant)	Compressor rpm doesn't change, not real world (moot point for electric compressor)
Determine A/C fuel use over cycle	Need to combine data into speed bins to perform analysis over drive cycle

Real World Procedure - Discussion of Advantages/Disadvantages

Advantage	Disadvantage
Close to real world A/C fuel use measured because the HVAC control is allowed to function as it would in the real world	Requirement for SCO3 solar lamps reduces the # of chambers that can run test
Gathers cooldown and steady state A/C fuel use data	The roof will be hotter than real world due to the solar lamps
Measures impact of thermal load reduction technologies	Test time to solar soak the vehicle for TBD hr prior to start
Solar sensor (if equipped) detects a solar load	Test time to run cooldown and steady state interior temperatures
Interior soak air temperatures at start of cooldown test are realistic	Cost
Process valid for drive cycle or constant speed points	Engine control during cold start could increase overall fuel use during cooldown – impact to A/C fuel use unknown
No vehicle-specific pretest analysis required (as would be required for portable heaters)	Cabin air temperature and capacity may vary between vehicle manufacturer and model
	Impact of improved thermal comfort technology is not assessed (e.g. seating)

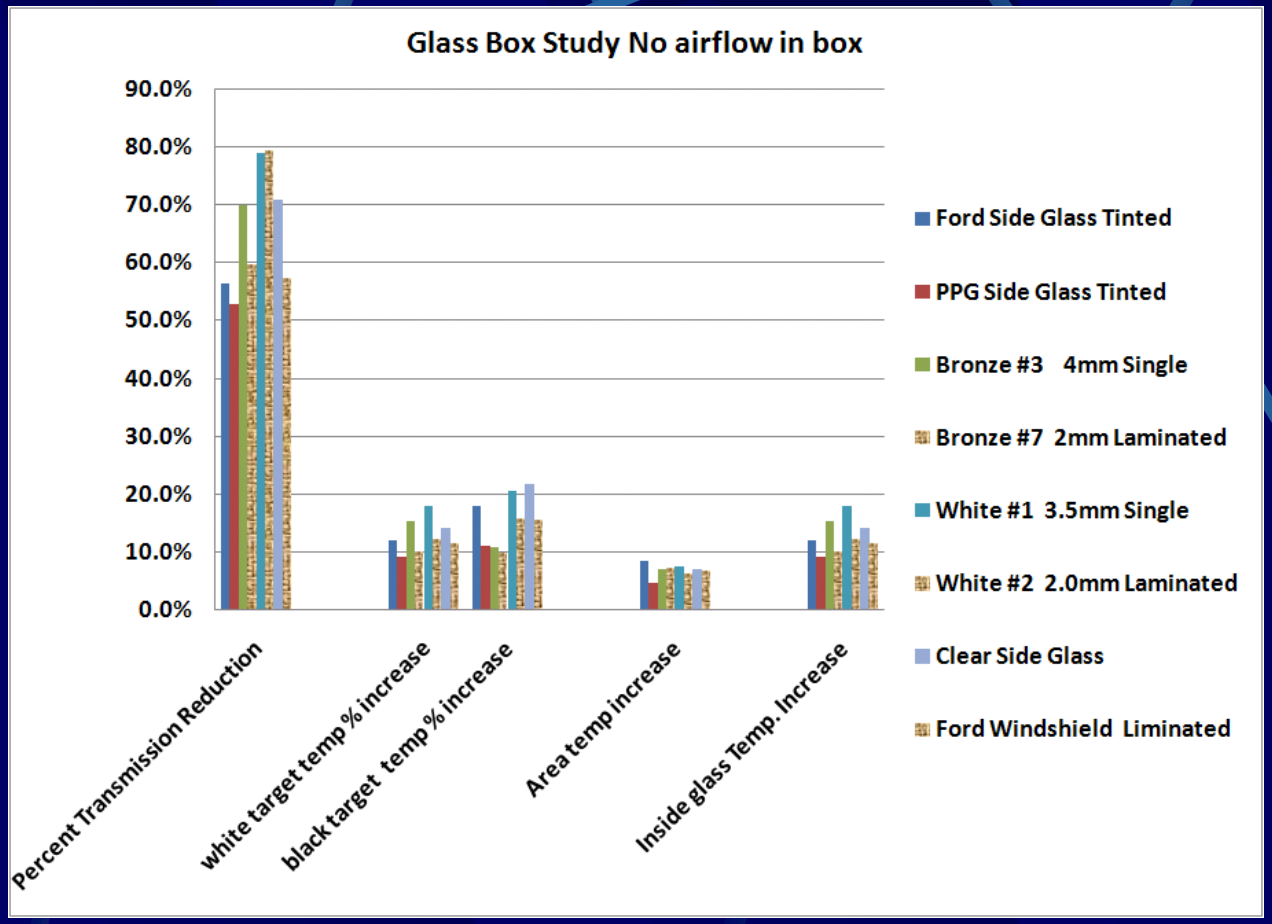
MAC Hardware Impact

- Do we need direct and indirect requirements in the future?
- Credits vs test?
  - Mix of both?
- Ejector and other special cycles
- Heat Pumps
- Heater technologies?
- Electrical technologies?

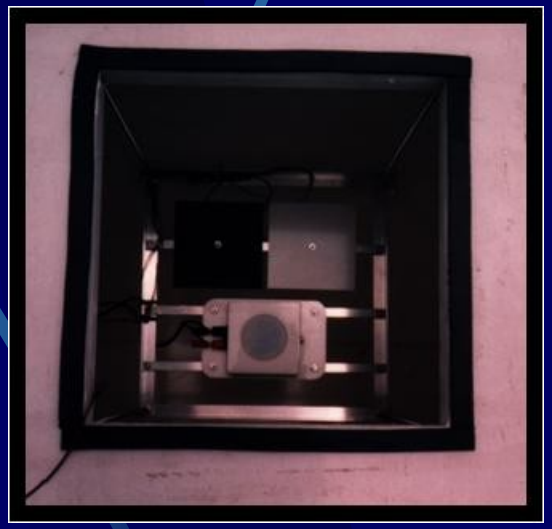
Vehicle Architecture Impact

- Vehicle Interior and Exterior Colors
- Glass/Polycarbonates
- Ventilated seats
- Ventilated passenger compartments
- Other capacity reduction strategies
- Considerations of customer useage
  - Trip length
  - Soaks vs steady state
  - Blower preferences
  - Mode preferences
- Battery cooling
- Temperature rise at air inlet
- Temperature at condenser inlet

Glass Temperature



Glass Box test
White and Black
Target Surfaces



Glass – Clear Tinted – Solar – Single pane Laminated