# HEAT TECHNOLOGIES, INC.

## HTI's
## High Efficiency (HE) Spectra HE™
## Technology And
## Spectra HE™ Ultra Drying System

## Technology Presentation.

# Briefly about the company:

- HTI is a US based corporation established in 1996
- One initial area of expertise was the technology of pulse combustion.
- The technology has been used in water heating, removal of deposits on large utility boilers, and heavy drying applications.
- HTI has three US patents relevant to this technology

# Spectra HE™ Ultra Drying System

- After discussing the pulse combustion dryer, its benefits with variety of end users, HTI realized, that some industries cannot use direct flame

- Also seen that a lot of end users have drying systems that can be dramatically improved.

# Spectra HE™ Ultra Drying System

HTI has created line of products that use acoustic pulsations for heating and drying using **electric and pneumatic means.**

The Spectra HE™ Ultra Drying System has been successfully applied to the converting industry and other heating, cooling, drying and other types of applications.

# Spectra HE™ Ultra Drying System

## Company Directives:

Design and build products and processes where the advantages of our technology provides solutions that offer significant environmental and cost savings.

Our products and processes provide:

- additional increased throughput,
- reduced production and product cost,
- reduced carbon footprint

# Spectra HE™ Ultra Drying System

Compared to other major drying technologies:

- Convective Drying
- Infrared Drying
- Combined Drying
- UV curing
- Indirect Conductive Drying
- E-Beam Curing

**HTI's New Drying Technology is**

- Advanced Convective Drying Enhanced by Strong Acoustic Oscillations

# Spectra HE™ Ultra Drying System

## Technology Advantages:

- Advanced Drying Rates
- Less energy required
- Less plant air
- Comparable or lower process air temperature
- Low in maintenance

