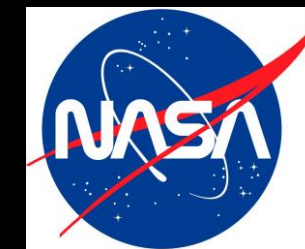


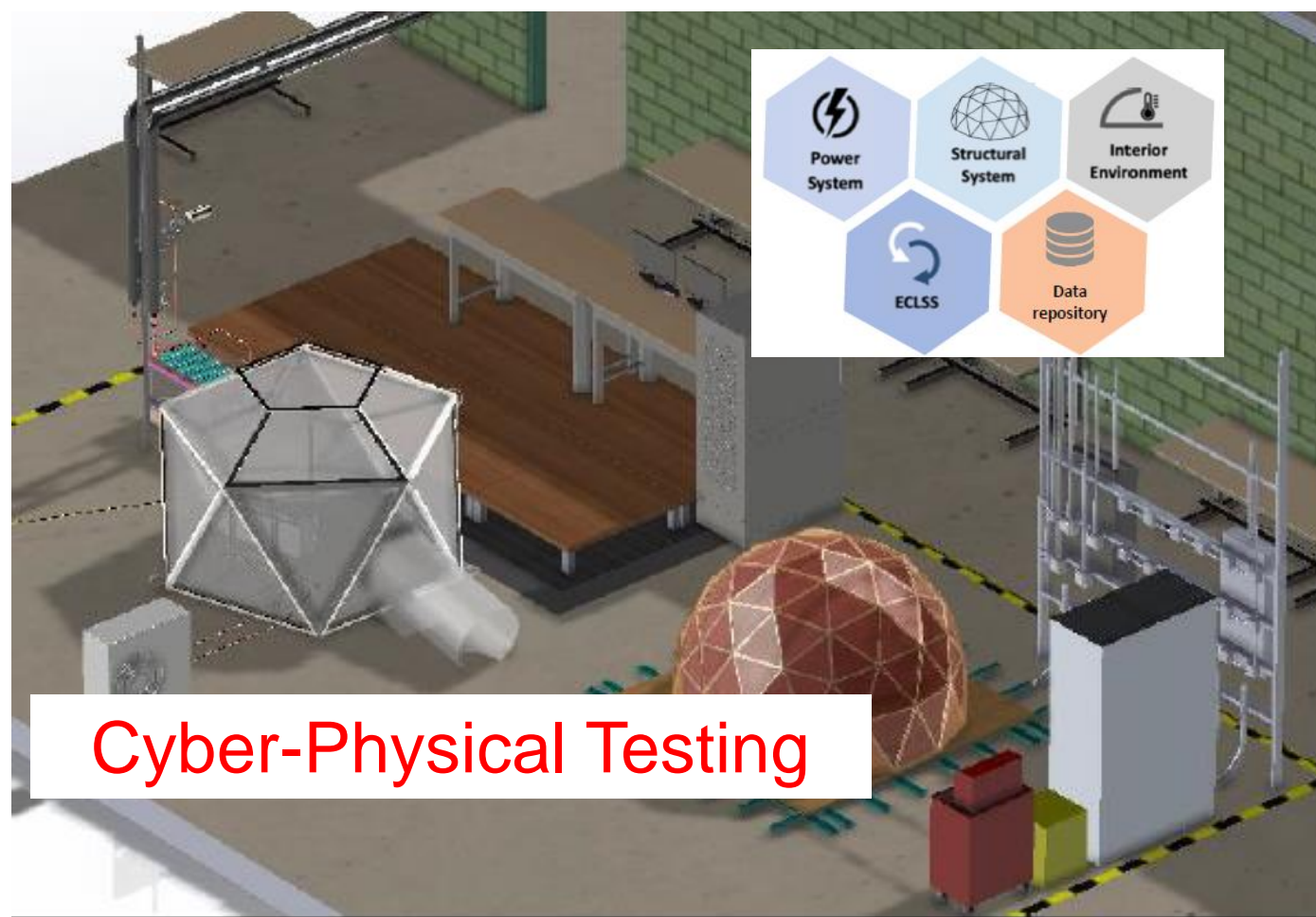
# Thermal Systems Research

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Ray W. Herrick Laboratories, Center for High Performance Buildings (CHPB)  
Resilient Extra-Terrestrial Habitats Institute (RETHi)  
Cooling Technologies Research Center (CTRC)

