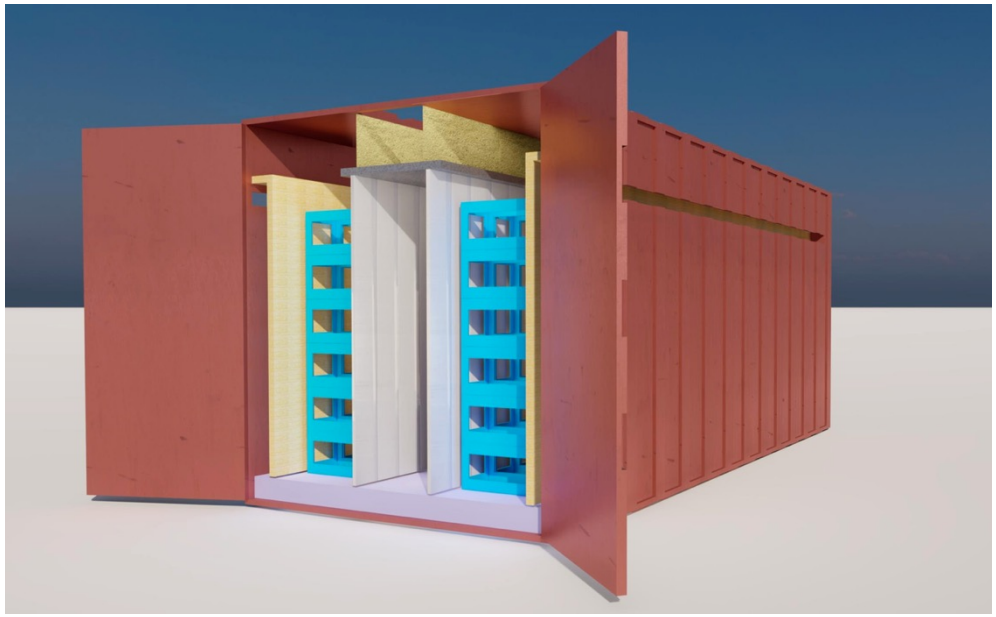
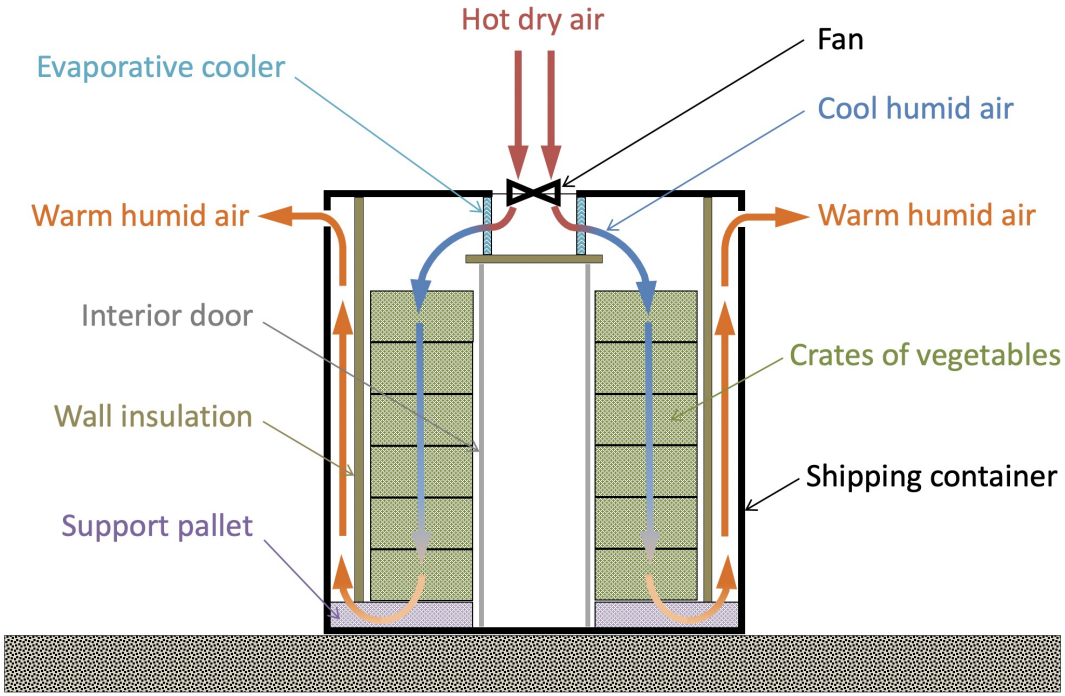
Shipping Container Based Design

