RETHINKING CONTAINERBOARD OPERATIONS

July 28, 2015

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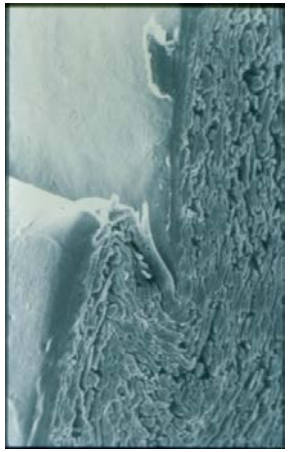
Welcome!

Antitrust Policy

This webinar will be held in strict compliance with the TAPPI Antitrust Policy.

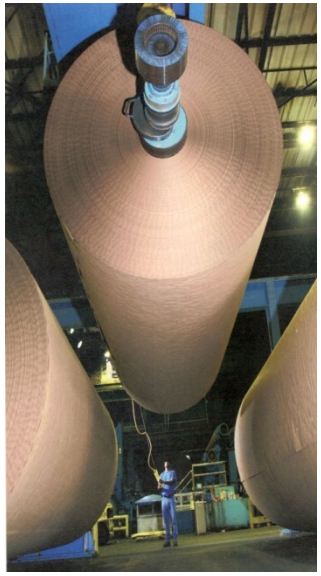
Specifically, discussing prices or pricing policy and discussing any restraint of competition of any kind will not be tolerated.

Today's Speakers



Jon Porter, Fosber America

Chuck Klass, Klass Associates



Mike Kocurek, NC State

Rethinking Containerboard Operations

There are ~~four~~ **five** important areas of knowledge for improving containerboard operations including

(1) knowing the corrugating customer's needs;

(2) knowing about the increasing demands on containerboard (printing advancements, impacts of recycling);

(3) knowing the important properties and tests that predict quality and runnability;

(4) knowing the factors that improve containerboard mill operations.

(5) Providing our operators with technical training

Introduction to 1500 fpm /457 mpm.

- Ongoing US. Corrugator Plant closures.
  - plants are concentrating on improving efficiencies.
  - Reduce cost per unit.
- Paper price increases.
  - Many times plants can’t pass along the increases.
- Increased customer demand.
  - Just in time production requirements.
    - Customers don’t want to carry any inventory.

Identifying obstacles to high speed

- First what type of Plant
  - Sheet feeder
  - Converting (Box Plant) ship some sheets.
  - What's your average basis weight?
    - Heat transfer systems
  - % Percentage of DoubleWall.
  - How many Flute changes?
  - How many Paper widths?
  - Order inserts?
  - Events verses Non-Events

Specialty high graphics

Identifying Factors That Impact Corrugator Runability.

- Data collection of process variables
  - Material management
  - Starch
  - Heat
  - Gaps
  - Level and alignment
  - Equipment meets OEM spec.
    - Roll wear/flute height
    - Roll's total indicated run-out (TIR)
    - Bearing wear, level and alignment.

Identifying Factors That Impact Corrugator Runability.

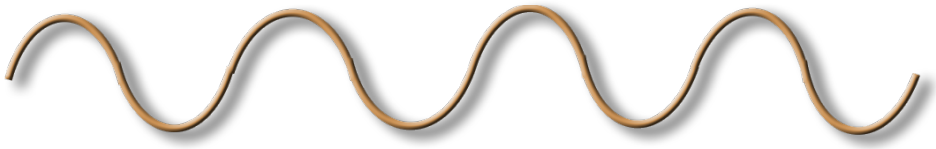
- Container: Liner and Medium.
  - Understanding Roll moisture content.
  - Managing butt rolls.
  - Basis Weights
  - Ring Crush
  - Water drop

Identifying Factors That Impact Corrugator Runability.

- Corrugator vessel temperatures
  - Target steam pressures normally 175 -185 psi.
  - Check steam vessels, steam traps for proper heat transfer and condensate removal.
  - When using an infrared heat gun to check temperatures use an inexpensive primer spray paint with a flash point exceeding 450^{o}F.
    - Best practice is use a contact pyrometer to take temperature readings.

