



**Impact of Test Facility Variables  
in Mobil Air Conditioning FE  
Validation**

July 14<sup>th</sup> 2010

# Introduction

- **Jacobs Engineering**
  - **Jacobs Technology - Technology Group**
    - Design, Build and Operate Test Systems and Facilities
    - Integrators of test equipment
    - Technical Project Management
- **Extensive Simulation / Correlation Experience**
  - In general we design and commission every wind tunnel to simulate as close to real world conditions as possible
  - Specifically for Ford Motor Company – DTF Road to Lab correlation for drivability

# Test Facilities For MAC FE Testing

**The type of Test Facility used is dependent on the test requirements**

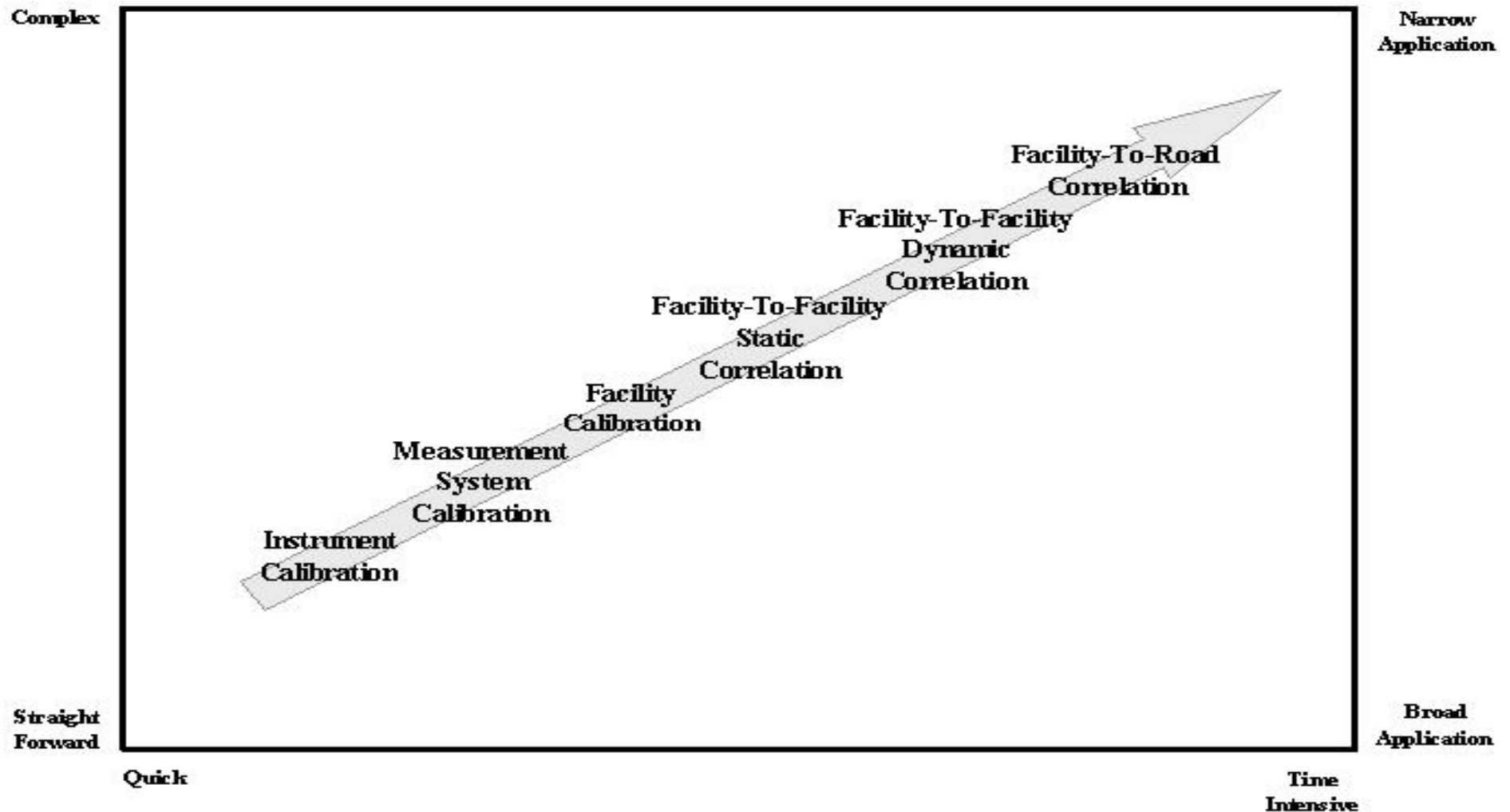
- **Road to Lab**
- **Economic cost tradeoff based on how real world the simulation needs to be**
- **Road to Lab Correlation**
- **Correlation between facilities to ensure consistency**