Idea:

- A used shipping container can be the primary structure
- “Swamp cooler” blows cool air directly through crates
- Benefits:
  - Easily replicable
  - Reduces labor
  - Sized well for a single aisle with crates on either side
  - Can also be used for transportation applications
  - Electronic control system
  - Improved performance?





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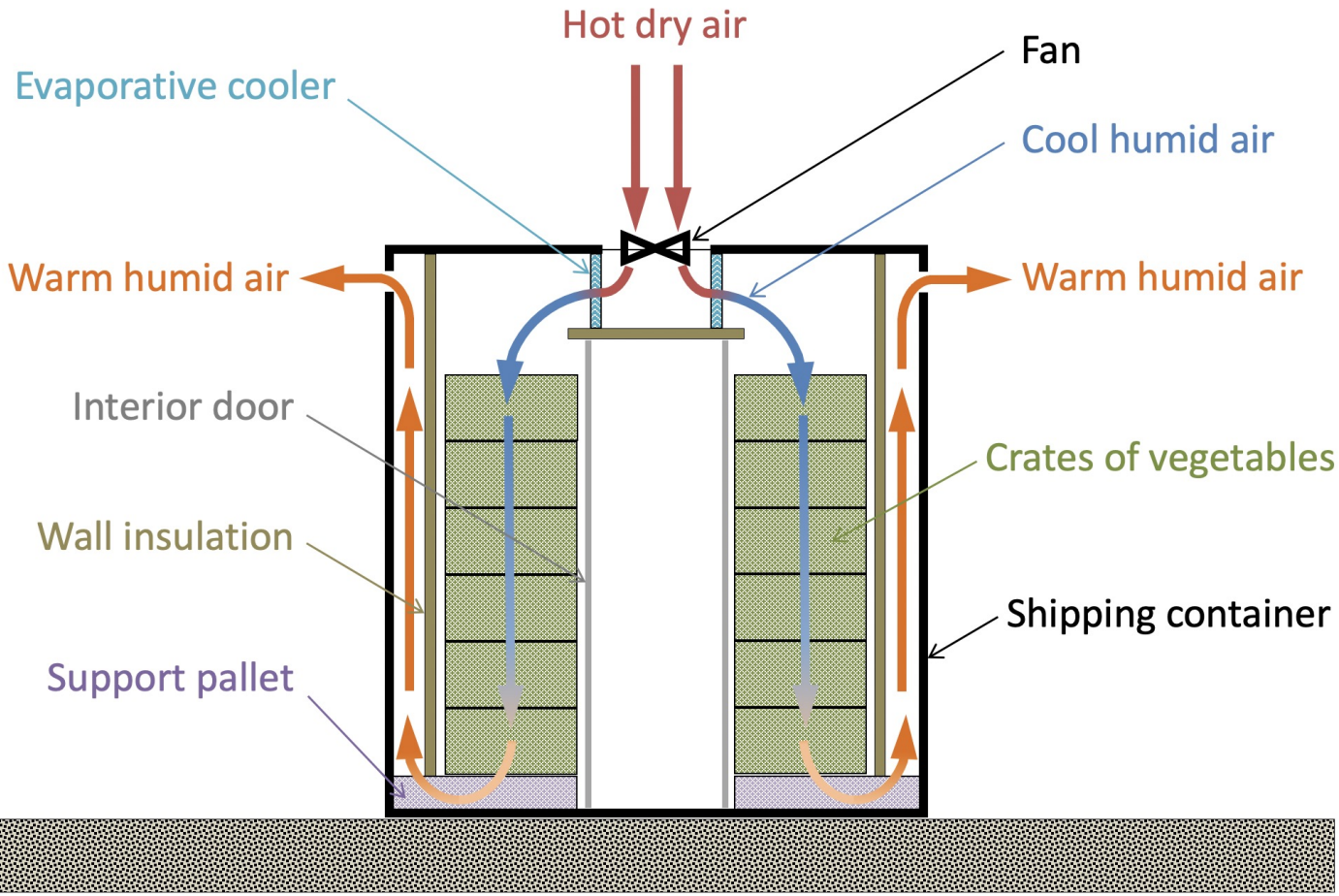
Evaporative cooling pad materials:

Aspen pads

Corrugated cellulose



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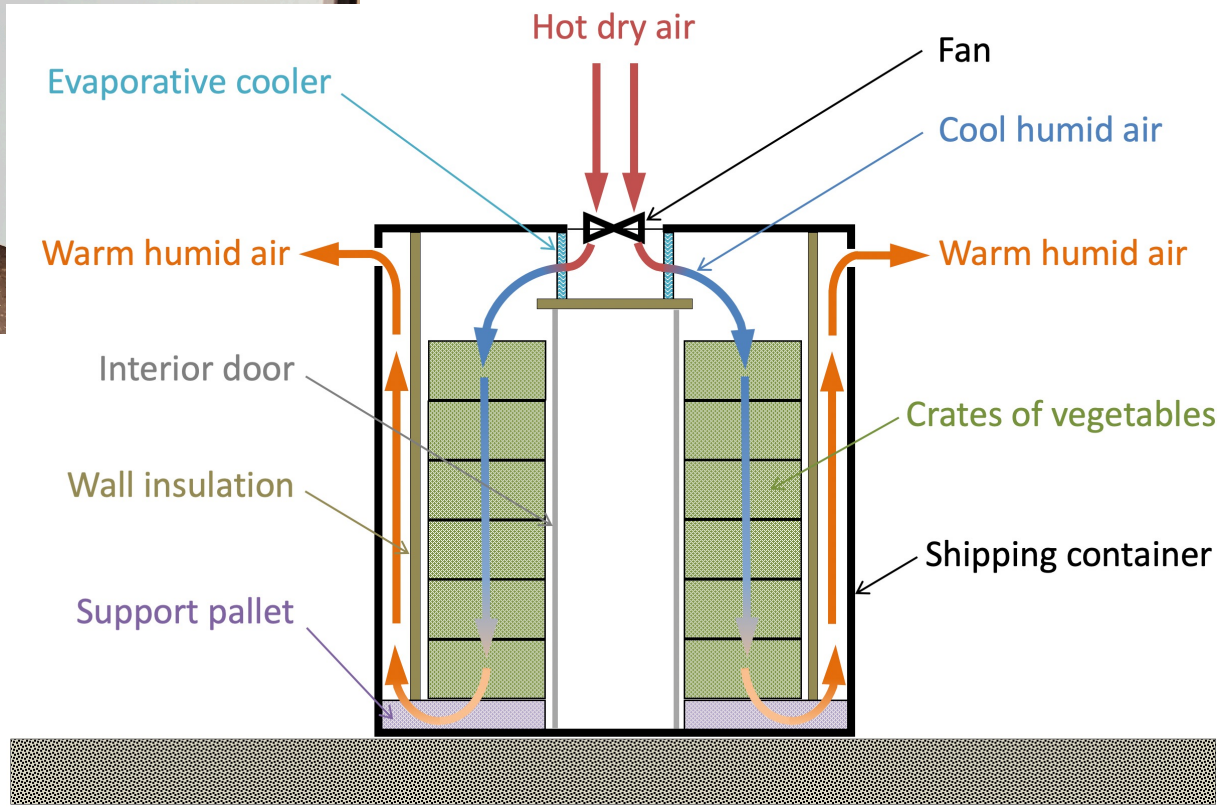


MIT D-Lab designing for a more equitable world

Shipping Container Based Chamber at MIT

Interior of the shipping container located on MIT's campus (prior to the installation of the electronic control system and insulation on the left wall and the ceiling). The team is modifying this 10' x 8' x 8' container to function as an evaporative cooling chamber. Visible is insulation (blue) on both open doors, insulation on the back wall (pink), an insulating wall (pink) spaced 3" from the exterior steel wall of the container, and the evaporative cooling unit hanging from the center of the ceiling. The stacks of plastic vegetable crates filled with water bottles are on the back-right corner of the container but are not visible.