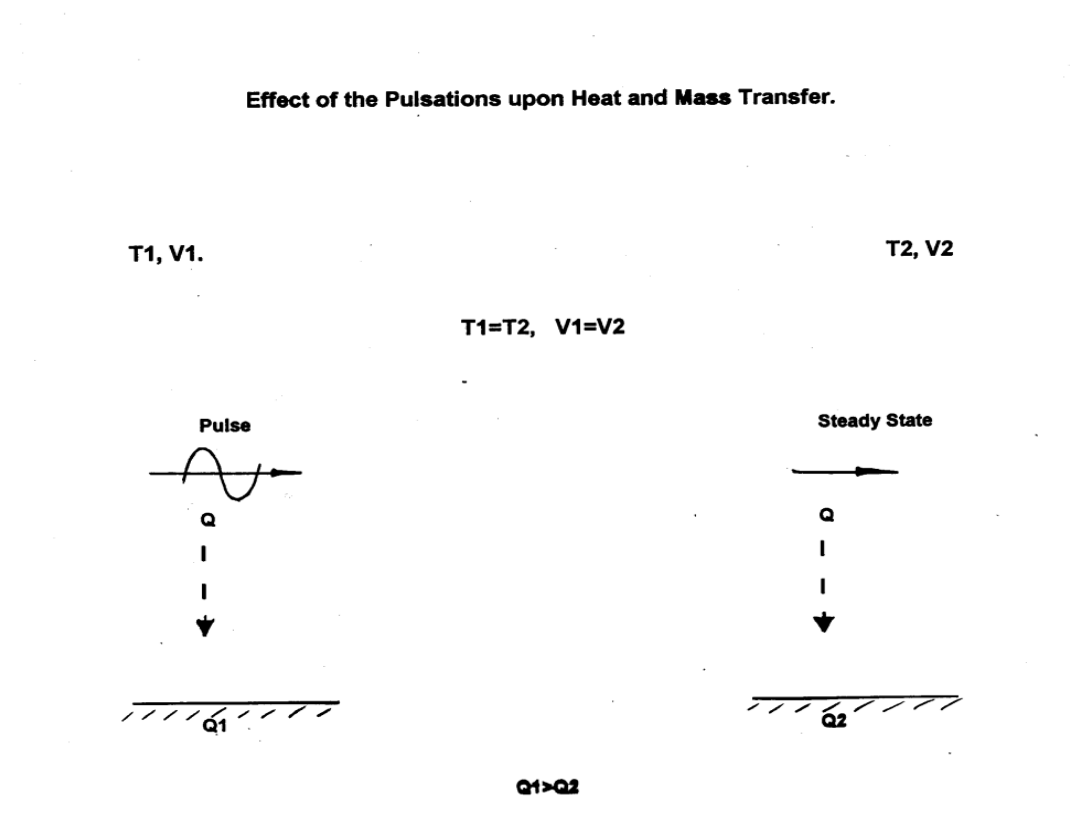
  

# Spectra HE™ Ultra Drying System

- HOW DOES IT WORK AND WHY?

# Spectra HE™ Ultra Drying System

- **Why Acoustics?**




- **Pulsations increase heat transfer**
- **Pulsations increase mass transfer**

# Spectra HE™ Ultra Drying System

- Mechanism of enhancement by oscillations is shown below (the oscillating jet is on the left, the material is on the right):