Selected Sponsors (ongoing projects):



## Resilient Thermal Systems & Deep Space Habitats

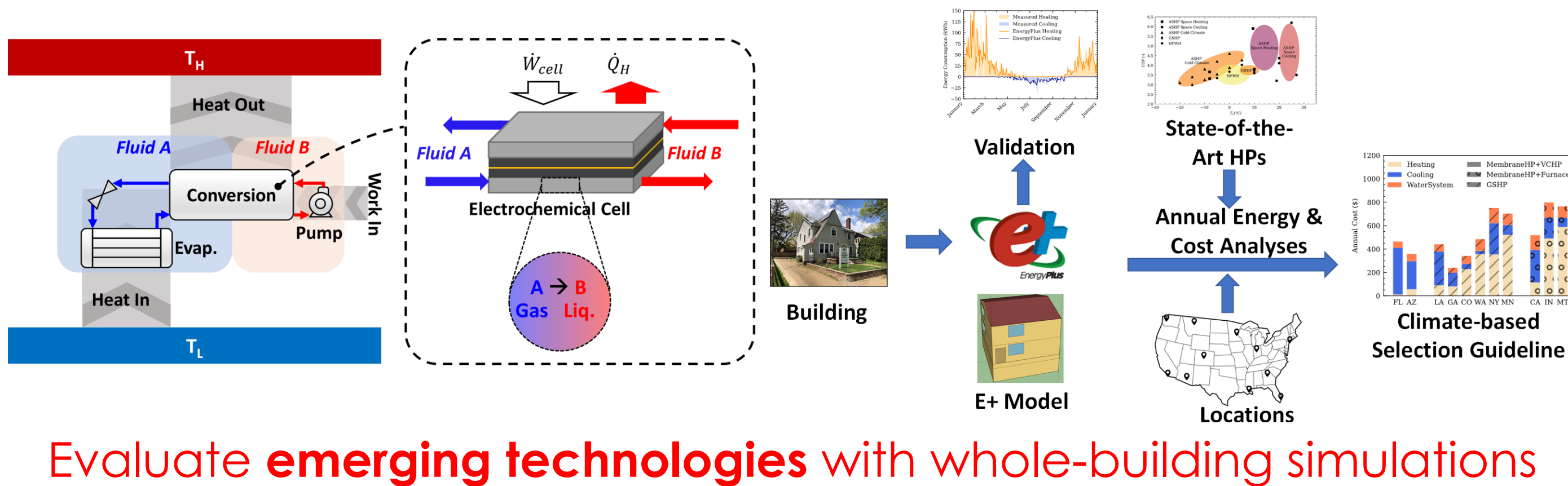


Cyber-Physical Testing