Shipping Container Based Chamber at MIT

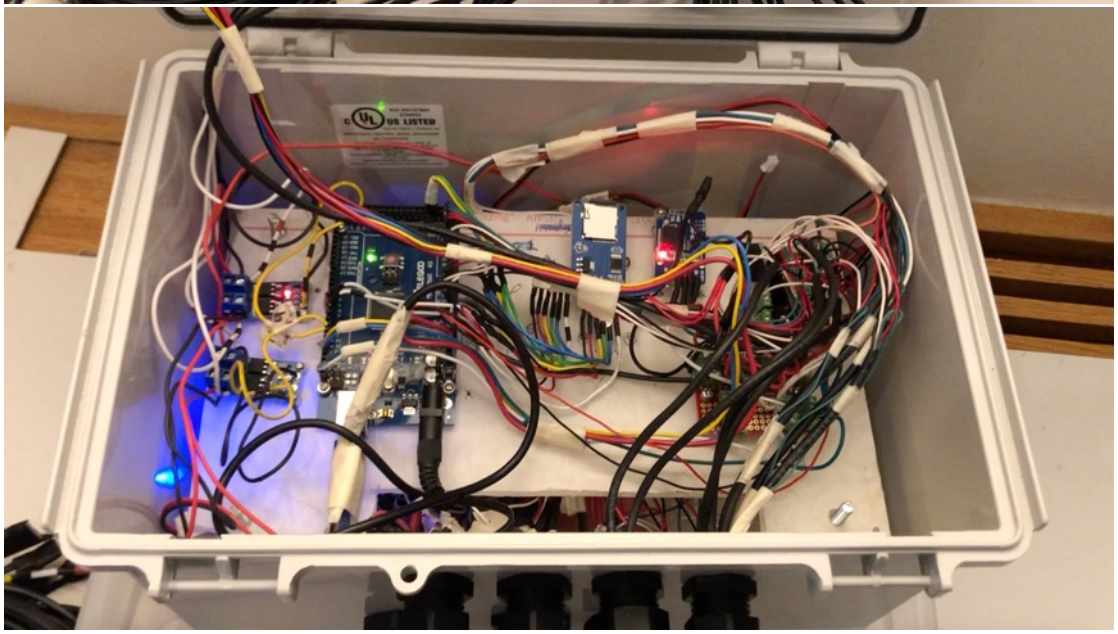
Left: Crates (black) in the experimental storage area are visible prior to the installation of the front wall. The experimental storage area contains 3 stacks, each stack is 6 crates tall, and each crate contains eighty 8-ounce water bottles. The door to the left of the crates is mounted on an overhead track

Center: The experimental storage area after the installation of the front wall to isolate the three stacks of crates. The door is in the closed position.

Right: The experimental storage area with the door slid open to expose the crates for removal and placement.

In practice the full length of the container would be used with multiple sliding doors to allow enclosure and access to all of the storage area. For our current testing we are using ¼ of the available storage area to avoid purchasing an additional 4,000+ water bottles.