# Correlation Defined

**In general, correlation is simply a relationship between two entities. In this case, the entities are the data from the road and laboratory tests. Stated mathematically, the requirement for correlation is:**

$$\text{DFacility} = f(\text{DRoad})$$

# Multi-Level Model for Facility Correlation



Multi-Level Model for Facility Correlation

# HVAC Testing Success in CWT

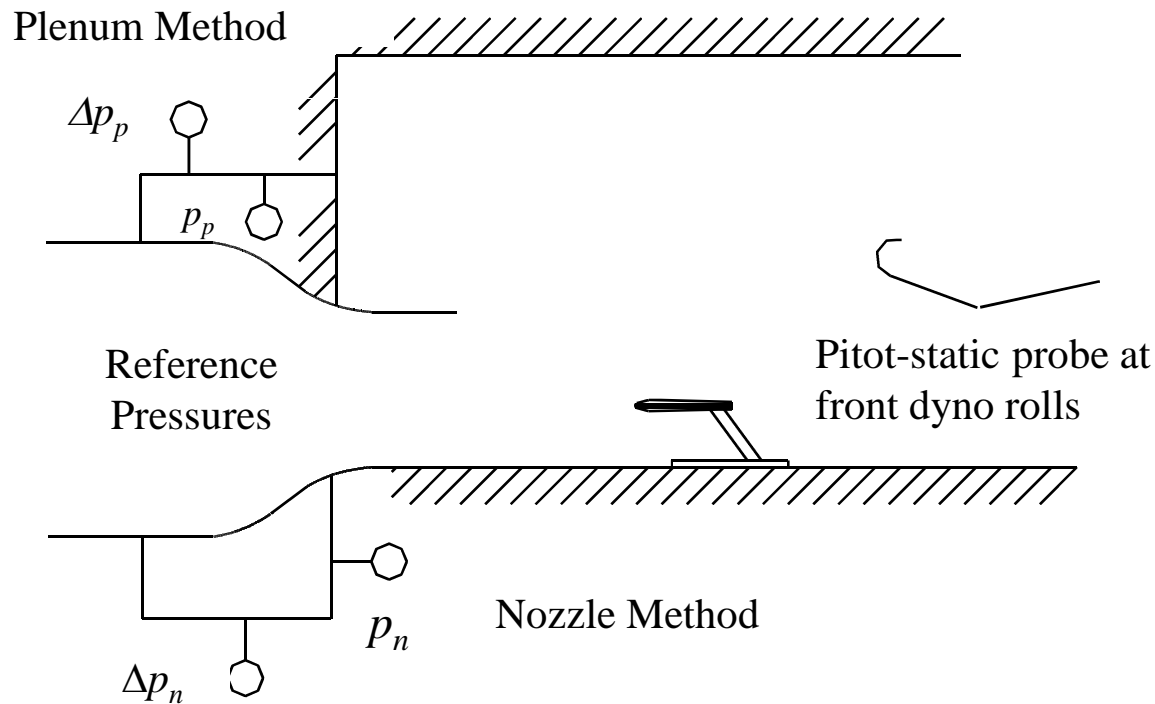
- **Representative Vehicle Airflow**
- **Idle Simulation**
- **Air Temperature Control**
- **Air Humidity Control**
- **Solar Simulation**
- **Dynamic Road Load Simulation**
- **Programmable Automated Testing**

# Representative Vehicle Airflow

Quality of simulation is dependent on nozzle size

- 16 to 25 sq ft for emission cells
- 50 to 100 sq ft for climatic cells
- 200 to 300 sq ft for aerodynamic facilities