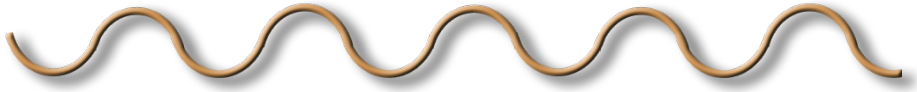
Application verses Heat.

A Flute



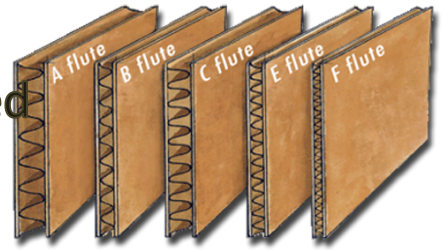
C Flute

B Flute



E Flute

Flute Tip surface area differences for each, A flute will require more starch than E flute. A flute will then need more heat to gel and cure then E flute.



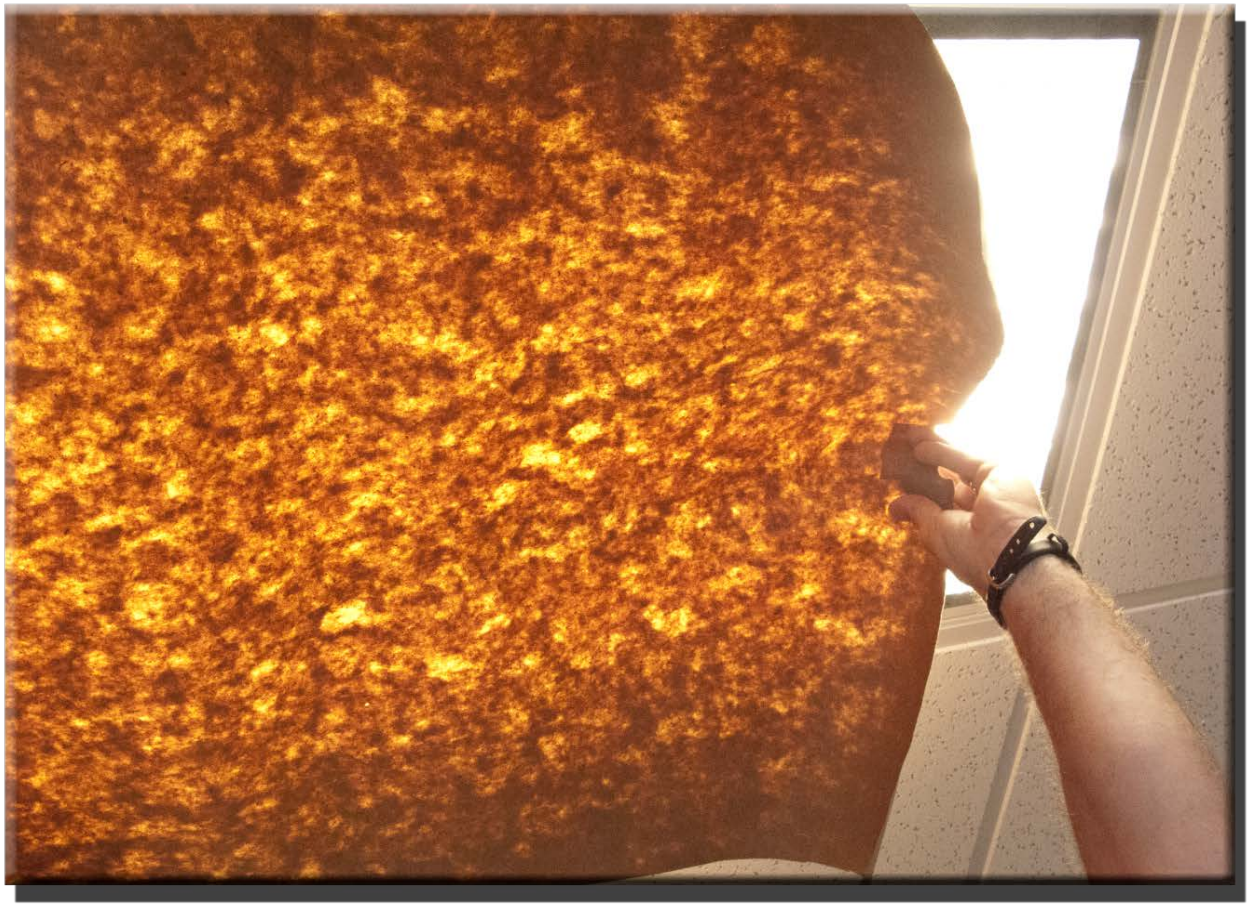
Paper Effect on Bonding

Paper inconsistency Will cause a variation in heat distribution

Too much moisture hinders the heating.