Electronic Control System



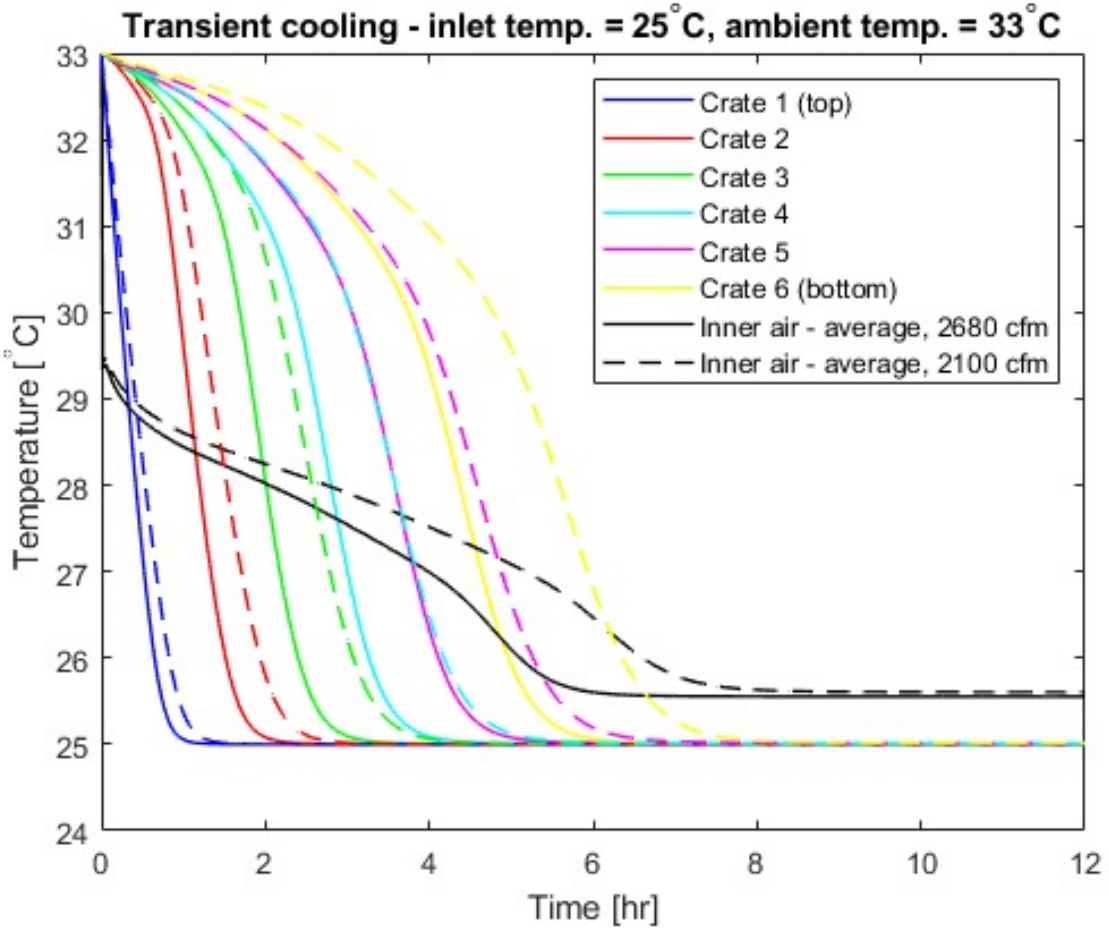
Measures and records

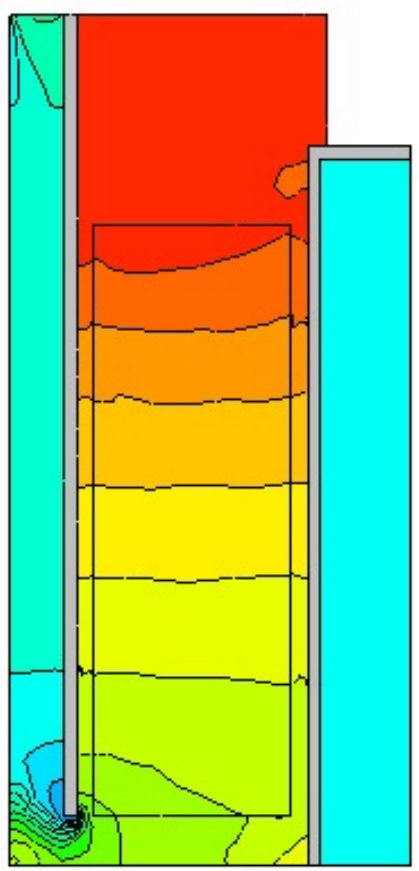
- Temperature
- Humidity
- Pressure
- Air speed
- Moisture
- Water levels

Controls:

- Water pump
- Fan speed

Heat and Mass Transfer Modeling





- Expected that we can cool vegetables by 8 ℃ in 6 hours
- Requires ~1.6 kW of solar panels and ~12 kWh of battery backup