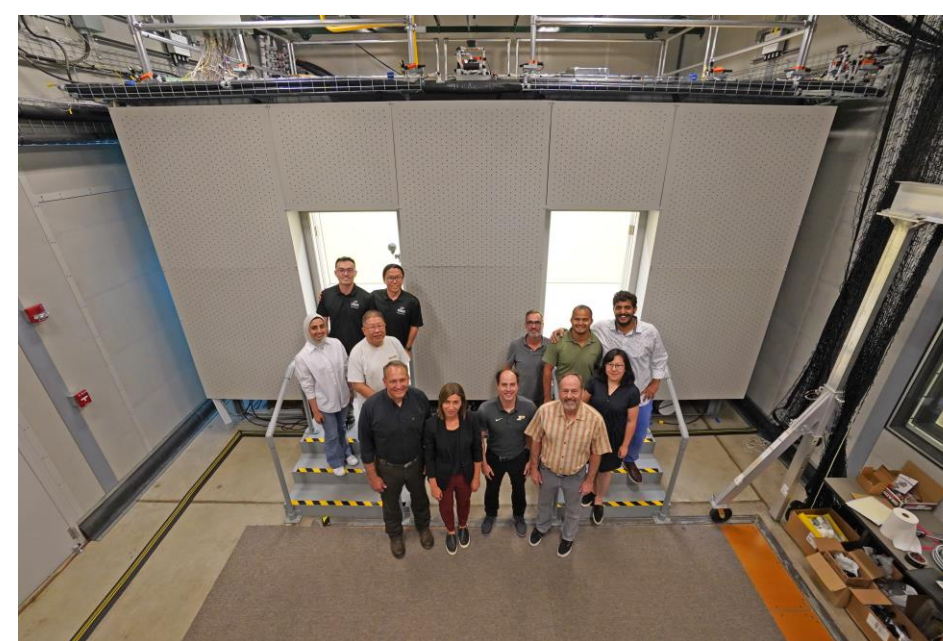
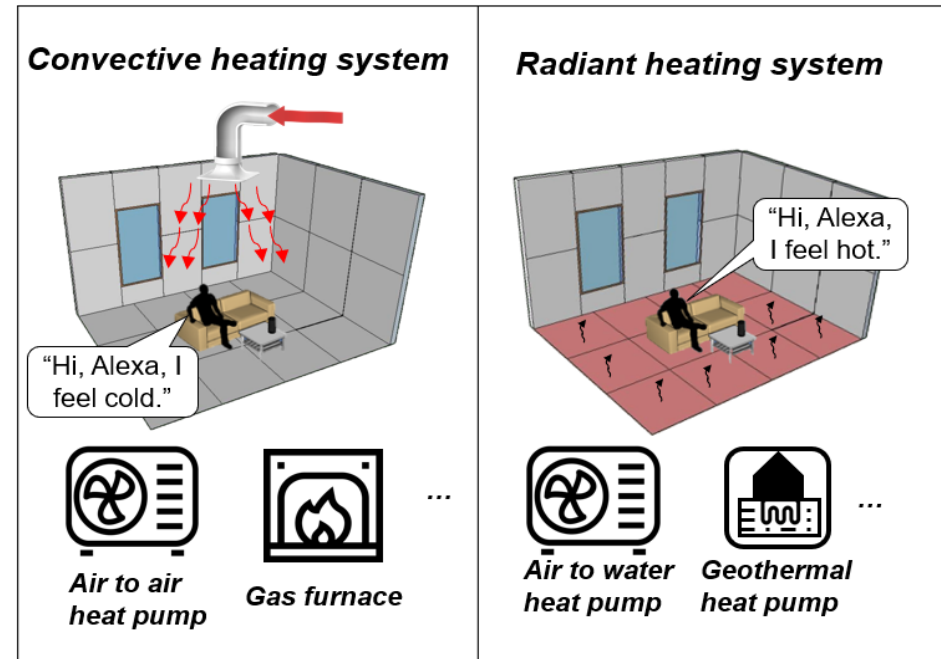
Damageable/Repairable System and Component Models (e.g., ECLSS)