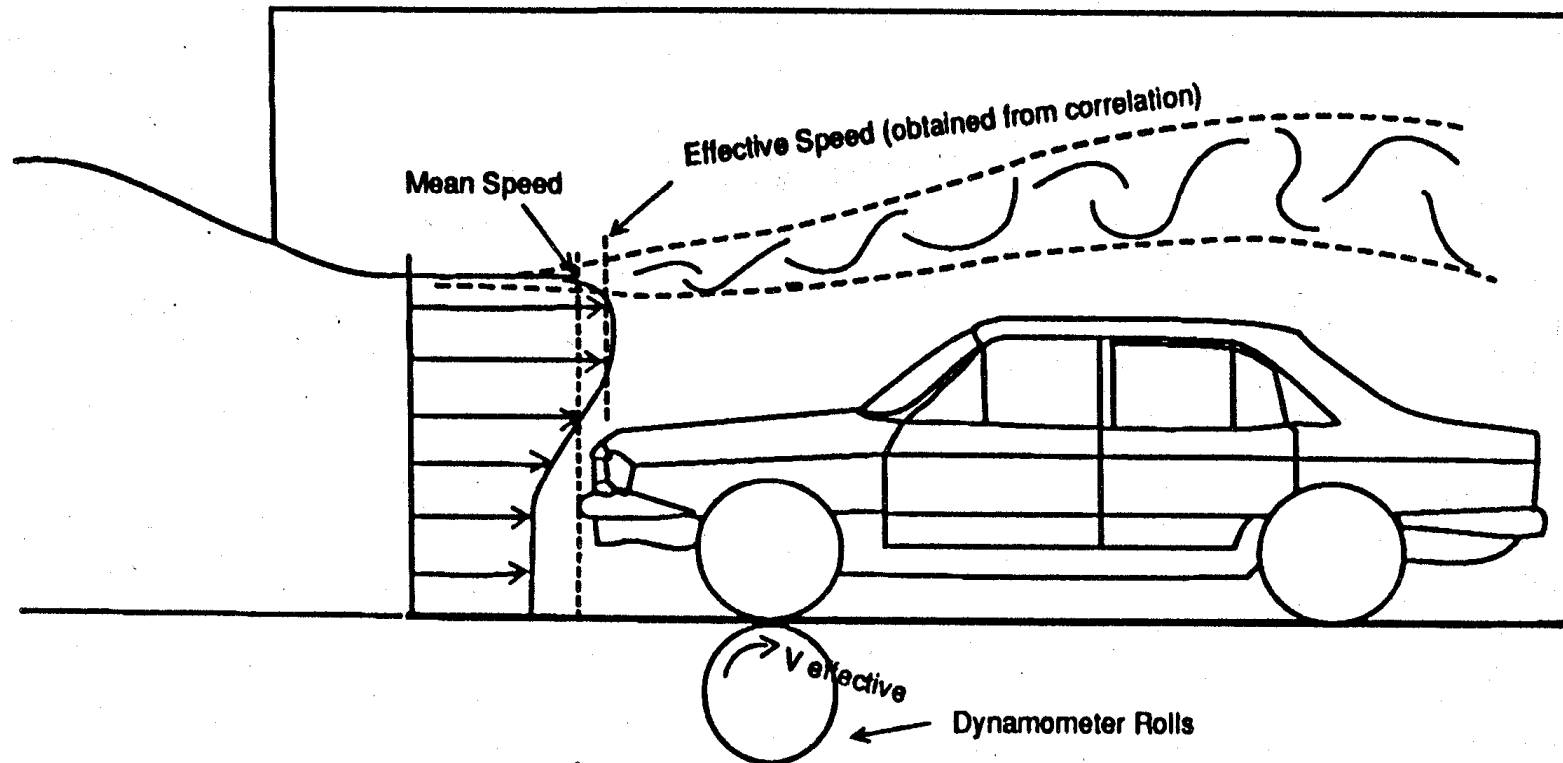
Air speed calibration is performed to correlate wind speed to vehicle speed with an empty tunnel initially