Low moisture facilitates overheating

“Wet or Dry” Streaks impact temperature variations



Wet / Dry Streaks
> 8” wide

Uneven Paper Tension

Diagonals indicate uneven paper tension creating wrinkles

Heat transfer will be uneven

Factors that Impact Penetration

- **Starch Viscosity**
  - Based on the starch formula
  - Dependent on temperature (delivery)
- **Paper**
  - Porosity of the corrugated medium and liners
  - Type of paper
    - Virgin
    - Recycled
    - High performance.
- **Effect paper temperature has on starch**

Mechanics of the bond

Viscosity too Low
Watery Penetrates
Medium too much

Viscosity too High
Does not Penetrate
Starch sits on top
of Medium

Good Viscosity
Good Penetration

Viscosity is the liquid thickness of the adhesive.

- Controlling viscosity is important since it affects the amount of adhesive that is applied to the tips of the flutes, and the rate of penetration into the paper.

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(5) Providing our operators with technical training

Charles P. “Chuck” Klass
Klass Associates Inc.

- To optimize performance and profit contribution of your machine you need to know:
  - Changing corrugated container and containerboard market demands
  - Changing raw materials
  - Benchmarking vis-à-vis competitor machines
  - Where to focus effort to improve paper machine performance at lowest effective cost

Changes in End Use Markets

- “Plain brown boxes” are neither plain nor brown anymore!
- High quality graphics
- Big box stores
  - >55% of retail sales are in big box stores
- Shelf appeal
  - The box is the “sales person”
- Impacts on linerboard and printing requirements
- Demand for lighter weight boxes

Trends in OCC Quality

- Quality of USA OCC is degrading
  - Increased imports of Chinese boxes
  - More white top – bleached fiber is not as strong
  - Litho-lam includes coated paper with bleached fiber, filler and coating materials
  - Increase in multi-color printing – both preprint and post print
  - **Single stream recycling**

Implications of OCC Quality Degradation

- Recycling mills are forced to cope with lower quality OCC
- Shorter fiber length of OCC and more contaminants
- More white top and coated liner
  - More bleached pulp in OCC
  - Filler used in white top
  - Need for increased dry strength agent use
  - More coating materials - latex/stickies

Single Stream Recycling

- Driven by cost of picking up recycled materials
- Increases level of contamination on OCC and other water papers
- Increases levels of non-OCC grades in OCC from single stream processers
- Likely to become more problematic
- USA mills will need to cope with this

Benchmarking Your Machine

- TAPPI TIP 0404-47
  Paper Machine Performance Guidelines
- Developed by TAPPI Papermakers Committee
- Reviewed and updated every five years
- Useful in benchmarking your machine
- Includes measures of efficiency and various operating parameters