## Emerging Heat Pump (HP) Technologies



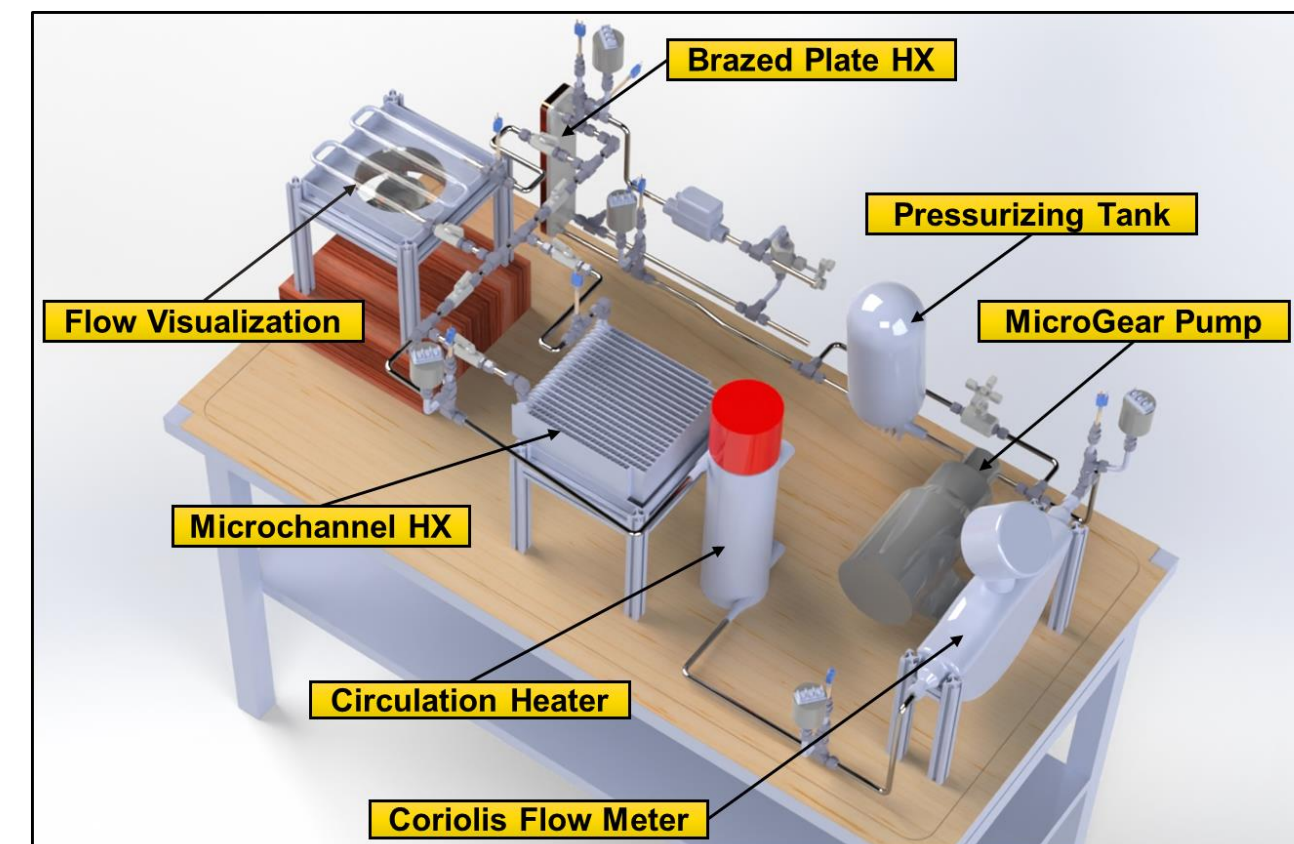
Evaluate **emerging technologies** with whole-building simulations