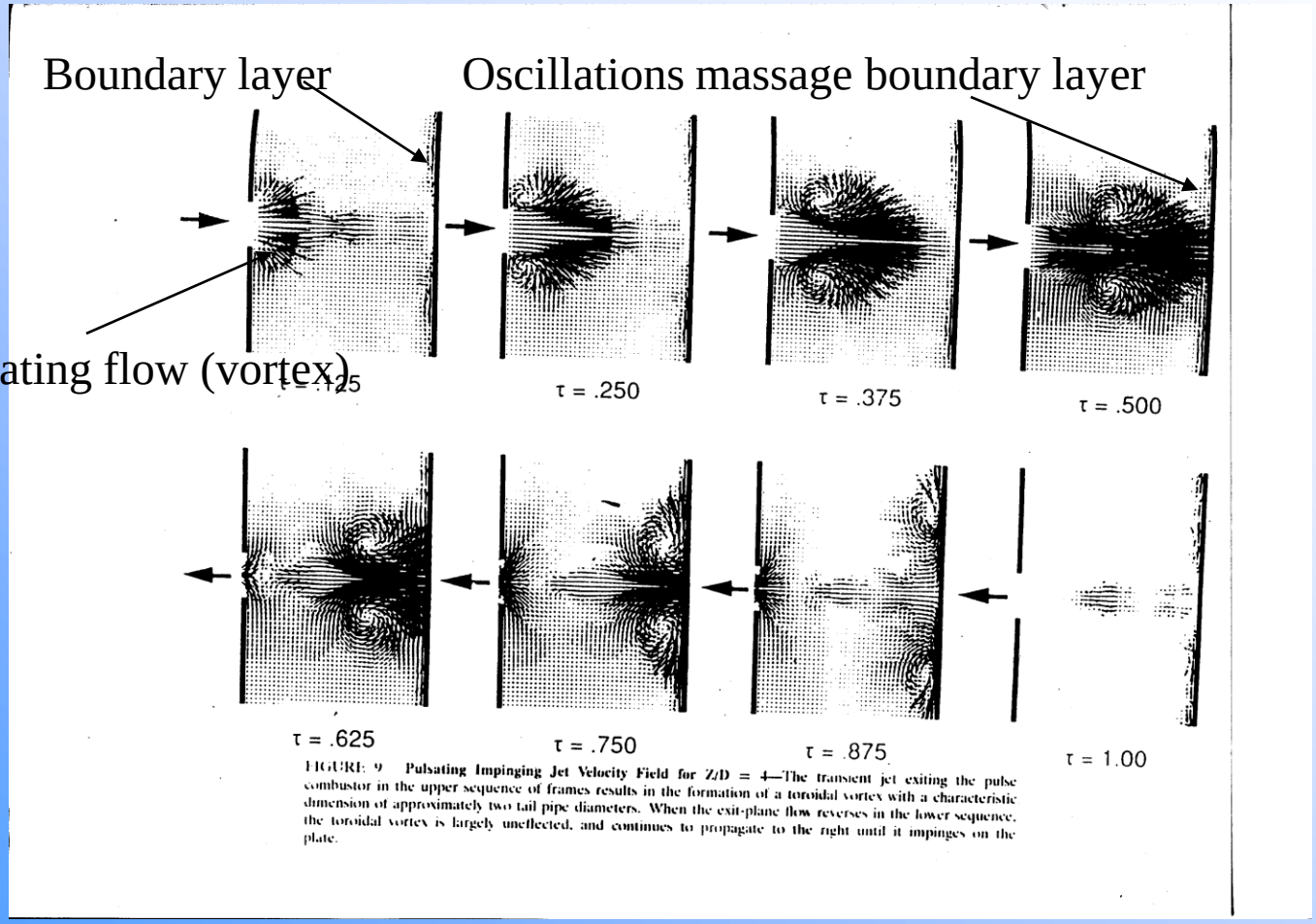


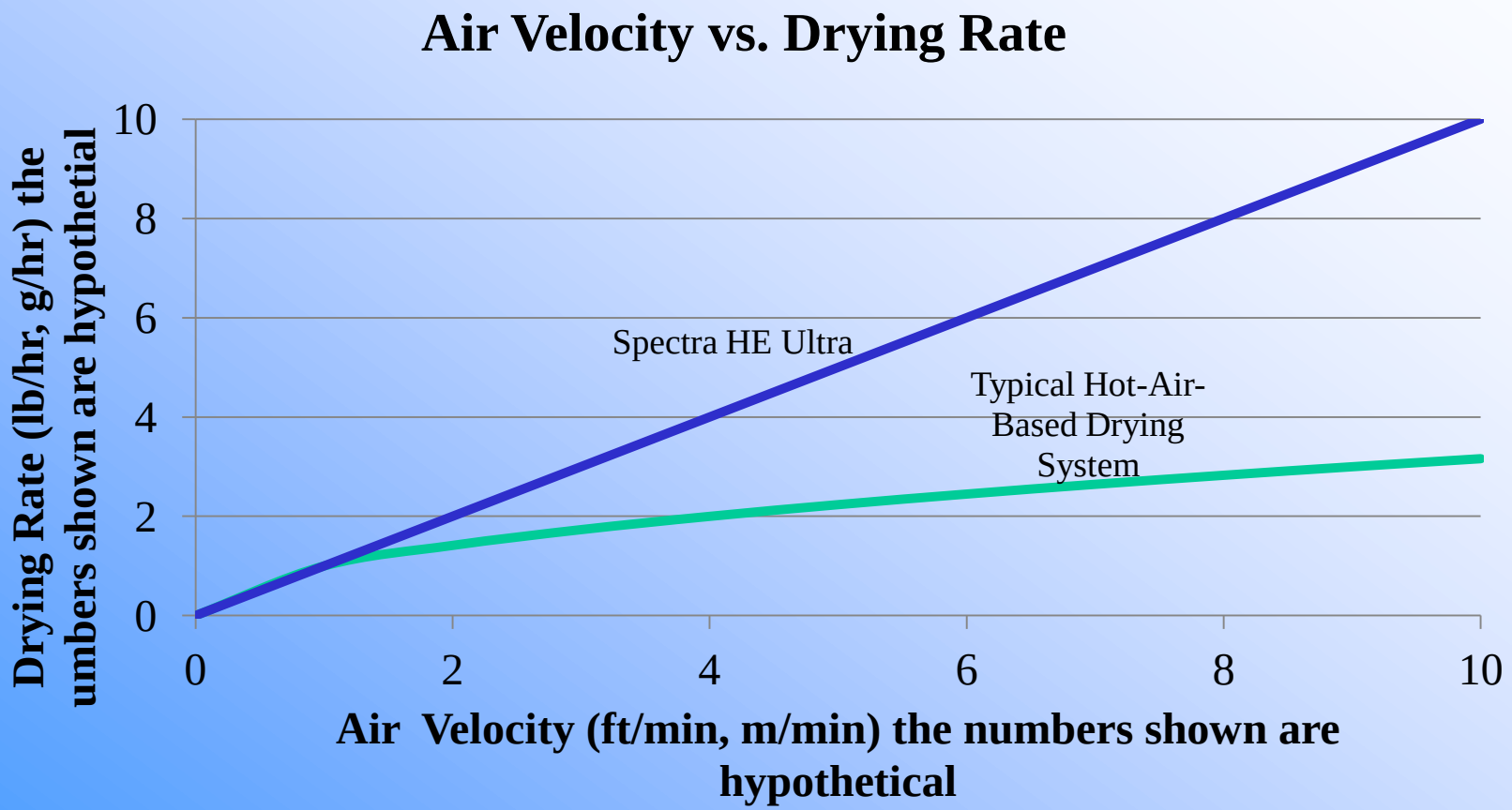

FIGURE 9 Pulsating Impinging Jet Velocity Field for Z/D = 4—The transient jet exiting the pulse combustor in the upper sequence of frames results in the formation of a toroidal vortex with a characteristic dimension of approximately two tail pipe diameters. When the exit-plane flow reverses in the lower sequence, the toroidal vortex is largely unreflected, and continues to propagate to the right until it impinges on the plate.

# Spectra HE™ Ultra Drying System

- See it for yourself:

# Spectra HE™ Ultra Drying System



# Spectra HE™ Ultra Drying System

**It is extremely important to note, that not all dryers created equal.