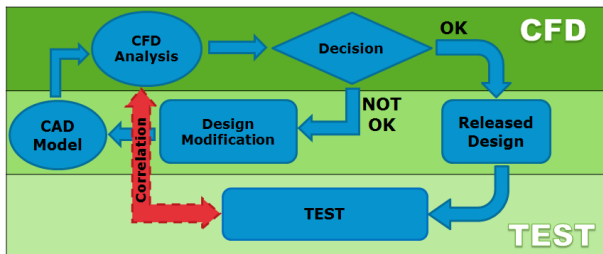


## Virtual Testing To Solve Your Problems

# The Most Advanced CFD Technology

Computational Fluid Dynamics (CFD) is the analysis of systems involving fluid flow, heat transfer and related phenomena by means of computer based simulation. By using the latest developments in CFD analysis, Mobile Climate Control (MCC) is able to embed CFD technology into the design process at an early stage of the design cycle. The use of CFD analysis in the design cycle directly translates into reduced iterations in order to obtain the final design, shorter lead times and reduced prototyping costs. As soon as an initial CAD model is available, a CFD analysis can be conducted to verify whether there is a flow or thermal issue. This assures that design can be adjusted and optimized at the earlier CAD stage, instead of waiting for prototypes to be built. This ensures significant savings of time and money.



Integration of CFD process with typical customer design cycle

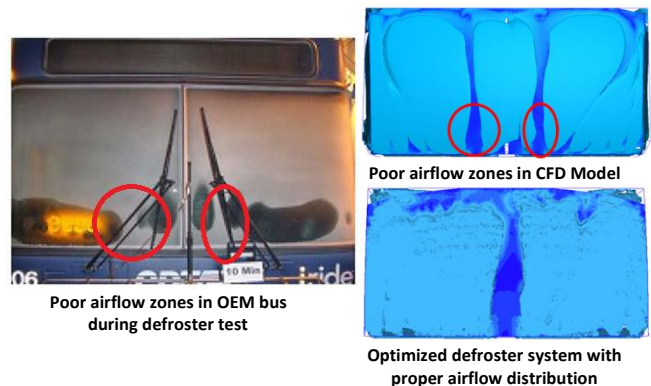
MCC prides itself on the outstanding quality of its engineering support. We provide a complete range of CFD consulting services including: **Laminar and Turbulent Flow, Steady State and Transient Conjugate Heat Transfer and Multi-physics Analyses** to drive products from concept to reality.

### Experience and skills

MCC utilizes the most current CFD technology across various applications in **On-road, Off-road, Defense, and Utility Vehicles** to validate and improve designs in a cost effective manner. We are highly experienced in a variety of applications in the commercial vehicle industry including:

- Passenger thermal comfort
- Defrost/Demist systems
- HVAC systems
- Optimization studies for various flow path profiles
- Rotating machinery (blowers/fans)
- Aerodynamics
- Fluid structure interaction
- Underhood airflow
- Electronic cooling

Our CFD consulting service has consistently met or exceeded the expectations and demands of all our clients. Our clients are some of the most successful organizations in their respective industries including: **Blue Bird, MCI, New Flyer, Gillig, Nova Bus, and Doosan/Bobcat.**



### State of the art CFD tools

We have considerable experience with world-class CFD/FEA tools such as:

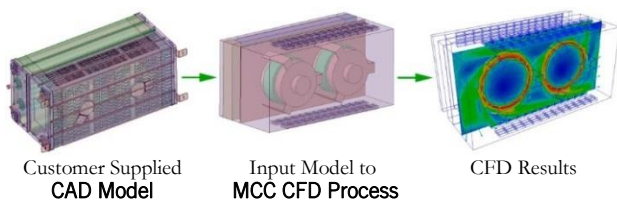
- Autodesk CFD
- Autodesk Simulation Mechanical
- SpaceClaim
- STAR-CCM+
- Ansys-CFD
- OpenFoam

The default CFD tools at MCC are Autodesk CFD and OpenFoam, however we can accommodate CFD projects using other CFD tools based on customer request.

## The Advanced CFD Process

The MCC CFD process is the most sophisticated process followed by world-class CFD software developers and includes the following steps after receiving the customer supplied cad model:

- 1) Define and specify the flow problem
- 2) Elaborate the (computational) geometry
- 3) Determine the flow domain
- 4) Create and optimize mesh
- 5) Devise overall simulation strategy
- 6) Set the CFD simulation input and boundary conditions
- 7) Execute and monitor the CFD simulation process
- 8) Post-processing of the CFD results
- 9) Compare performance results with stated objectives and provide design improvement recommendations
- 10) Repeat the analysis and revise systems as needed
- 11) Document findings and provide a thorough report



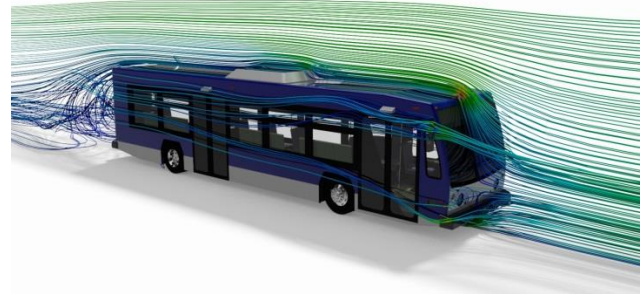
## Major CFD Applications for Commercial Vehicle

These are some of the most common analyses which are conducted at MCC on a daily basis:

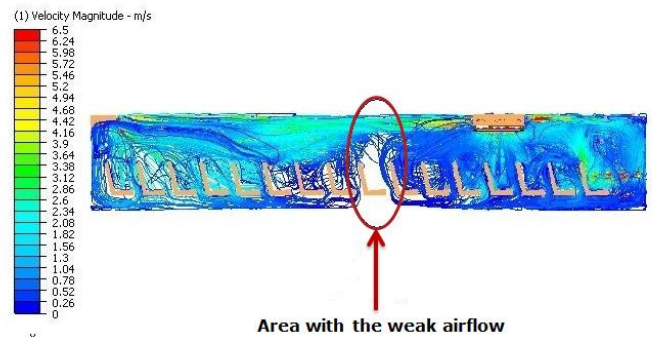
- Improvement of climate control functions and passenger comfort under various harsh conditions
- Optimizing windshield defrosting systems in commercial vehicles
- Flow analysis of entire HVAC system for optimization of casing and ducting system
- Evaluate performance of rotating machineries
- Optimizing thermal performance of heat exchangers
- Aero-structural analysis of buses to determine and study the effects of aerodynamic forces on their roof units

**MCC provides exceptional CFD/FEA consulting services. This helps our clients to achieve superior designs with significant cost reductions.**

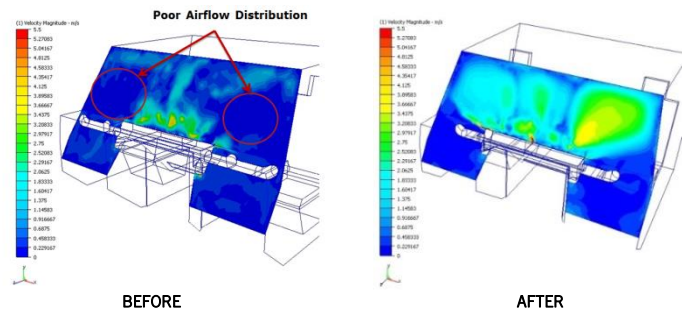
## Examples of Major Systems Analyses



Aerodynamics analysis of a bus



Passenger comfort analysis of bus



Optimization of defrosting system in a utility vehicle