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QUALITY CHARACTERISTICS

COMPRESSION STRENGTH

FLATNESS

MOISTURE LEVEL

SMOOTHNESS

DIMENSIONAL STABILITY

DUST FREENESS

GLUABILITY

RUNNABILITY

ROLL UNIFORMITY

MOISTURE UNIFORMITY

BASIS WEIGHT UNIFORMITY

CALIPER UNIFORMITY

DENSITY UNIFORMITY

FIBER ORIENTATION UNIFORMITY

Containerboard Properties & Tests

Sheet Structure

Fiber Orientation

Formation

Basis Weight

Caliper

Bulk / Density

Fiber Properties

Bonding

Stiffness

Elastic Modulus

Smoothness

Absorbency

Effect of Moisture

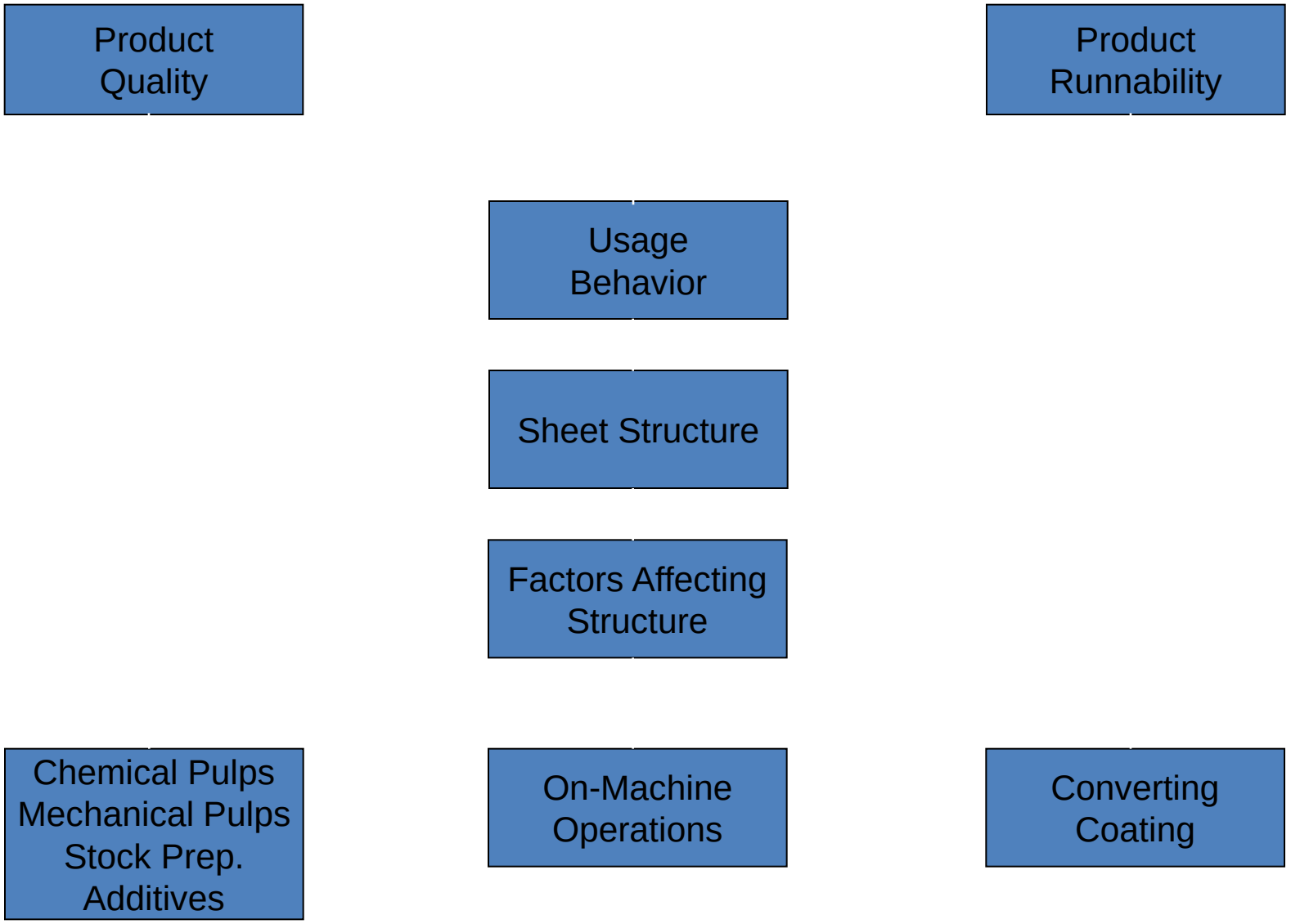
Curl/ Warp/ Baggy Edges

Mullen

Tensile

Ring Crush /STIFI/ECT

Process Improvement & and Product Linkage



General Strength Equation (modified from D. Page)

$$\text{Strength} = \frac{(BW)\ (FS)\ (FL)\ (RBA)\ (BS)\ (FO)\ (F)}{(FC)\ (MC)\ (SS)}$$

