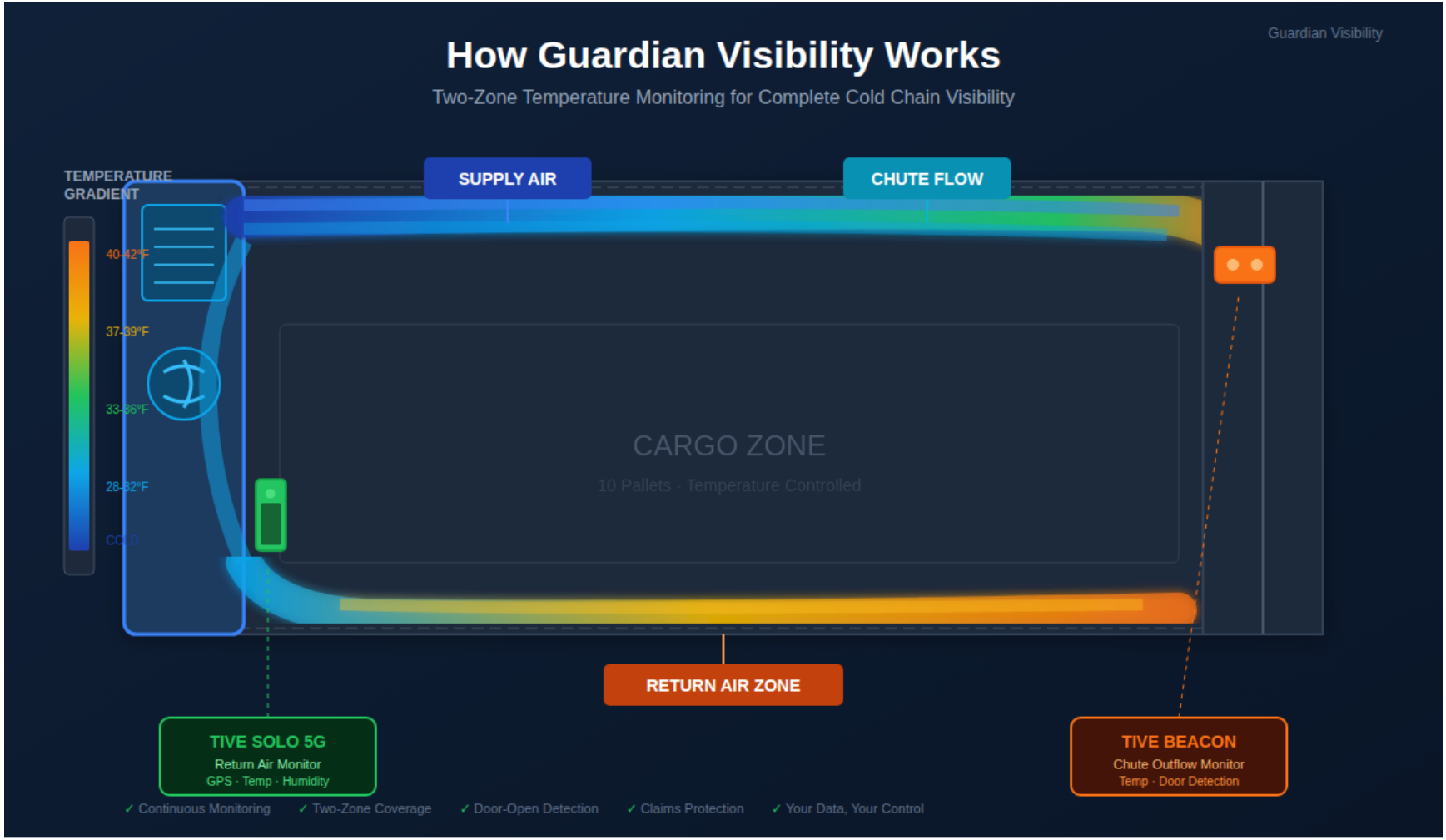
Refrigerated Trailer Airflow System

Technical Documentation & Training Materials

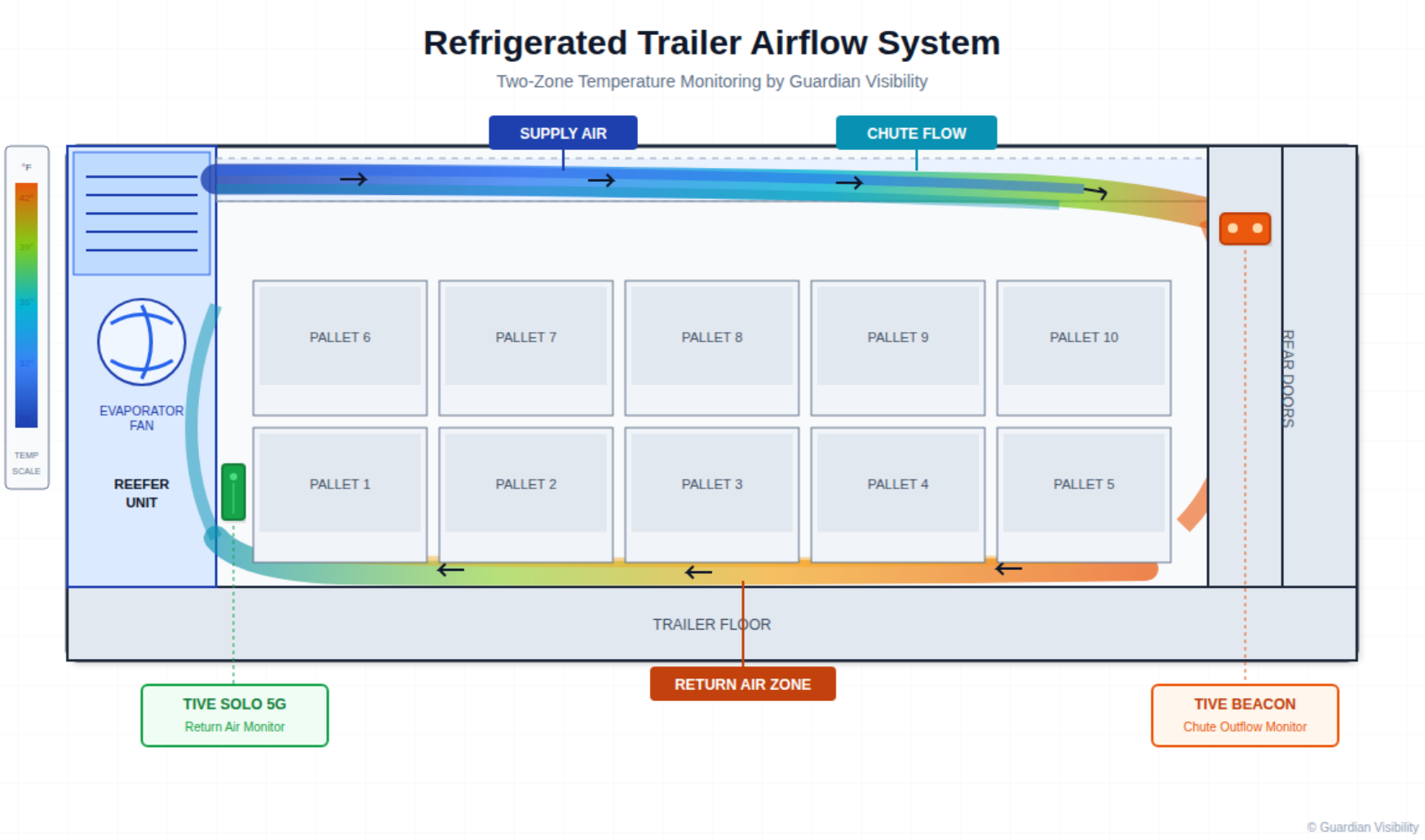


Two-Zone Temperature Monitoring by Guardian Visibility

guardianviz.com · (406) 430-6100

Technical Reference Diagram

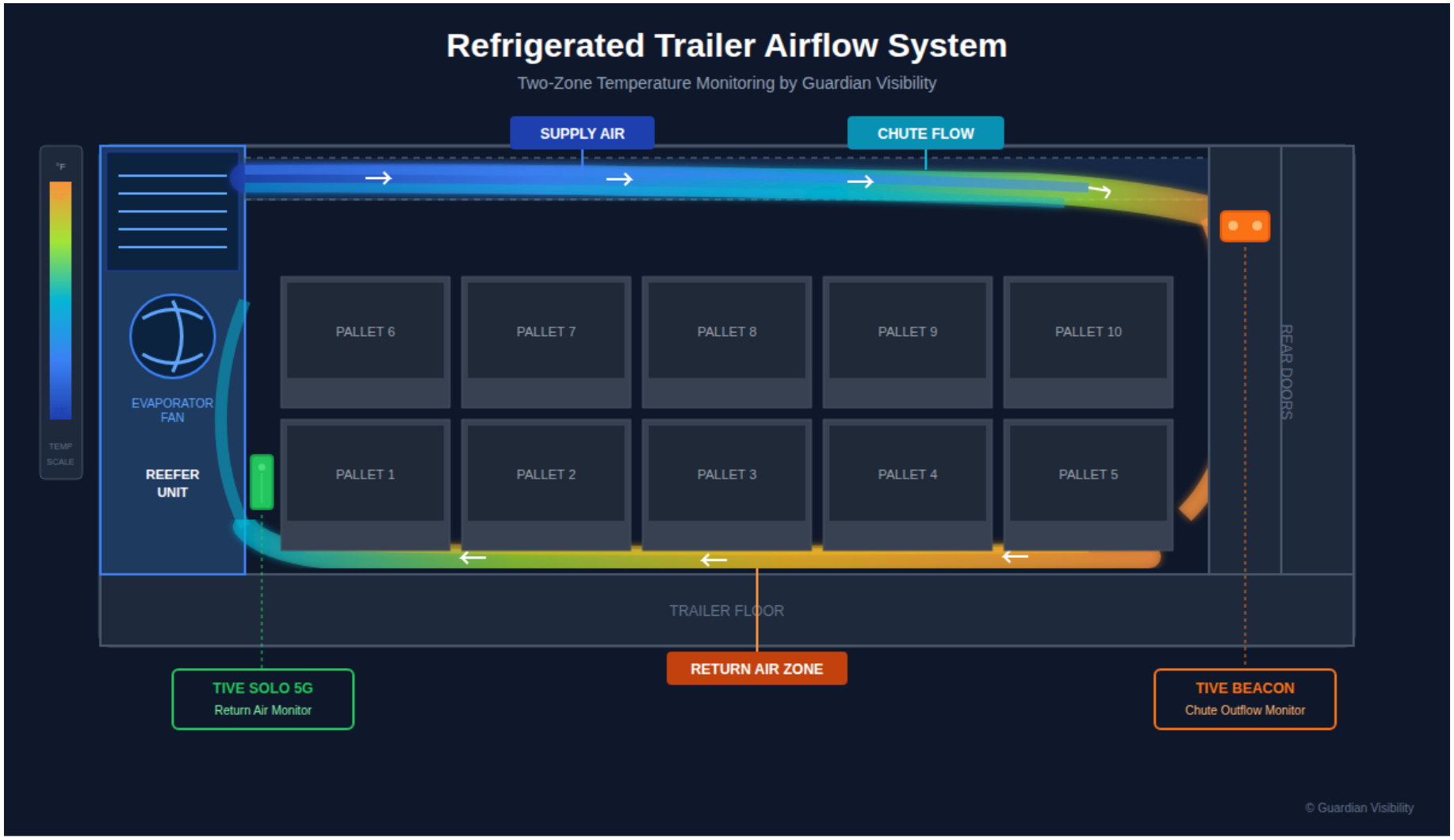
Engineering-grade visualization showing airflow physics, temperature gradients, and sensor placement. Optimized for print and documentation.



Print Version - White Background

Presentation Version (Dark Theme)

Optimized for keynote presentations and digital displays. High contrast design for projector visibility.



Dark Theme - Optimized for Presentations

The Science Behind Cold Chain Airflow

1. Forced Convection

The evaporator fan creates forced convection, pushing cold air (28-32°F) through the ceiling-mounted supply air chute. This active circulation is essential for maintaining consistent temperatures throughout the trailer.

2. Chute Flow Dynamics

Air transitions from laminar to turbulent flow as it travels through the chute, gradually warming as it absorbs heat from the cargo. The chute geometry ensures even distribution across the full trailer length.