## Human-Building Interactions Laboratory (HBIL)

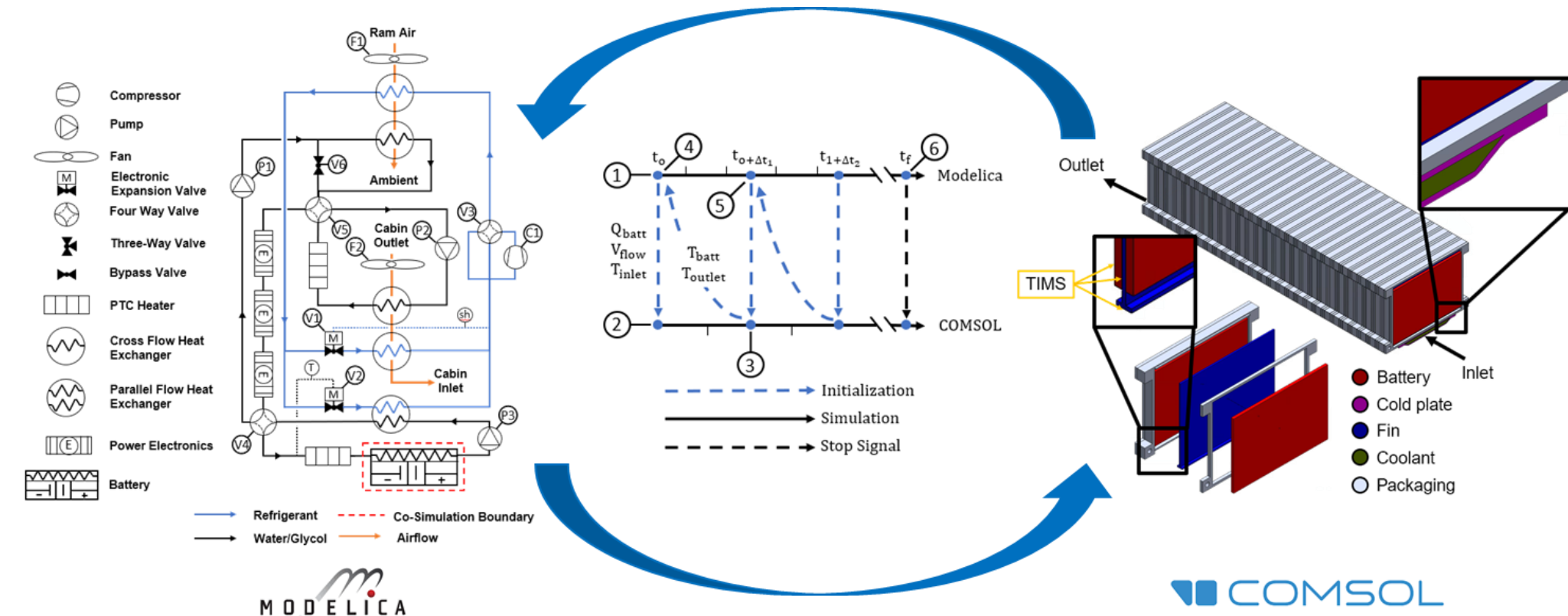


- Evaluate occupant satisfaction for **different thermal-comfort delivery approaches** and various building interactions
- Emulate **innovative technologies** such as wall-integrated micro-heat pumps