BW = Basis Weight

FS = Fiber Strength FL = Fiber Length

FC = Fiber Coarseness

RBA = Relative Bonded Area

BS = Bond Strength

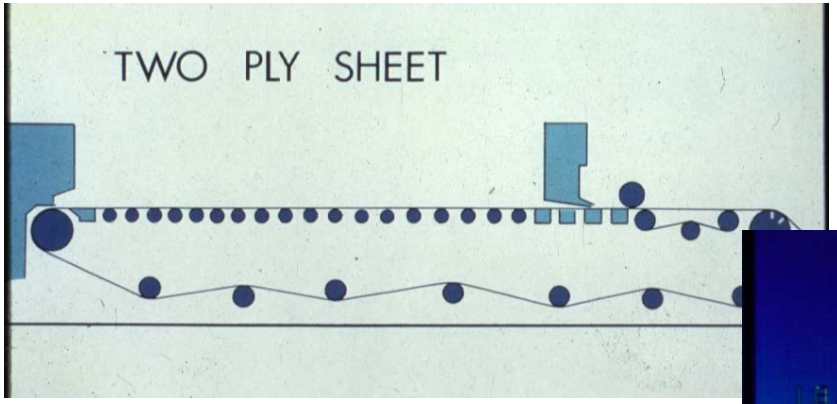
FO = MD / CD Fiber Orientation

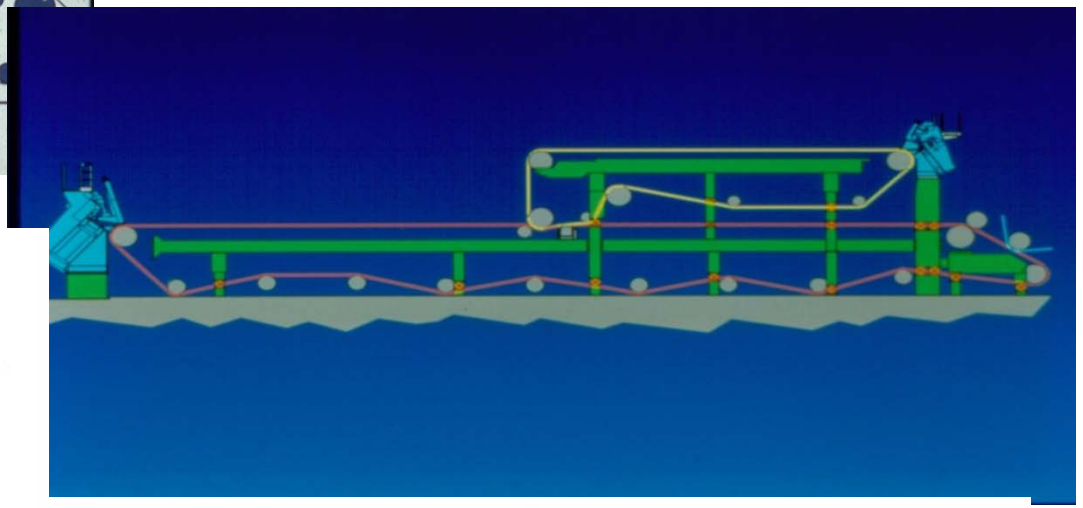
F = Formation (sheet uniformity)