3. Thermal Stratification

Cold air is denser than warm air. After absorbing heat from cargo, the warmer air (40-42°F) naturally descends to floor level, creating a stratified temperature gradient from top to bottom of the cargo space.

4. Return Air Path

Warm return air flows along the floor, under the pallets, back to the evaporator intake. This completes the circulation loop and allows continuous cooling of the cargo space.

Temperature Gradient Scale

The color-coded temperature visualization shows how air temperature changes as it flows through the trailer:

Temperature	Color	Zone	Description
28-32°F	Deep Blue	Supply Air	Coldest - Direct from evaporator discharge
33-36°F	Light Blue	Chute Flow	Cold - Traveling through ceiling chute
37-39°F	Cyan/Green	Transitional	Neutral - Beginning to absorb cargo heat
40-42°F	Light Orange	Return Air	Warm - Returning to evaporator intake

Why Two-Zone Monitoring Matters

The Problem with Single-Point Monitoring

Traditional temperature monitoring uses a single sensor, typically placed near the reefer unit. This only captures conditions at one location and misses critical information about how temperature varies throughout the trailer.

Guardian Visibility's Two-Zone Solution

Our system monitors both ends of the airflow cycle:

TIVE Solo 5G (Green): Mounted at the front wall in the return air zone. Monitors the warmest air in the trailer as it returns to the evaporator. Includes GPS tracking, temperature, and humidity.

TIVE Beacon (Orange): Mounted above the rear doors at the chute outflow point. Monitors supply air temperature as it exits the chute and enters the cargo space. Detects door-open events through airflow changes.

Benefits of Two-Zone Coverage:

• Complete temperature visibility across the entire cargo space

• Early detection of cooling failures or equipment issues

• Door-open detection through airflow pattern changes

• Better data than reefer downloads for claims protection

• Scientific validation matching USDA refrigerated transport standards

Ready to Upgrade Your Cold Chain Monitoring?

Join the Carrier Preferred Program and get two-zone temperature monitoring with carrier-owned equipment. First 500 installations include free device kit.

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