**

Water based drying system cannot simply transferred to the solvent based drying process:

1) Our water based dryers in general use 1/3-1/2 of the amount of air used by traditional hot air systems.

# Spectra HE™ Ultra Drying System

- **Solvent Vs. Water (cont.)**

2) Solvent evaporation requires specific amount of air to carry the vapor as well as it is heavily regulated by LEL/LFL requirements

3) Solvent based system may require less or **no heat** (our system are self preheating)

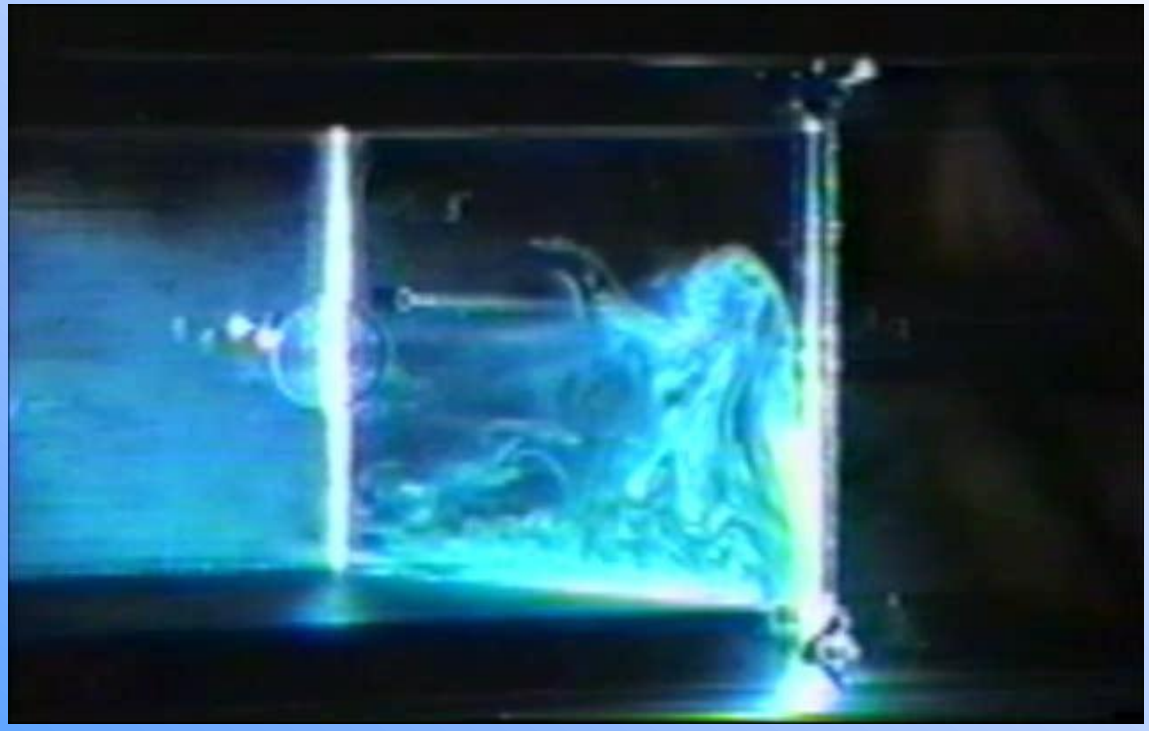
# Spectra HE™ Ultra Drying System

- You can use following variables to control the operation of the dryer:

1) Temperature
2) Volume of Supply Air
3) Distance between the turbo slot and material
4) Web Speed

# Spectra HE™ Ultra Drying System

- Here is what happens with a solvent when things are right:



# Spectra HE™ Ultra Drying System

## How the actual equipment may look like?

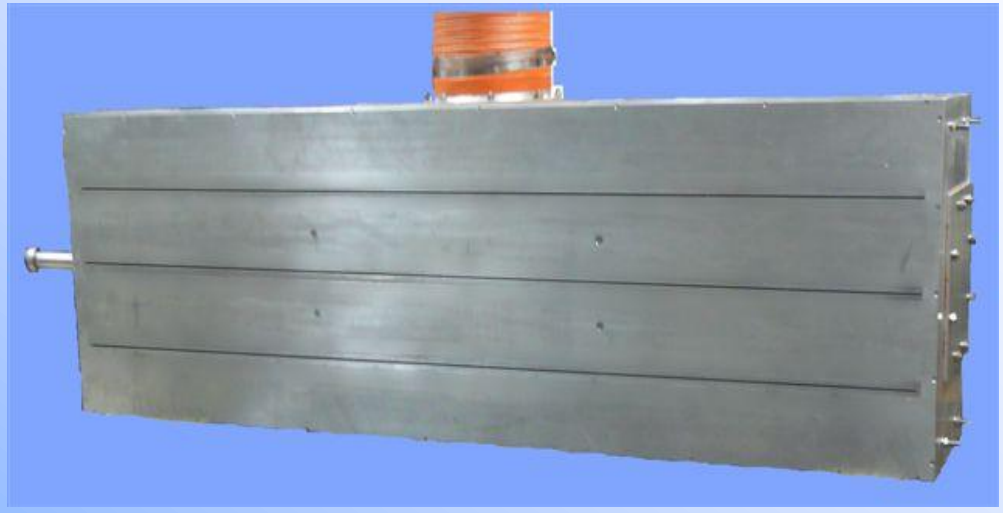
- We offer complete custom design and manufacturing for stand- alone complete replacement or new dryers, add-ons, replacement for between color dryers, tunnel dryers (sometimes even eliminate it) for Gravure, In-Line, CI presses, Paper Converting and Coating, etc.

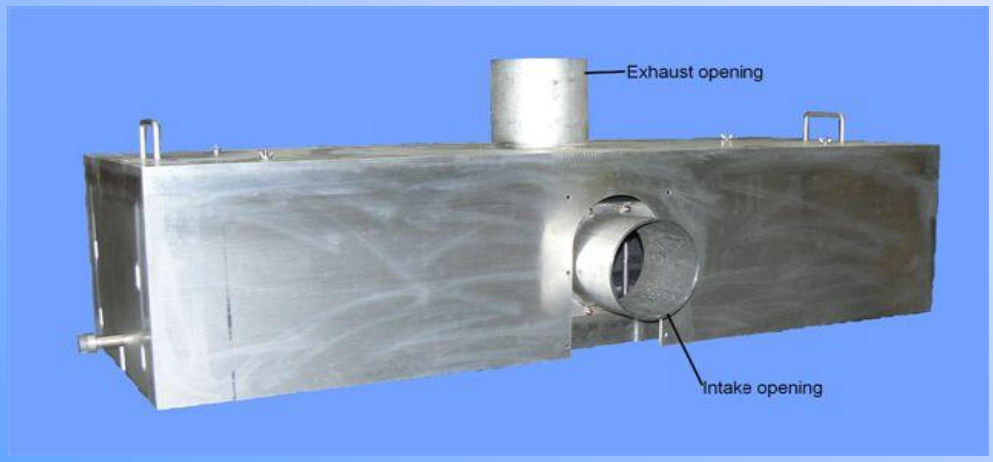
# Spectra HE™ Ultra Drying System

- The acoustic dryer section consists of the following:
  - Control panel
  - Electric Heater
  - Regenerative Blower