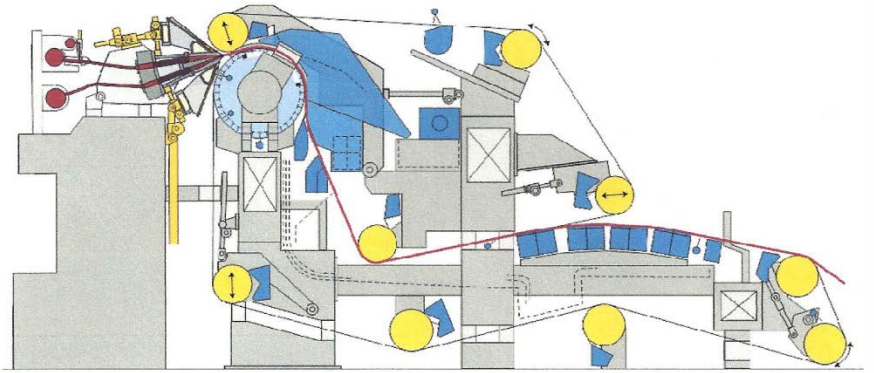
SS = Sheet Shrinkage in Dryers

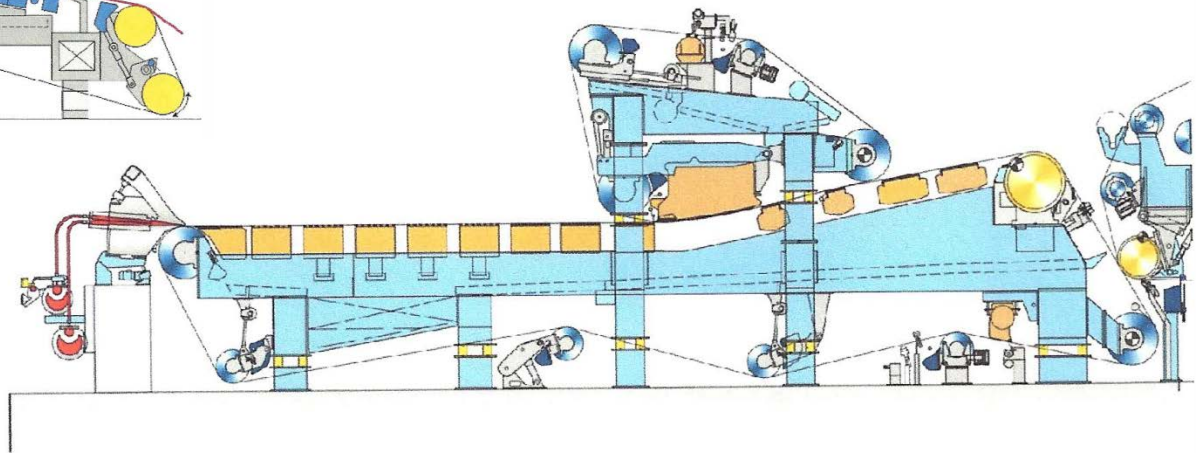
MC = Sheet Moisture Content

Improving Mill Operations - Papermaking Other Topics & Faculty









IMPROVING MILL OPERATIONS
OTHER TOPICS & FACULTY

Stock Preparation

Refining (M. Kocurek)

- Mechanism of Refining
- Variables
- Energy and Intensity

Chemical Additives (D. Swales, Kemira)

- Charge control
- Retention
- Strength Additives
- Deposits and Foam Control

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OTHER TOPICS & FACULTY

Headbox Operations (J. Shands ,PaperChine)

- Reducing Approach System Variations
- Vacuum Deaeration Concepts
- Fan Pump Recommendations
- Uniform Stock Flow in the Headbox
- Formation Improvement and Microturbulence Strategies
- Slice Profile Variations
- Dilution Profiling – Keys to Efficiencies
- Headbox Misalignment TSI/TSO Case Studies (M. Wakefield, L&W)

IMPROVING MILL OPERATIONS
OTHER TOPICS & FACULTY

Sheet Forming (J. Shands, PaperChine)

- Fourdrinier Table Variables
- Slice Geometry and Jet Angles
- Forming Board Calculations
- Stock Activity, Harmonics, and Formation
- Twin Wire Gap Forming Mechanisms of Dewatering
- Assessments & Limitations
- Blade Technology
- Improving LoVac and HiVac Zones
- Couch Operations

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OTHER TOPICS & FACULTY

Pressing (D. Lange, Andritz)

The effect of couch solids on dryness out of the press

Nip venting: grooving and drilling of roll covers and shoe press belts

Sheet break reduction schemes in the press section

Steambox pros and cons

What the state-of-the-art press section looks like and why.

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OTHER TOPICS & FACULTY

Drying (C. Klass, M. Kocurek)

- Important drying variables that improve performance
- Dryer Performance Benchmarks
- Efficiency Models
- Variables Affecting Strength Development and Loss
- Moisture Variation Effects and Control
- Effects on Liner and Medium Sheet Properties and Tests

IMPROVING MILL OPERATIONS
OTHER TOPICS & FACULTY

Surface Treatments and Finishing (C. Klass)

Size Press Applications, Chemicals

Types of Size Presses, Calender Sizing

Types of Calenders

Caliper Problems and Control

Troubleshooting Calender Problems

Doctors, Components

Variables of Operation, Troubleshooting

Auditing Reels

Thank you for your attention!

Any Questions?

- Increase your understanding of the new developments, demands, important variables and challenges to producing linerboard & medium
- Learn how mills can meet challenges and take advantage of opportunities to improve operations

- **Register by August 3** and take advantage of the Early Bird Discount

www.tappi.org/15container