## Thermal Management Systems of EVs and Data Centers



Pumped Two-Phase Loop and Immersion Cooling

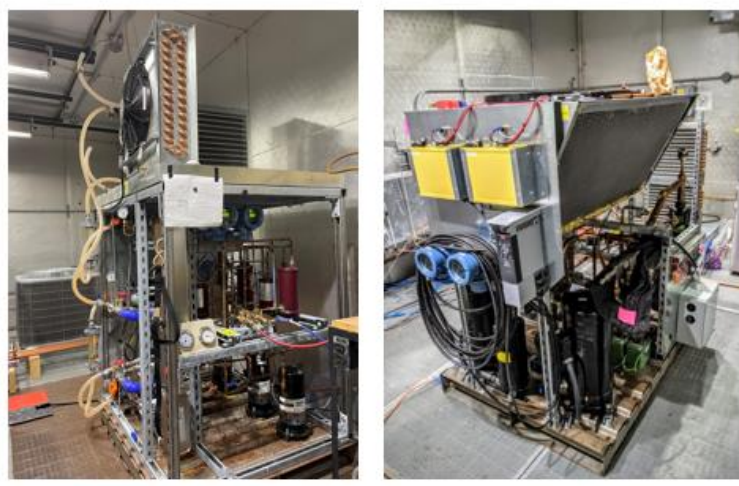


Dynamic Modeling and Multi-Scale Co-Simulations

## Low-GWP and Natural Refrigerants in HVAC&R Systems

R-290 Cold-Climate Heat Pump Systems

R-290 Multi-Temp Refrigeration System



R-600a Next-Generation Domestic Refrigerators



Next-Generation Low-GWP (A2L) Heat Pump Systems



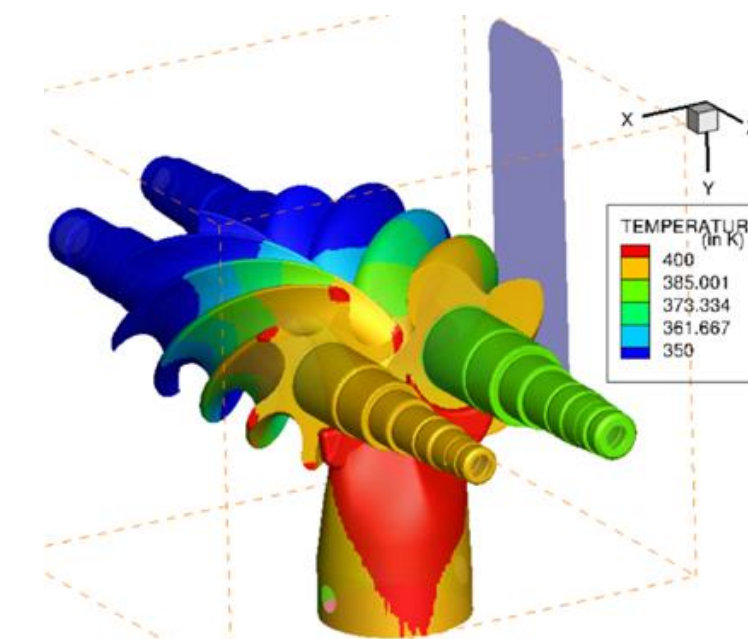
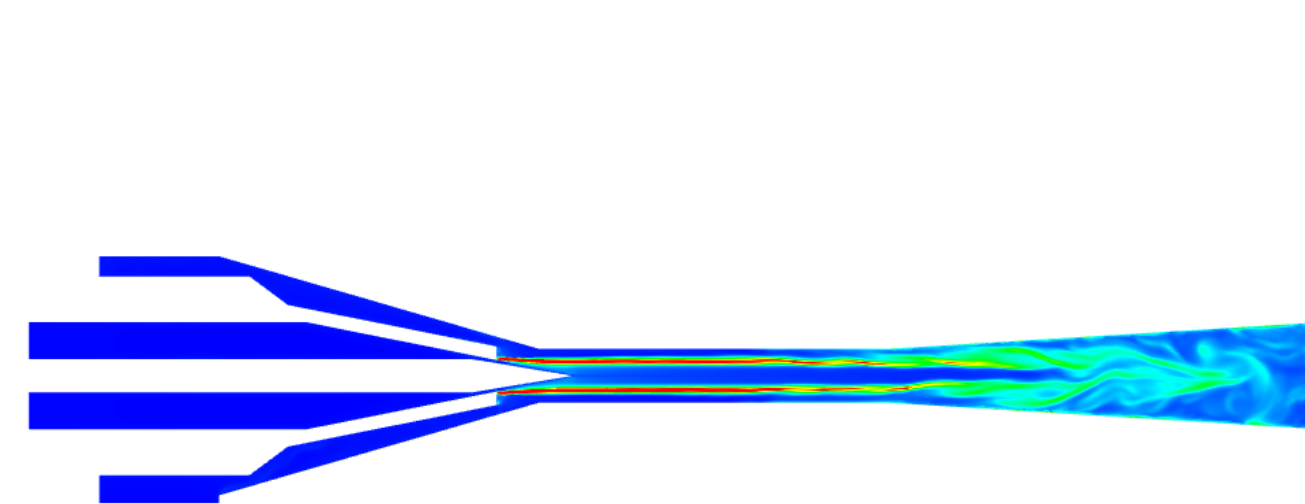
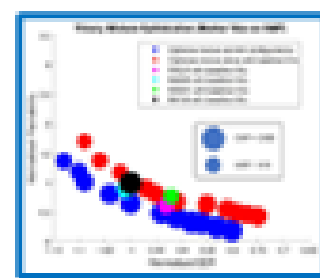
Flammability & Military Threats



System Integration



Optimization



Ray W. Herrick Laboratories