- One or more dryer sections including exhaust

# Spectra HE™ Drying System

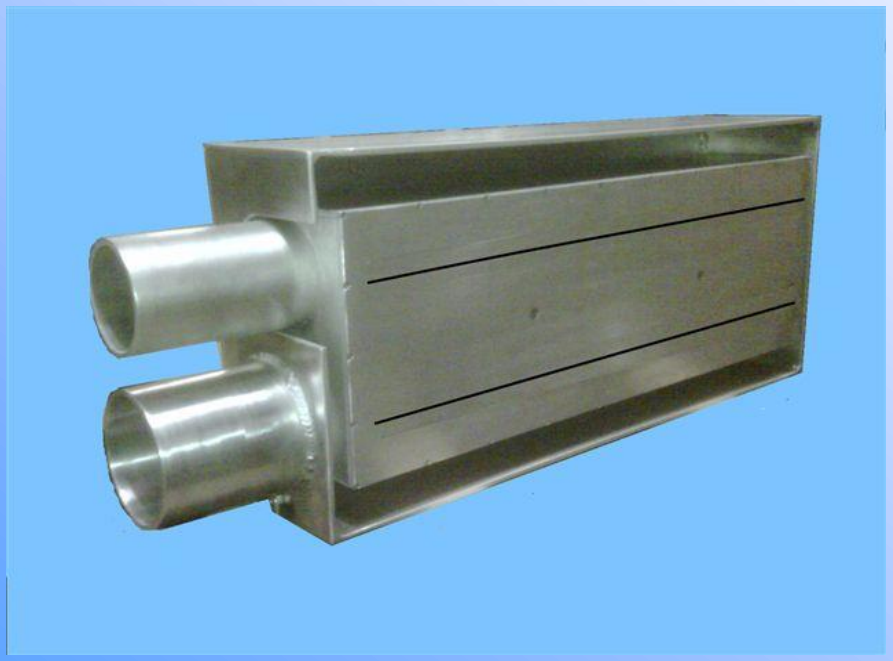





Spectra HE TM Ultra Drying System. Copyright Heat Technologies, Inc. 2011. All Rights Reserved

# Spectra HE™ Drying System

Photo of a single drying station for a 26” wide web.



# Spectra HE™ Ultra Drying System

- These photos show how a 50”long dryer –replacement of a 20ft long old dryer for heavy coating applications may look like:

# Spectra HE™ Ultra Drying System

- Top Section Open

# Spectra HE™ Ultra Drying System

- This dryer fully replaced a 56ft long dryer at maximum loads and speeds with 13% of the energy if compared with existing dryer.

# Spectra HE™ Ultra Drying System

- Systems can be configured to replace or add to your current thermal system.
- Initial speeds of 500-650 fpm to improved speeds from 1,000 to 1,500 feet per minute at 2 lbs/ream (2-3 grams per square meter) dry and 30-35% solids on a 16”-72" web width were registered
- A drying system consists of the following:
  - One or more drying stations sections or zones,
  - a control panel
  - electric heater(s)
  - One or more regenerative blowers
- *Replacement of or a booster to various heating, drying and cooling applications*

# Spectra HE$^{TM}$ Drying System

- Can meet production goals with less capital equipment
- Increase throughput
- Reduce energy consumption while maintaining the same production rate.

**Regardless of your need or situation Spectra HE Ultra can save you money.**

# Spectra HE$^{TM}$ Ultra Drying System

- If tube is your process, and a confetti is a boundary layer, this is what our technology does to the boundary layer on a micro scale:

# Spectra HE™ Ultra Drying System

## Typical project sequence.

- Presentation
- Clear definition of business relationships with a customer
- Preparation of the proposal
- Execution of the contract

# Thank You.

We welcome the opportunity to fully discuss your application under complete confidentiality.