# Representative Vehicle Airflow

## Blockage correction based on:

- Frontal area of vehicle
- Vehicle profile
- Distance from the Nozzle





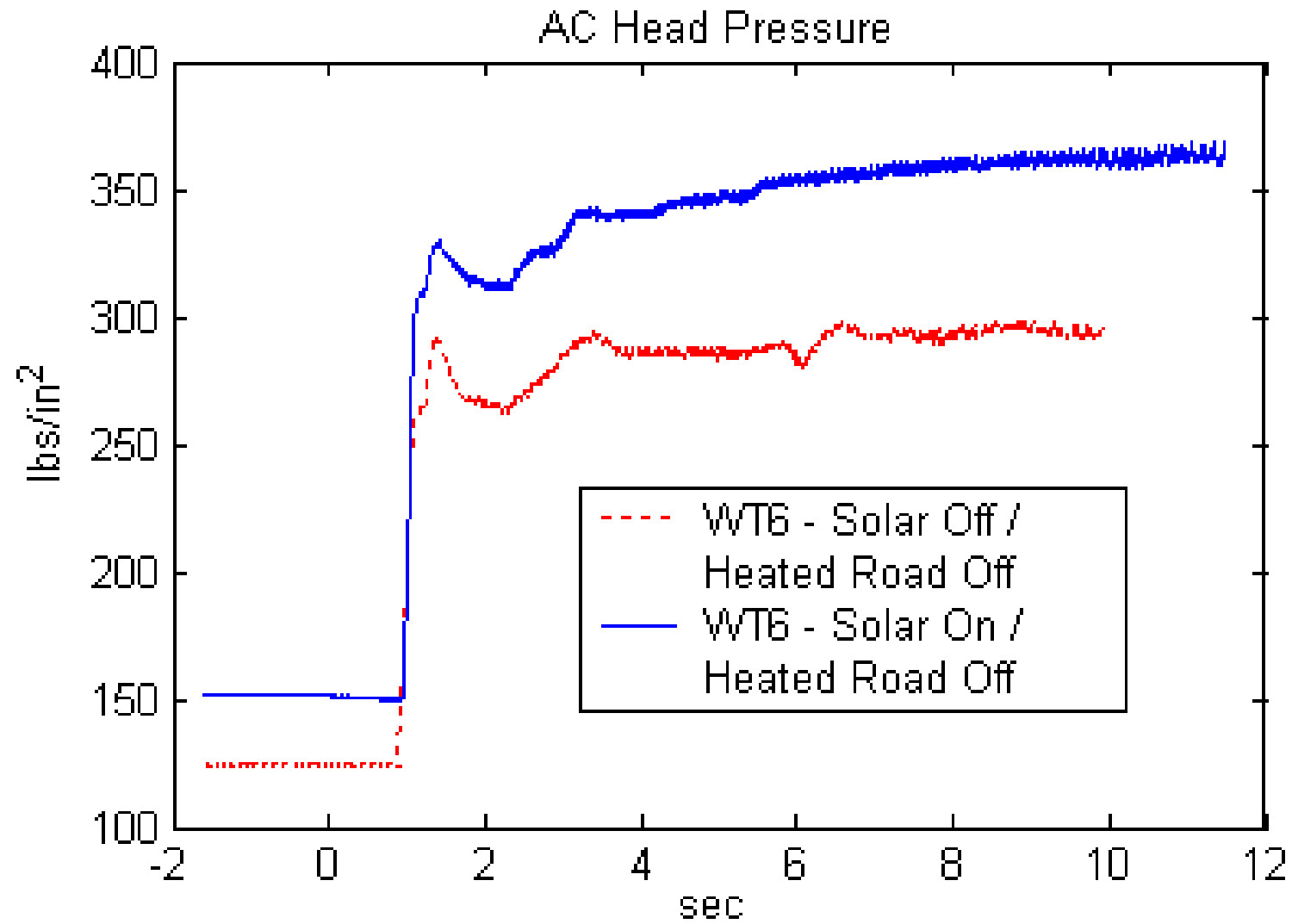
# Solar Simulation

**OEM's use 850-1100 W/m<sup>2</sup> for MAC Tests  
Measured at 1 Meter Above CWT Floor Center  
of Greenhouse**

**Based on Balanced Grid Across the Test  
Section**

**Newer Systems Offer Side Loading  
Infrared –vs- Full Spectrum**

# Effects Of Solar on MAC Systems



# Defining the Correlation

**Define Test Fleet**

**Select key vehicle parameters**

**Define band of acceptance**

**Use on board acquisition system**

**Define Road Test Process**

**Develop test facility simulation**

**Correlate road to test facility**

**Transition Road Test to Facility**